

7signal Sapphire

Loupe User Guide

Release 3.1

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

FCC APPROVAL PENDING ON RELEASE DATE

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

This device is restricted to indoor-only use in 5150.0-5250.0 MHz and 5470.0 -5725.0 MHz bands

NOTE TO THE USER

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

CONTACT INFORMATION

Contact us at 7signal

- by mail: Panuntie 6, FI-00620 Helsinki, Finland
- by email: info@7signal.com
- by phone: +358 40 777 7611 (exchange)

For handling of software defects, send email to: defect-report@7signal.com

In case of other requests, send email to: support@7signal.com

TABLE OF CONTENTS

1 Loupe	1
1.1 Loupe login.....	1
1.2 Loupe at a first-glance.....	1
2 Using Loupe	2
2.1 Channel aggregation and selection.....	4
2.2 Saving the Charts	4
2.3 Advanced Chart Settings	4
3 Tabs	6
3.1 Tabs and analysis	6
3.2 Tab memory	6
4 Summary	7
4.1 SLA Compliance KPI.....	7
4.1.1 Traffic-light SLA.....	8
4.1.2 SLA Compliance over time	8
4.1.3 Element level SLA Compliance over time	9
5 Service Level Agreement, SLA.....	10
5.1 Three-basket principle	11
5.2 SLA table active cells	12
6 TP/SNR.....	13
7 Network Performance Indicators.....	14
8 Radio congestion	15
9 Client performance Indicators	16
10 Data rate Codec Indicators	17
10.1 Codec and channel history.....	17
11 Spectrum	18
11.1 Over period chart.....	18
11.2 Time-axis chart.....	19
12 Top.....	20

13 Alarms	21
14 Info	22
15 Report	23
16 How To Troubleshoot Using Loupe	24
16.1 Typical pattern	24
16.2 Troubleshooting: Use Cases.....	24
16.2.1 Accessibility Problem	24
16.2.2 Downlink Performance Problem.....	29
16.2.3 Downlink And Uplink Performance Problem	32
17 KPI Glossary	37

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 address into the Address field. An encrypted connection (HTTPS) is used for data communication.

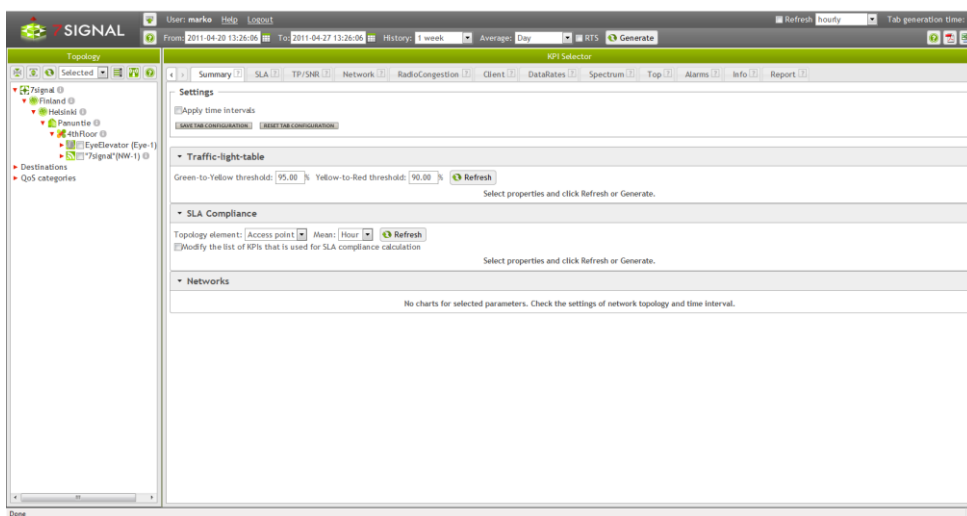
1.1 Loupe login

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 default 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. 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:

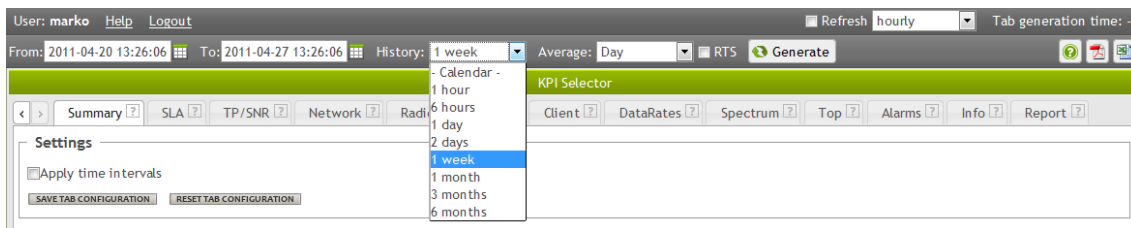
Summary	SLA
TP/SNR	Network
RadioCongestion	Client
Data rates	Spectrum
TOP	Alarm
Info	Report

2 USING LOUPE

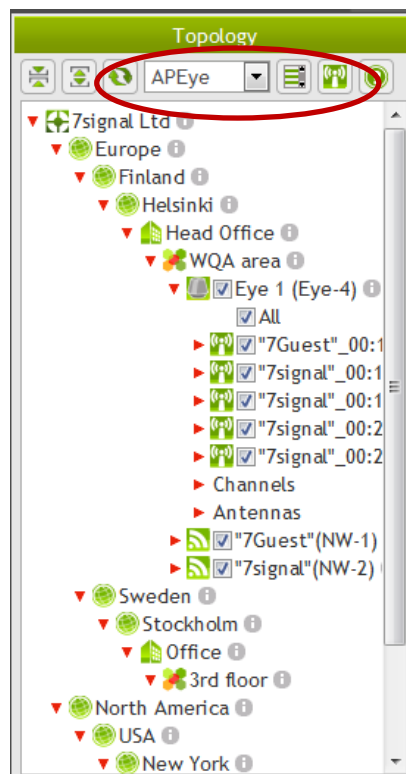
Sapphire Carat gathers and stores data obtained from automated test to the database. Loupe enables you to view the results and make comparisons between different devices, tests, and time spans.

Building a Result View:

1. Decide which group of indicators (KPI) 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.)
5. From the Topology view, choose the level of area aggregation
 - a. Area aggregation is class by which test results are grouped and displayed. E.g. results can be displayed by a single access point or by whole network.



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.

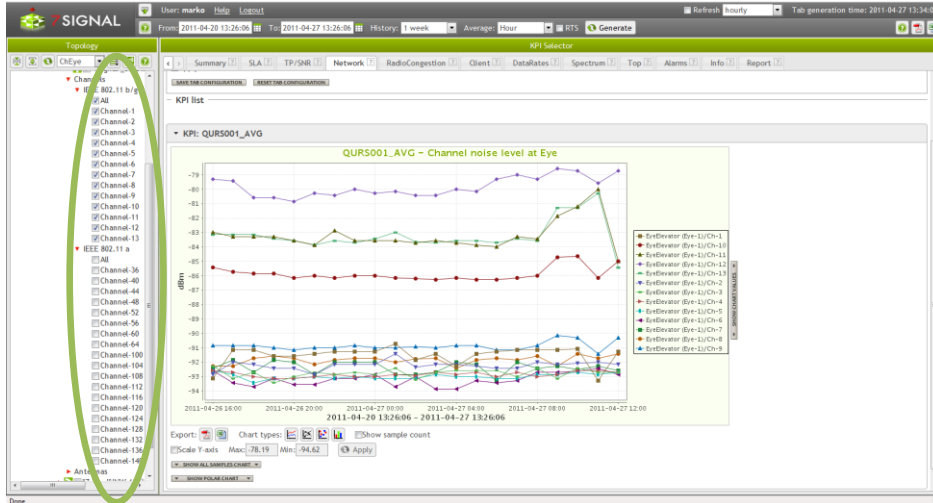
6. Alternatively, you can select Destinations from the tree hierarchy, and then select a Sonar for which you want to display the results.
7. You can hide the KPI list by selecting Hide KPI
8. Click Generate to display the results.

The results open up in the same view / panel. Right clicking in graph will activate the chart tooltips.

Note! Rendering the results may take a long time if you select a lot of data to be calculated in single report.

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

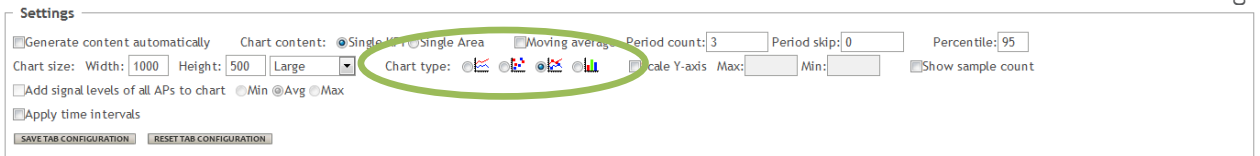
You can view the details of the results by selecting Show raw chart and Show chart data next to the chart (raw = all data points and samples without averaging). You can modify the charts by choosing or editing the values above the chart listing:

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

The screenshot shows the 'Settings' panel in the Loupe interface. The 'Chart size' dropdown is highlighted with a green oval, showing 'Large' selected. Other settings include 'Generate content automatically', 'Chart content', 'Single KPI', 'Single Area', 'Moving average', 'Period count: 3', 'Period skip: 0', 'Percentile: 95', 'Chart type', 'Scale Y-axis', 'Max', 'Min', and 'Show sample count'. There are also buttons for 'SAVE TAB CONFIGURATION' and 'RESET TAB CONFIGURATION'.

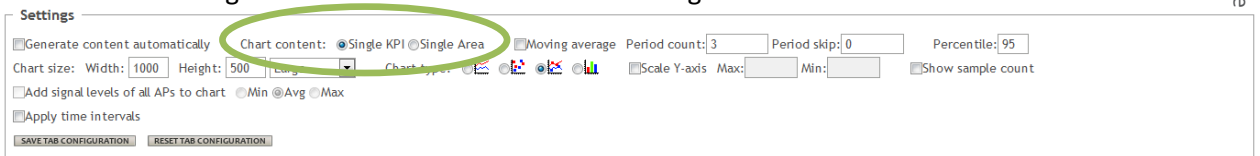
2. Chart type

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



3. Display method of charts

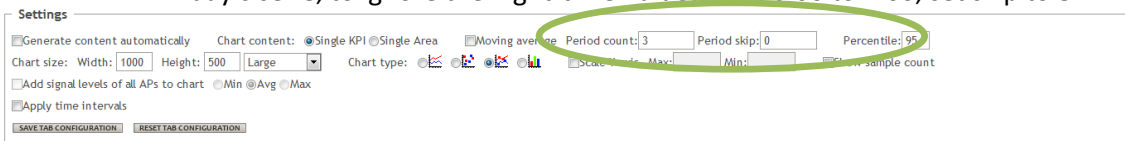
- a. Single KPI chart – Each KPI displayed as a separate chart
- b. Single Area chart – All chosen KPIs in a single chart



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

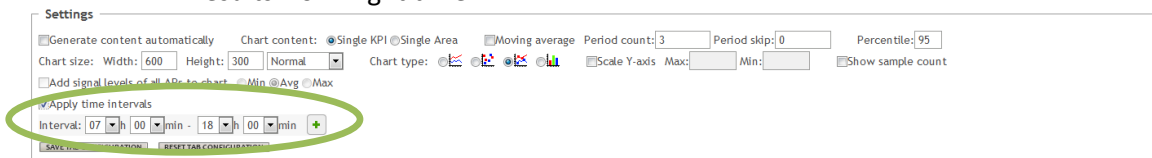
4. Moving average

- a. 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.
- b. 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



5. Time intervals

- a. Apply time intervals – user can be 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.



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.

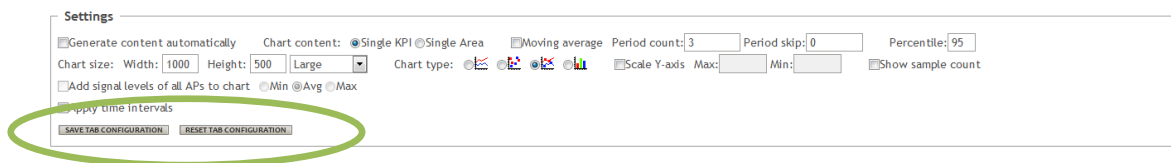
3.1 Tabs and analysis

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

Each tab have individual save and reset buttons for selected configurations and graphs. By default the selections are not saved but by pressing “Save tab configuration”, the selections will be saved in next login. “Reset tab configuration” will return the settings to default.



4 SUMMARY

4.1 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 calculates a geometric average of all the selected 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.

SLA compliance is expressed in %

- 100% means that all individual selected metrics met the set target level during the calculation period
- Compliance may be calculated for hourly or daily averages

Geometric average is used in SLA compliancy calculation (NOTE: different than arithmetic average)

- Key difference is that if one element fails completely (goes to 0), average gives 0 for that time.
- This enables detecting full failure to meet completely any single element in the one compliance metric.

The **geometric mean**, in mathematics, is a type of mean or average, which indicates the central tendency or typical value of a set of numbers. It is similar to the arithmetic mean, which is what most people think of with the word "average", except that the numbers are multiplied and then the n th root (where n is the count of numbers in the set) of the resulting product is taken.

For instance, the geometric mean of two numbers, say 2 and 8, is just the square root of their product; that is $\sqrt{2 \times 8} = 4$. As another example, the geometric mean of the three numbers 4, 1, and $1/32$ is the cube root of their product ($1/8$), which is $1/2$; that is $\sqrt[3]{4 \times 1 \times 1/32} = 1/2$.

Source: Wikipedia

4.1.1 Traffic-light SLA

Traffic-light SLA compliance table shows single values for each selected elements (access points or links). The color of the table shows if an element meets the performance target.

▼ Traffic-light-table

Green-to-Yellow threshold: % Yellow-to-Red threshold: % [Refresh](#)

Selected time period: 2011-04-20 - 2011-04-27

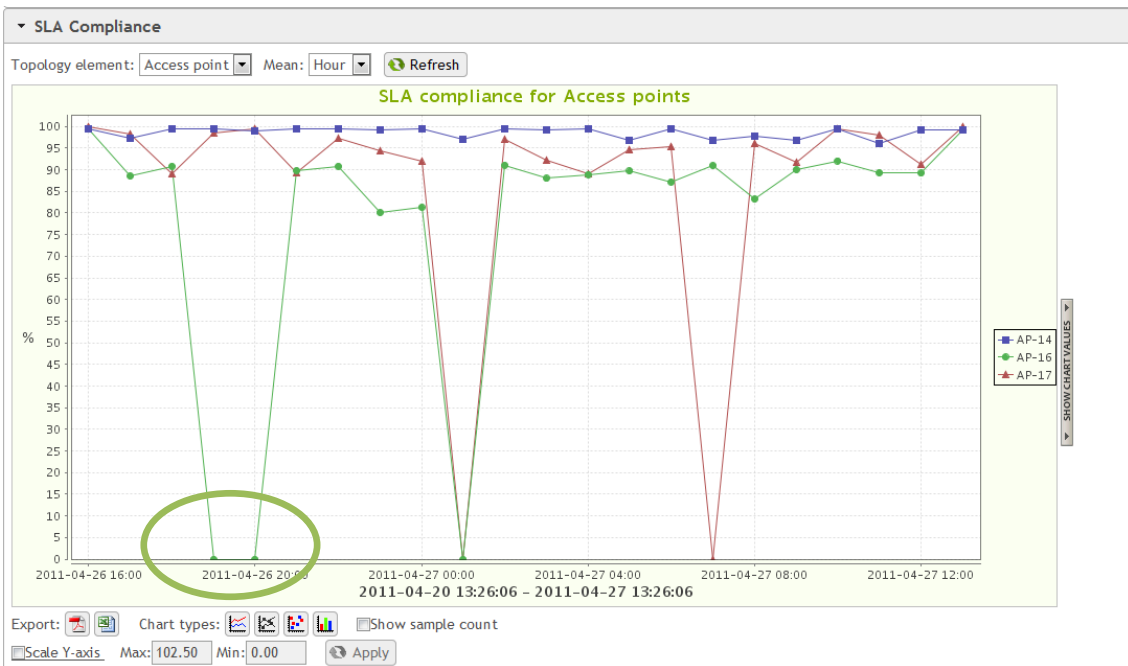
Access point	SLA compliance	<input type="checkbox"/> All
AP-14	98.54%	<input type="checkbox"/> Full SLA
AP-16	87.99%	<input type="checkbox"/> Full SLA
AP-17	95.13%	<input type="checkbox"/> Full SLA

Export: [Print](#) [Excel](#)

[Generate full SLA report for the selected items](#)

4.1.2 SLA Compliance over time

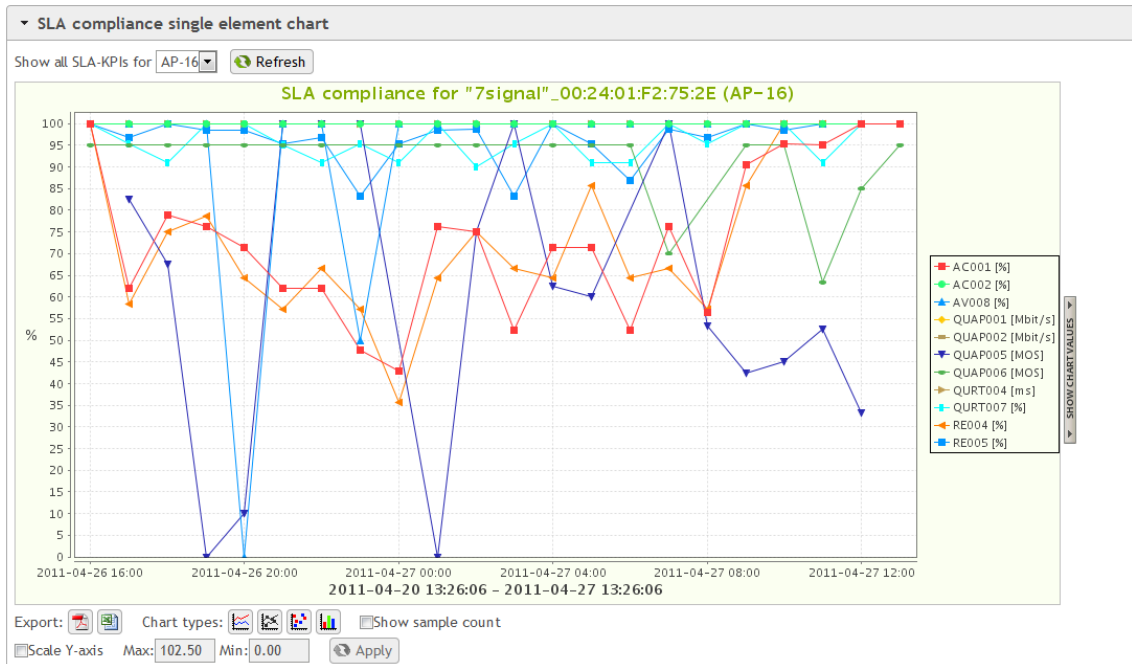
In the picture below, there are three network elements, AP-14, AP-16 and AP-17. Based on the chart one can assume that AP-14 is operating as expected. On the other hand, the other elements seem to be occasionally below the SLA compliance target. Note that AP-16 might be completely out (during pointed time) or some KPI does not meet the target threshold.



While all elements would benefit from some attention, it is obvious that AP-16 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 SLA single element chart or more detailed metrics’.

4.1.3 Element level SLA Compliance over time

The single element chart shows performance issues with VoIP MOS downlink (QUAP005) but also with radio attach success (AC001) and FTP test success (RE004).



The SLA group defines the threshold values for all individual KPIs. However, the resultant KPI threshold values can be set in Carat.

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

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:

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

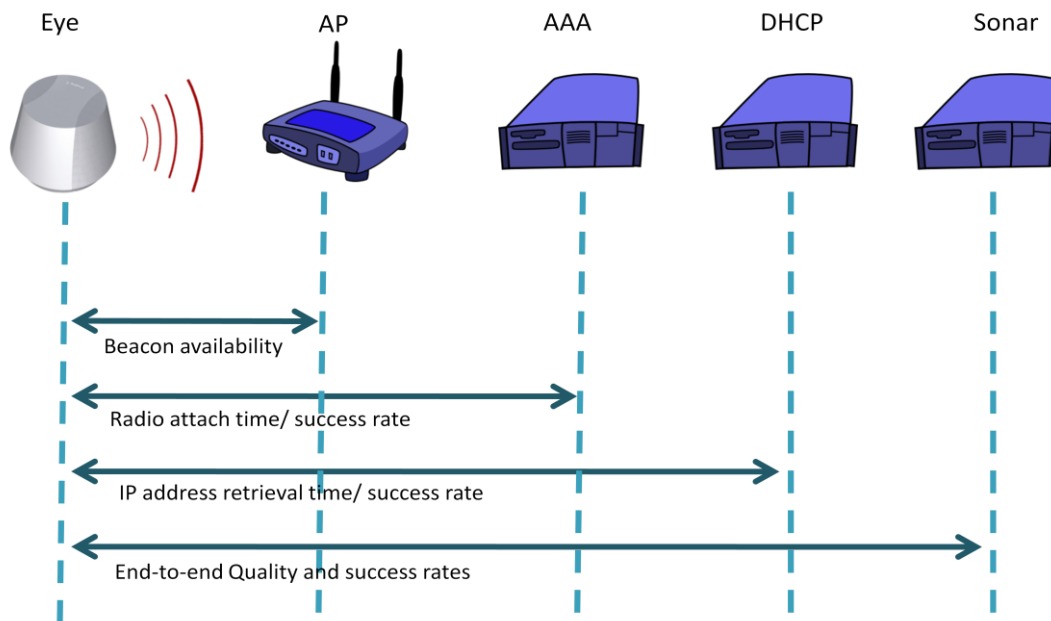
The screenshot shows the 7signal SLA view interface. The main table displays KPIs for the EyeElevator (Eye-1) client. The table has columns for KPI names and their current values. The values are color-coded: green for good, yellow for warning, and red for critical.

KPI	Value
AV008: Beacon availability in managed AP scan	100.0%
AC001: Radio attach success rate	89.3%
AC002: IP address retrieval success rate	100.0%
QURT007: Ping success rate	97.2%
RE004: FTP test success rate	88.2%
RE005: VoIP test success rate	99.6%
QURT004: Ping RTT	100.0%
QUAP001: FTP DL throughput	100.0%
QUAP002: FTP UL throughput	100.0%
QUAP005: VoIP MOS downlink (listening)	75.2%
QUAP006: VoIP MOS uplink (talking)	92.8%

Below the main table, there is a 'KPI' section with a 'Target' column and a 'Green/Yellow' status indicator. The targets and status are as follows:

KPI	Target	Status
AV008: Beacon availability in managed AP scan	>=1.0F	80.0% 70.0%
AC001: Radio attach success rate	>=1.0F	98.0% 90.0%
AC002: IP address retrieval success rate	>=1.0F	98.0% 90.0%
QURT007: Ping success rate	>=1.0F	80.0% 50.0%
RE004: FTP test success rate	>=1.0F	90.0% 75.0%
RE005: VoIP test success rate	>=1.0F	90.0% 75.0%
QURT004: Ping RTT	<=50.0ms	99.5% 95.0%
QUAP001: FTP DL throughput	>=5.5Mbit/s	95.0% 85.0%
QUAP002: FTP UL throughput	>=1.5Mbit/s	95.0% 85.0%
QUAP005: VoIP MOS downlink (listening)	>=3.6F	90.0% 80.0%
QUAP006: VoIP MOS uplink (talking)	>=3.6F	90.0% 80.0%

Default SLA metrics describe network connectivity and quality-of-service (QoS) starting from radio availability to end-to-end connection quality. Below is an illustration of client connection phases.



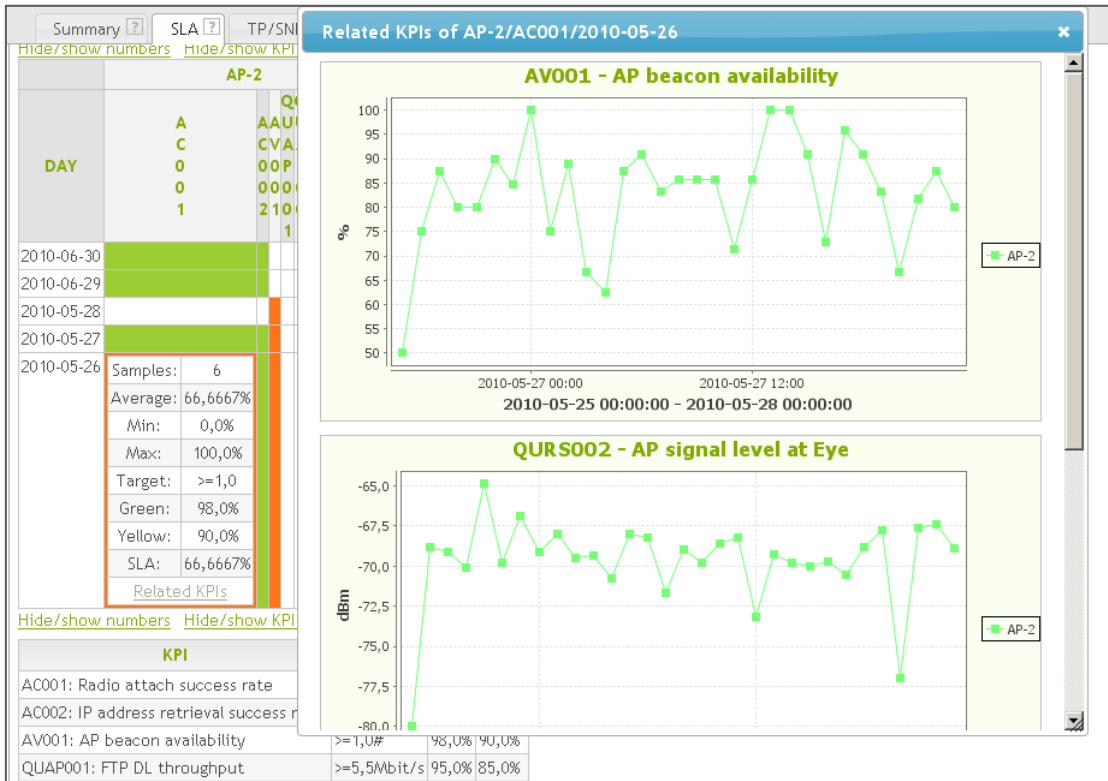
5.1 Three-basket principle

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.



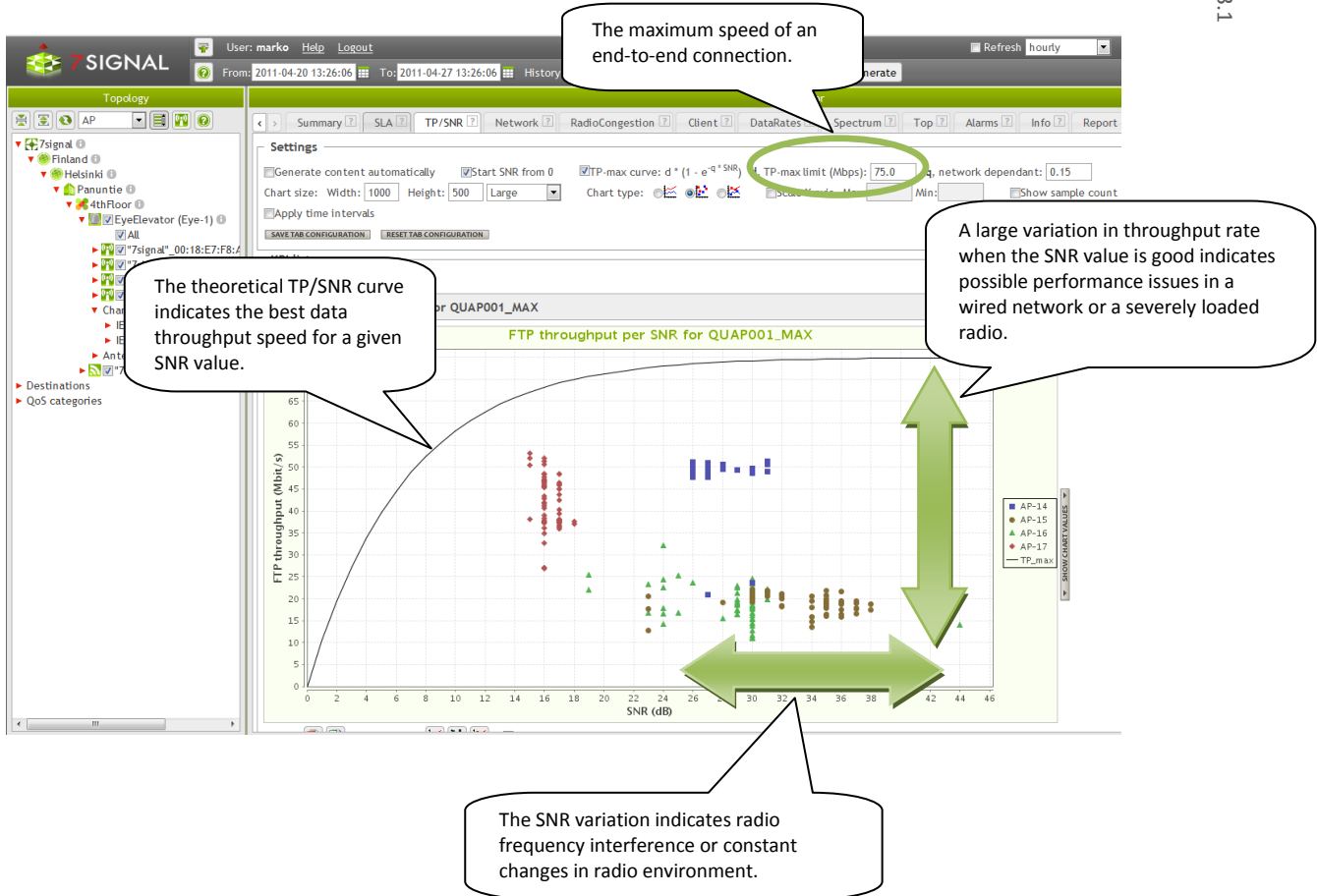
In case further analysis is needed, the link “Related KPIs” pop additional KPI charts up. The charts show a set of KPIs on time-interval that has shown on SLA table row expanded with one unit earlier and later. If the SLA table row is for an hour, the KPI chart includes the preceding and the following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

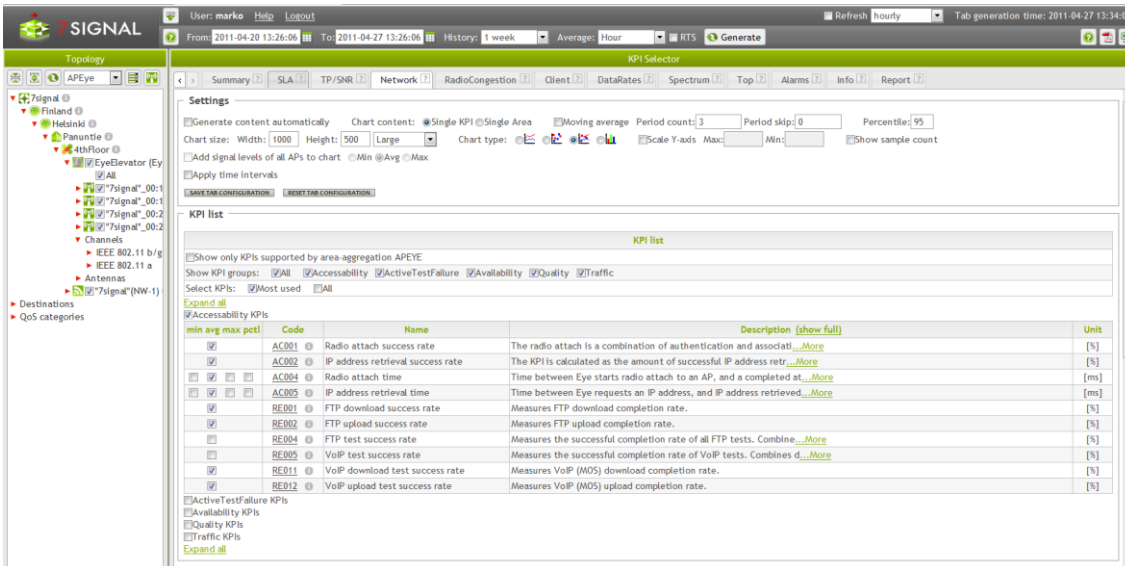
The picture below is an example on how to interpret the TP /SNR chart.



7 NETWORK PERFORMANCE INDICATORS

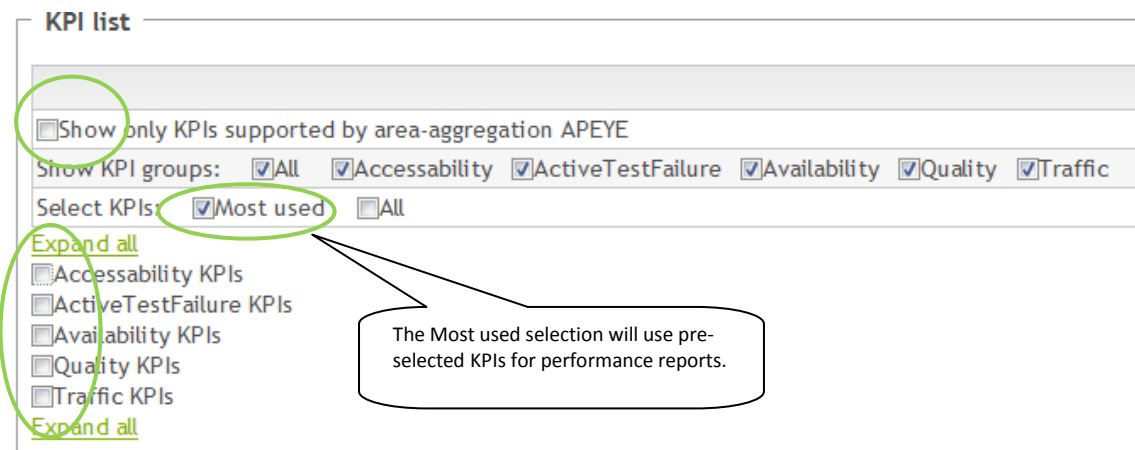
The KPIs in the Network tab are divided into five groups: Accessibility, Availability, Quality, Traffic and Active test failures.

- 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.



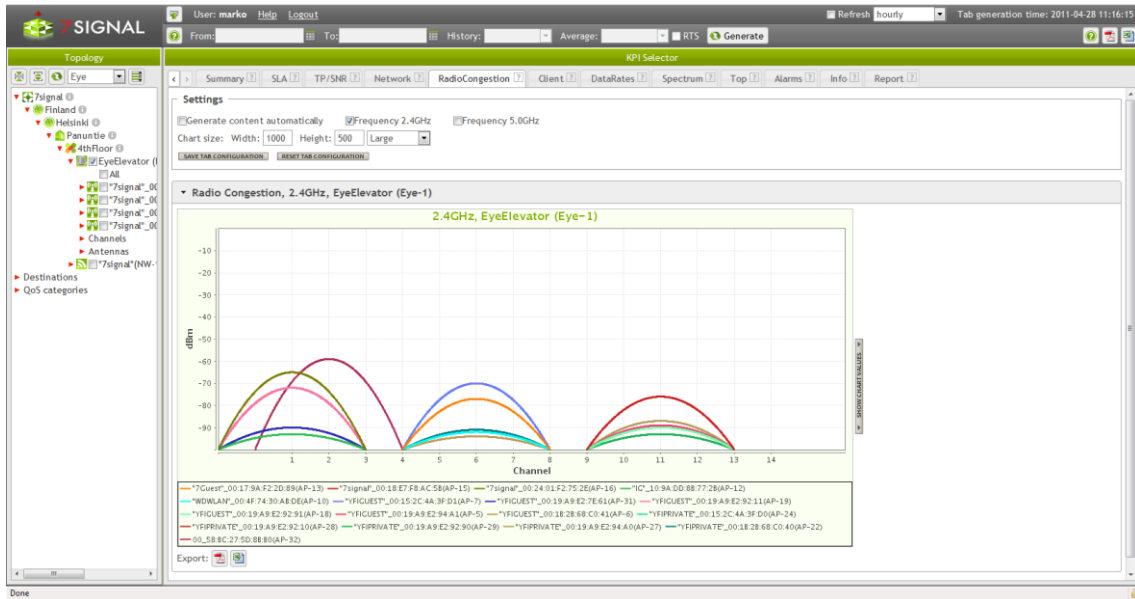
The Network KPIs are grouped in to separate selectable sub-groups. Check-boxes are available to select the sub-group. Both top-horizontal and vertical check-boxes control the same set of KPIs. Even when the horizontal selection limits the number of KPIs, the user benefits from the vertical control as well.

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

8 RADIO CONGESTION

Radio congestion view shows the most recent channel usage information for the Eye coverage area. The channel information is presented for both 2.4 GHz and 5 GHz frequencies. Graphs may be displayed separately for each antenna on as an average of all antennas.

The radio graph presents average signal level results and theoretical signal bandwidth in order to see possible overlapping issues. The table below the graph presents line color, BSSID and radio MAC information.



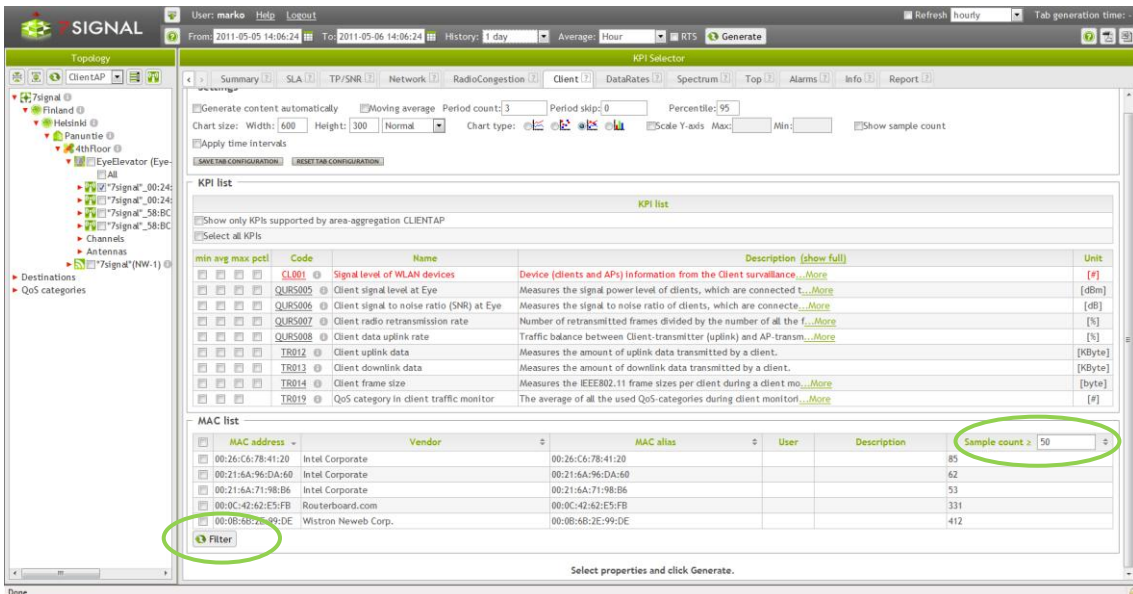
9 CLIENT PERFORMANCE INDICATORS

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

Client statistics are e.g. signal level, SNR, client retransmissions or frame sizes.

You can view the results by user (i.e. by clientAP) by choosing the Client level from the Topology view. The clients will be shown only from selected access points and from selected time period. The client list have client MAC address, client device radio interface vendor name, MAC alias (can be set with Sapphire GUI), user (can be set with Sapphire GUI), description (can be set with Sapphire GUI) and sample count.

The number of shown clients can be limited with sample count value. Filter button is for displaying the clients from selected access points and time period only.

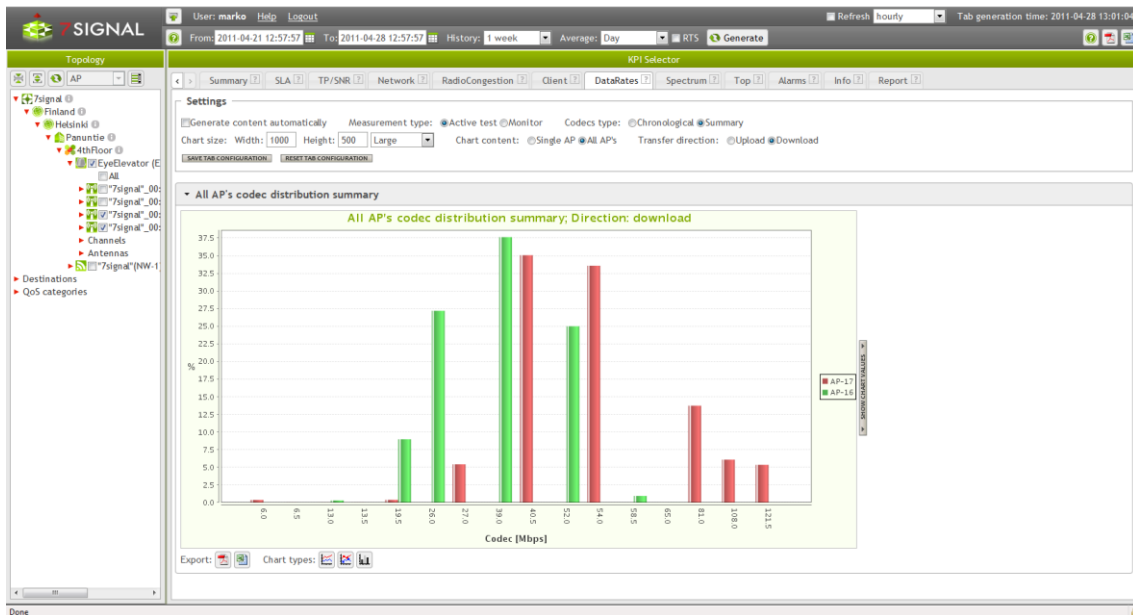


10 DATA RATE CODEC INDICATORS

This view displays the distribution of radio codecs used during the active tests. The codec used indicates the data transfer rate (Mbps). The use of small codecs is a sign of interference/functionality problems in the radio 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 client list.

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.



10.1 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.

Changes history of "7signal"_00:18:E7:F8:AC:5B(AP-15)

Time	Event	Previous value	New value
2011-04-27 13:11:01	Channel change	9	11

11 SPECTRUM

Loupe displays the spectrum analysis results from the chosen time span.

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

11.1 Over period chart

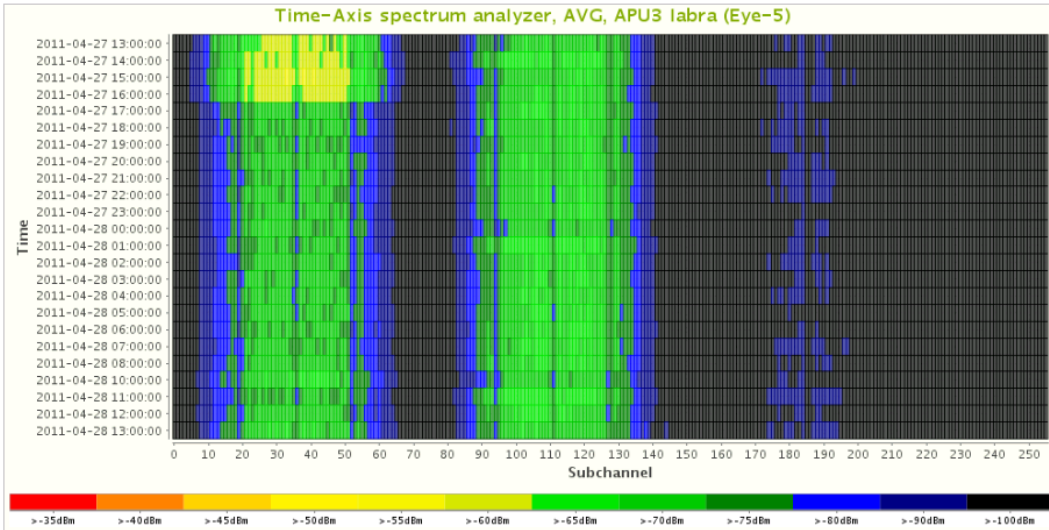
Loupe displays the spectrum analysis results from the chosen time span to assist you in continuous monitoring. In the “over period chart”, the signal level is plotted on the y- axis, and each antenna is represented by an individual chart. The swept frequency band is on the x axis. If you select several 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.



11.2 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.

WLAN channel	1	2	3	4	5	6	7	8	9	10	11	12	13
Frequency (GHz)	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
Subchannel	36	51	66	81	96	111	126	141	156	171	186	201	216



The show time-axis table – button will open more detailed spectrum results based on the selected time period and averaging time. The number of rows can be selected by adding value to the box above to table. This example has averaging time 1min and number of rows 10, which gives results from 10min period.

HIDE TIME-AXIS TABLE

Number of rows in table (Rows * Channels = Total entries): * 256 = 2560

> -35 dBm > -40 dBm > -45 dBm > -50 dBm > -55 dBm > -60 dBm > -65 dBm > -70 dBm > -75 dBm > -80 dBm > -90 dBm > -100 dBm

WLAN channels		1	2	3	4	5	6	7	8	9	10	11	12	13	
Timestamp	2400-2410 MHz	2410-2421 MHz	2421-2431 MHz	2431-2442 MHz	2442-2453 MHz	2453-2463 MHz	2463-2474 MHz	2474-2485 MHz							
2011/04/27 13:27:00:0	[Spectrum data]														
2011/04/27 13:28:00:0	[Spectrum data]														
2011/04/27 13:29:00:0	[Spectrum data]														
2011/04/27 13:57:00:0	[Spectrum data]														
2011/04/27 13:58:00:0	[Spectrum data]														
2011/04/27 13:59:00:0	[Spectrum data]														
2011/04/27 14:00:00:0	[Spectrum data]														
2011/04/27 14:01:00:0	[Spectrum data]														
2011/04/27 14:02:00:0	[Spectrum data]														
2011/04/27 14:28:00:0	[Spectrum data]														

12 TOP

This view displays the best and/or worst performing BSSIDs based on the selected KPIs. The default TOP selections will display e.g. beacon availability and average throughput.

The screenshot shows the 'KPI Selector' interface in the 7signal application. The interface includes a left-hand navigation tree, a top navigation bar with various tabs, and a main content area with a 'Settings' section and a 'KPI list' table.

Settings:

- Generate content automatically:
- Number of rows in the list: 5
- Order list: Best Worst Both
- Apply time intervals:

KPI list:

AP	AV001	AP	AV002
AP-14	100.0000 %	AP-14	100.0000 %
AP-17	100.0000 %	AP-15	99.3506 %
AP-15	99.7429 %	AP-17	91.6666 %
AP-16	99.4832 %	AP-16	85.3896 %

AP	QUAP001	AP	QUAP002
AP-14	46.6793 Mbit/s	AP-17	60.3681 Mbit/s
AP-17	43.3242 Mbit/s	AP-14	50.6448 Mbit/s
AP-16	19.3655 Mbit/s	AP-16	30.8727 Mbit/s
AP-15	16.7711 Mbit/s	AP-15	17.2539 Mbit/s

AP	QURT004
AP-14	1.5797 ms
AP-17	2.1331 ms
AP-16	2.2391 ms
AP-15	6.4472 ms

13 ALARMS

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

Alarms can be seen by access point and filter by status and severity.

Settings

Generate content automatically Show alarms for all APs Order Alarms by: Severity Descending

Filter Alarms by: Status: All New Acknowledged Offed Severity: All Criticals Warnings Messages

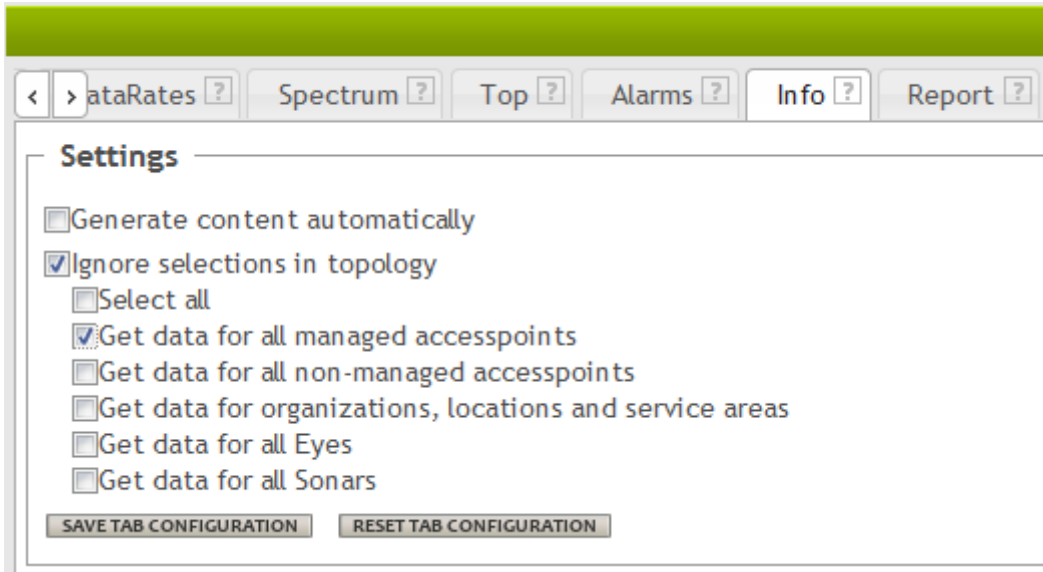
Alarms summary

Severity	Alarm text	AP Id	AP name	Eye Id	NW Id	Create time	Ack time	Off time
warning	Unknown Access Point Detected	78	(*EiIsaKoti73*_00:0C:C3:7F:1B:CC)	4	0	2011-04-26 19:03:50	-	-
warning	Unknown Access Point Detected	88	(00_58:BC:27:59:CC:20)	2	0	2011-04-27 09:44:28	-	-
warning	Unknown Access Point Detected	89	(00_58:BC:27:5D:8B:B0)	2	0	2011-04-27 09:44:28	-	-
warning	Unknown Access Point Detected	92	(00_58:BC:27:5D:8B:B0)	3	0	2011-04-27 09:53:36	-	-
warning	Unknown Access Point Detected	118	(*YFIPRIVATE*_00:19:A9:E2:7E:60)	5	0	2011-04-27 11:36:30	-	-
warning	Unknown Access Point Detected	87	(*hkl34*_00:18:F8:3C:1A:9E)	3	0	2011-04-27 17:07:22	-	-
warning	Unknown Access Point Detected	142	(*HOTSPOT*_02:24:D6:00:01:7E)	3	0	2011-04-28 13:04:04	-	-
warning	Unknown Access Point Detected	143	(*HOTSPOT*_02:24:D6:00:01:7E)	5	0	2011-04-28 13:12:30	-	-
warning	Attach Success Rate	2	Printer g-radio (*7signal*_00:18:E7:F8:AC:5B)	1	1	2011-04-28 15:27:12	-	-
warning	VoIP Success Rate	2	Printer g-radio (*7signal*_00:18:E7:F8:AC:5B)	1	1	2011-04-28 15:29:38	-	-
warning	FTP Success Rate	2	Printer g-radio (*7signal*_00:18:E7:F8:AC:5B)	1	1	2011-04-28 15:31:24	-	-
warning	Retransmission Rate Exceeded	2	Printer g-radio (*7signal*_00:18:E7:F8:AC:5B)	1	1	2011-04-28 15:35:50	-	-

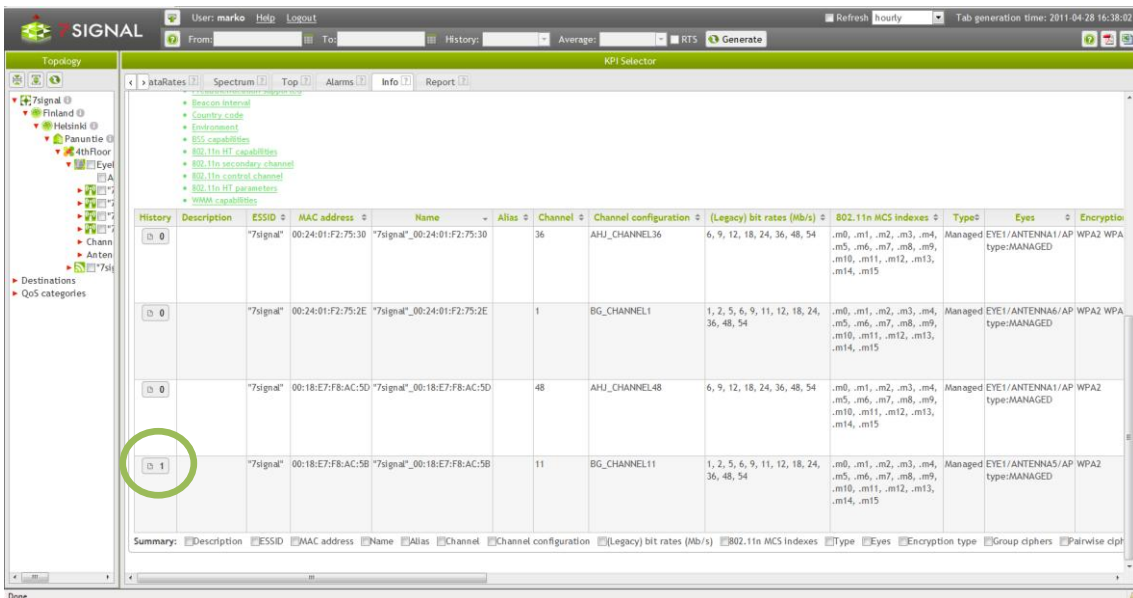
14 INFO

Info view presents detailed information about the network elements.

The info results can be generated automatically based on the topology tree selections or user can use topology selections from the settings pane.



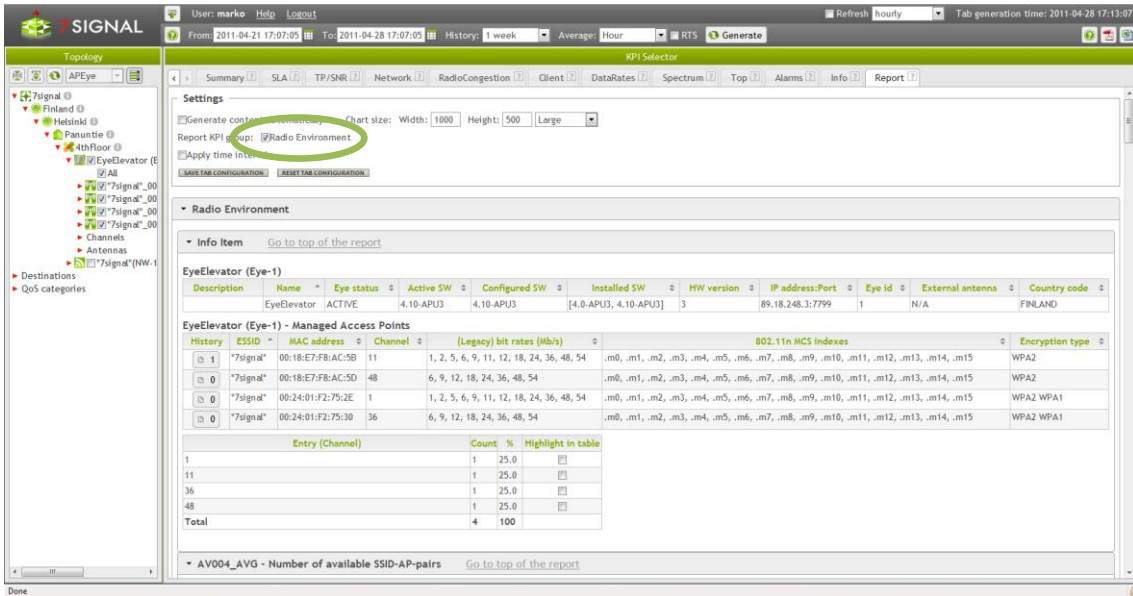
Info view shows e.g. access point authentication methods, supported bit rates, beacon intervals, 802.11n HT capabilities etc. It also gives changed history data of the changed access point settings.



15 REPORT

Report view is for generating pre-defined reports. In this version there is "Radio Environment" report. The purpose of radio environment report is to show environment statistics from the selected area.

Radio Environment report includes basic element info, number of SSID-AP-pairs, signal levels, SNR, channel usage, channel noise and spectrum results. All the reports include also short explanation of the graph results.



Report can be exported also to pdf or csv format.



16 HOW TO TROUBLESHOOT USING LOUPE

16.1 Typical pattern

A typical troubleshooting workflow is as follows:

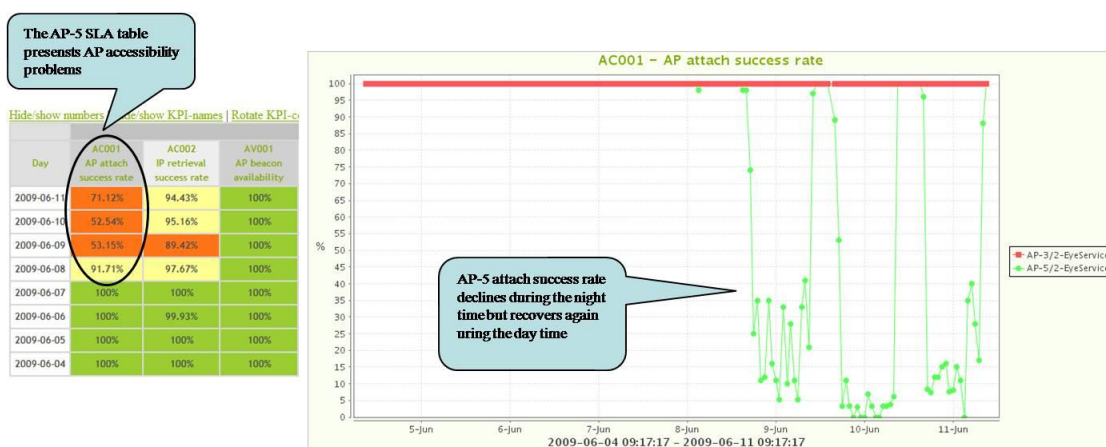
1. When logging in, you discover that there is an unusually large amount of failed wireless connection availability tests (AC001).
2. Go to the SLA tab and choose the access point or network where the issue has occurred. From the pull-down menu, choose the last 7 days as the time span and set the averaging 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)

16.2 Troubleshooting: Use Cases

16.2.1 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)

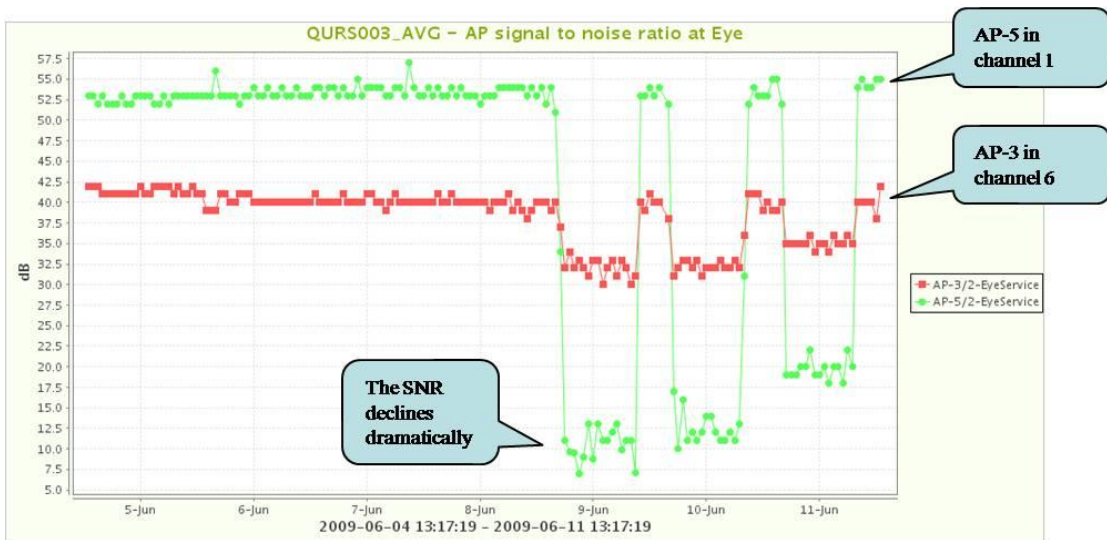
The beacon availability presents if AP has been active and achievable



➔ AP radio transmission has been active

AP SNR at Eye (QURS003)

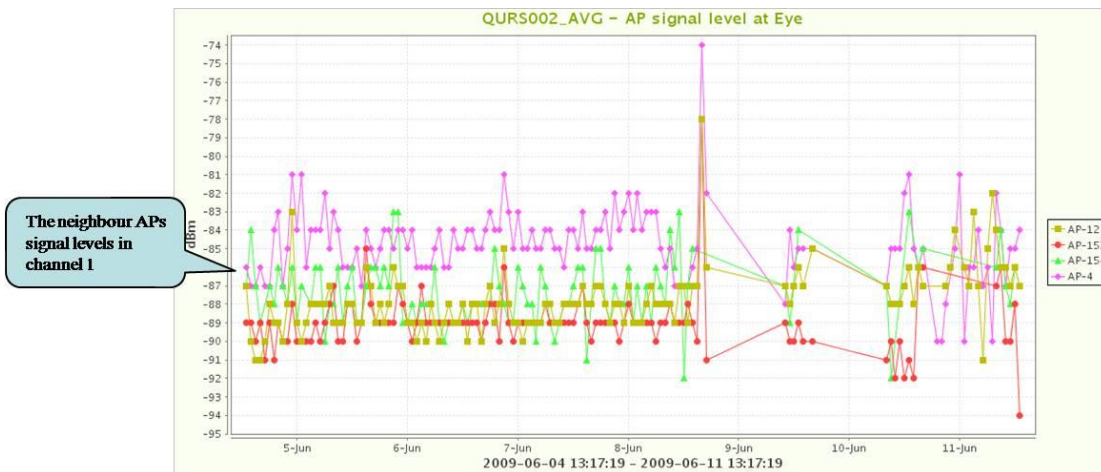
The measured AP signal level and SNR indicate variations in the radio environment



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

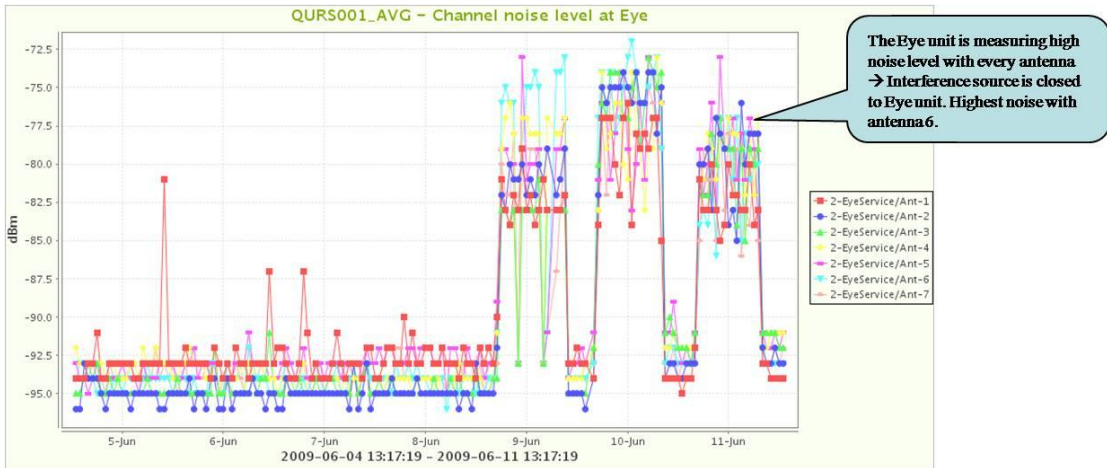
The signal levels of neighbor APs (QRS002)

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



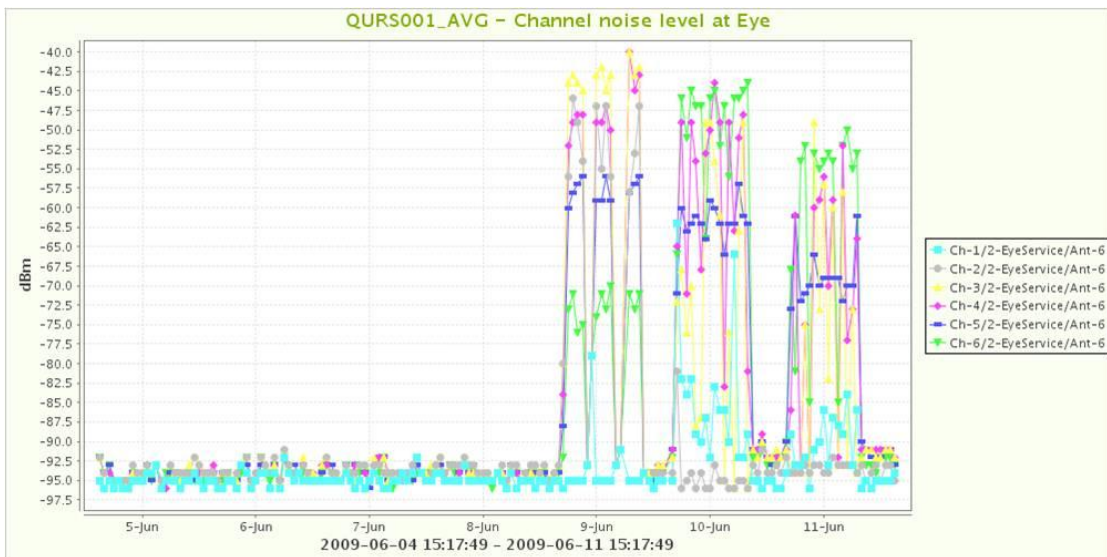
Channel noise level / Antenna (QRS001)

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



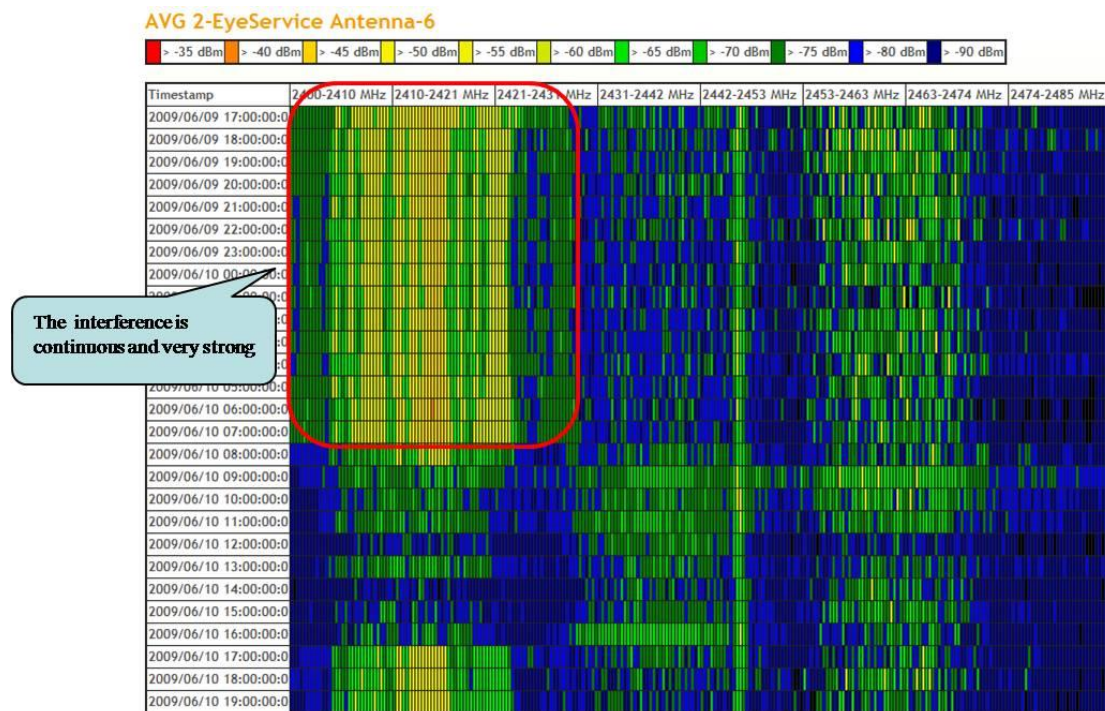
Channel noise level / Antenna 6, channels 1-6 (QRS001)

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.



16.2.2 Downlink Performance Problem

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

The VoIP MOS DL performance is unacceptable during the working days

Day	AC001 AP attach success rate	AC002 IP retrieval success rate	AV001 AP beacon availability	QUAP001 FTP DL throughput	QUAP002 FTP DL throughput	QUAP005 MOS Downlink	QUAP006 MOS Uplink	QURT004 Ping RTT	QURT007 Ping success rate	RE004 FTP test success rate	RE005 VoIP test success rate
2009-05-05	100%	100%	100%	94.01%	99.08%	75.01%	88.21%	97%	100%	100%	100%
2009-05-04	99.92%	100%	100%	92.61%	96.24%	76.1%	87.13%	98.2	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%	97.19%	99.1	100%	100%	100%
2009-04-30	100%	100%	100%	90.52%	99.11%	66.06%	90.33%	95.7	100%	100%	100%
2009-04-29	99.92%	100%	100%	93.67%	99.07%	53.23%	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%	89.87%	96.28%	62.87%	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%	71.51%	98.48%	77.44%	89.74%	97.38%	98.89%	99.83%	99.49%
2009-04-23	99.84%	83.71%	100%	90.73%	98.21%	70.43%	92.77%	93.07%	97.88%	99.9%	99.35%
2009-04-22	99.79%	85.68%	100%	89.84%	97.67%	77.07%	93.07%	95.35%	96.07%	99.61%	99.45%
2009-04-21	100%	93.65%	100%	83.16%	96.2%	70.57%	88.57%	93.22%	99.19%	100%	99.76%

KPI	Target	Green	Yellow
AC001: AP attach success rate	≥1.0f	98.0%	90.0%
AC002: IP retrieval success rate	≥1.0f	98.0%	90.0%
AV001: AP beacon availability	≥1.0f	98.0%	90.0%
QUAP005: FTP DL throughput	≥1.0Mbit/s	95.0%	85.0%
QUAP002: FTP UL throughput	≥1.0Mbit/s	95.0%	85.0%
QUAP005: MOS Downlink	≥3.5	90.0%	80.0%
QUAP006: MOS Uplink	≥3.6	90.0%	80.0%
QURT004: Ping RTT	≤200.0ms	99.3%	93.0%
QURT007: Ping success rate	≥1.0f	80.0%	50.0%
RE004: FTP test success rate	≥1.0f	90.0%	75.0%
RE005: VoIP test success rate	≥1.0f	90.0%	75.0%

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

The table presents downlink performance problems during the working days.

➔ Wireless or fixed network problem?

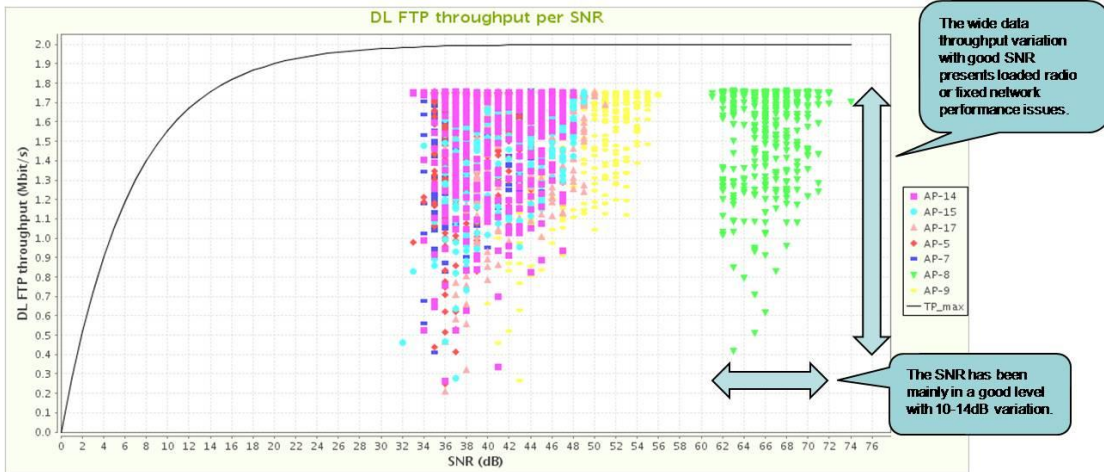
Check also these KPIs:

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

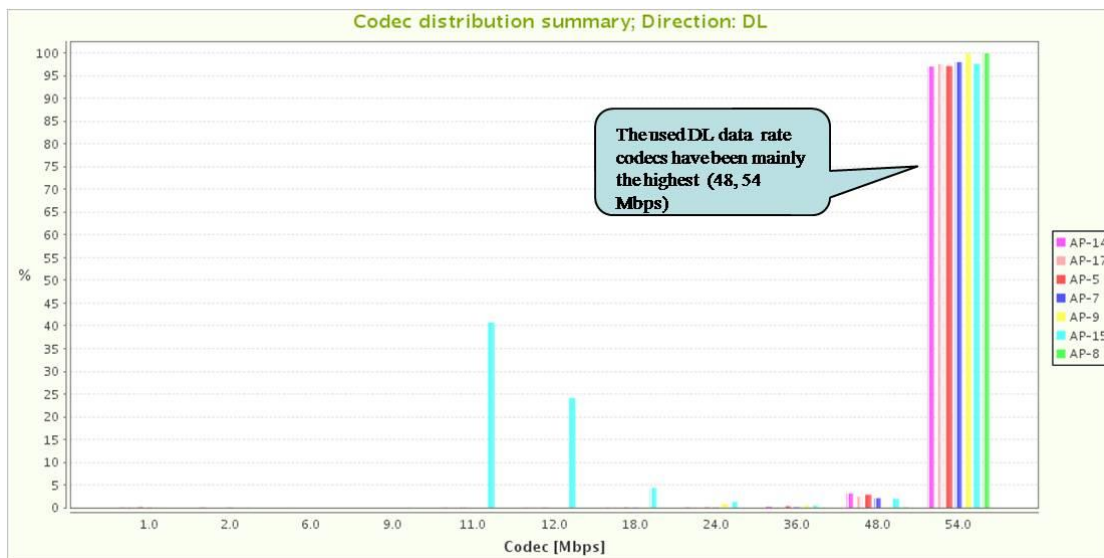
FTP DL throughput / SNR (TP/SNR)

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



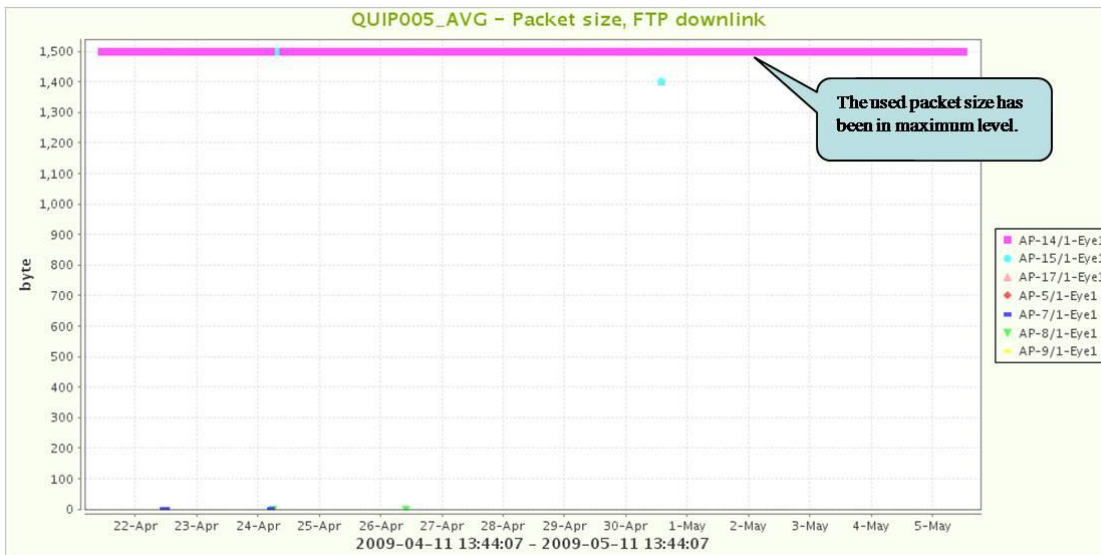
DL codec distribution (Data rates)

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



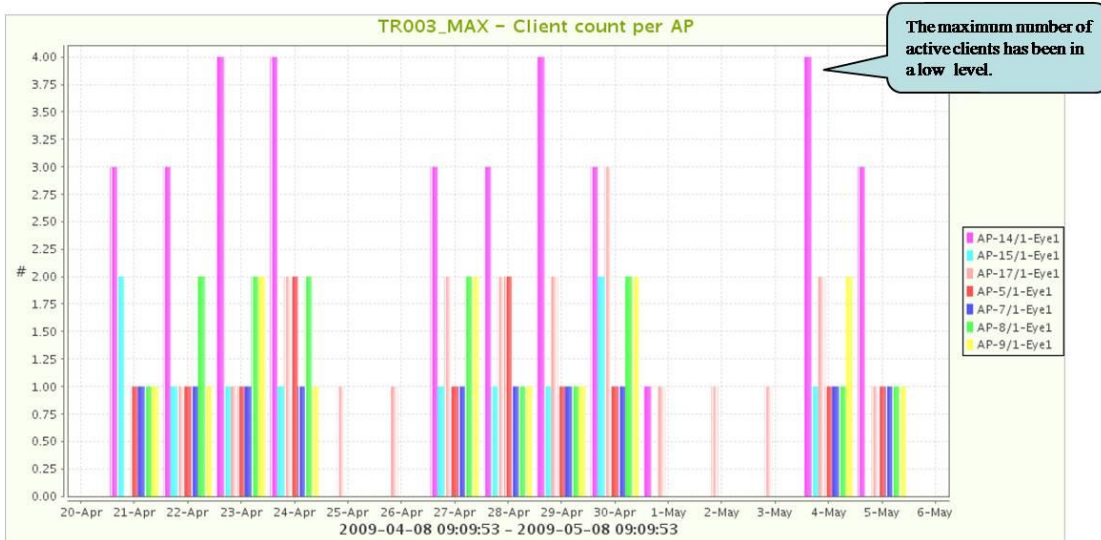
FTP DL packet size (QUIP005)

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

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

➔ Wireless or fixed network problem?

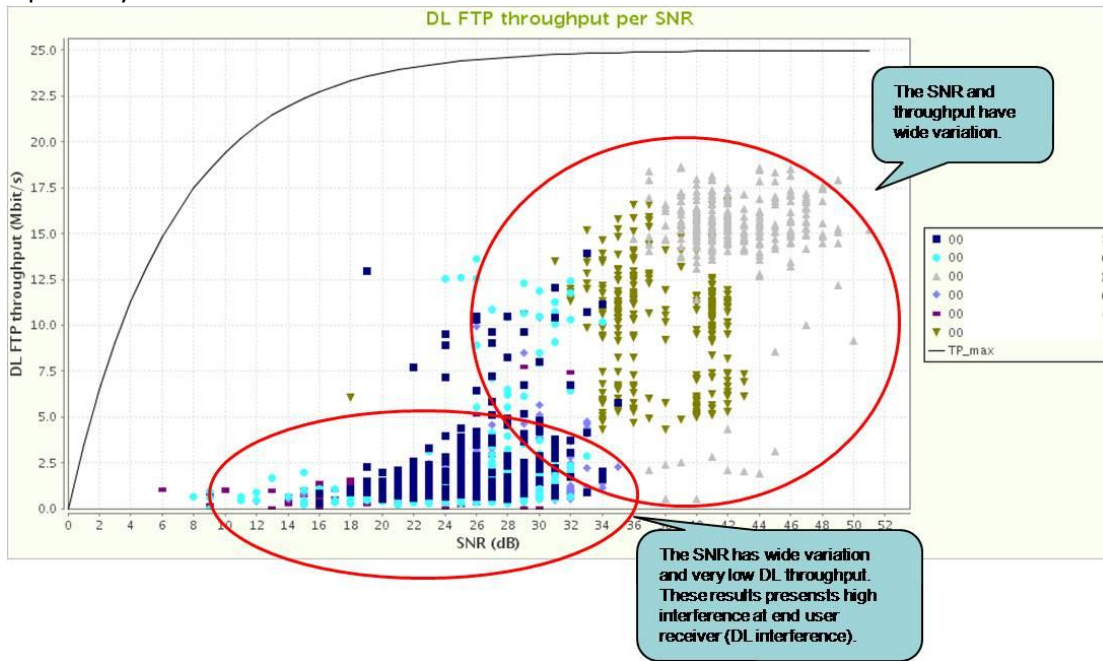
Check also these KPIs:

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

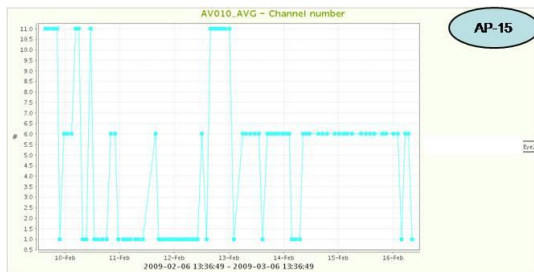
QUAP005 & QUAP006	VoIP MOS downlink (listen) & VoIP MOS uplink (talk)	The VoIP MOS KPI presents detailed information about VoIP MOS variation in the network. With 2 or more Sonar setup the VoIP MOS performance can be observed in wireless and wired side.
QUAP015	VoIP MOS packet loss	The VoIP packet loss 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)

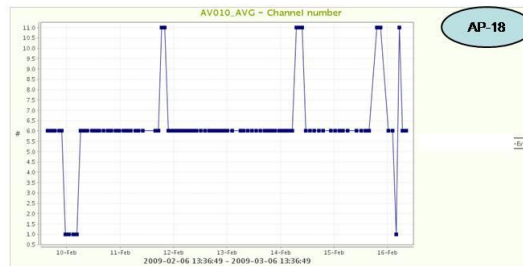
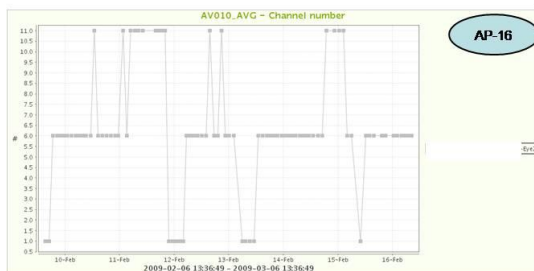
The TP/SNR KPI can be used to determine if wireless and/or wired side conditions change repeatedly.



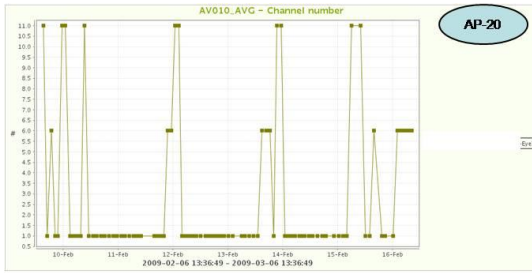
AP Channel information (AV010)



The APs have automated channel selection activated

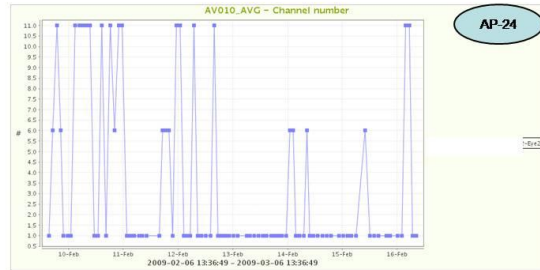


AP Channel information (AV010)

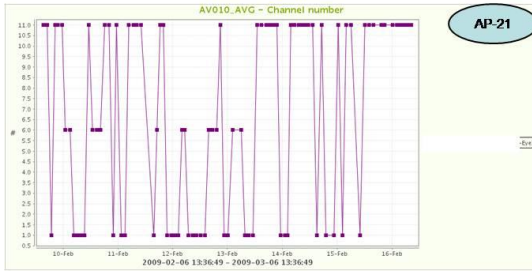


AP-20

The APs have automated channel selection activated



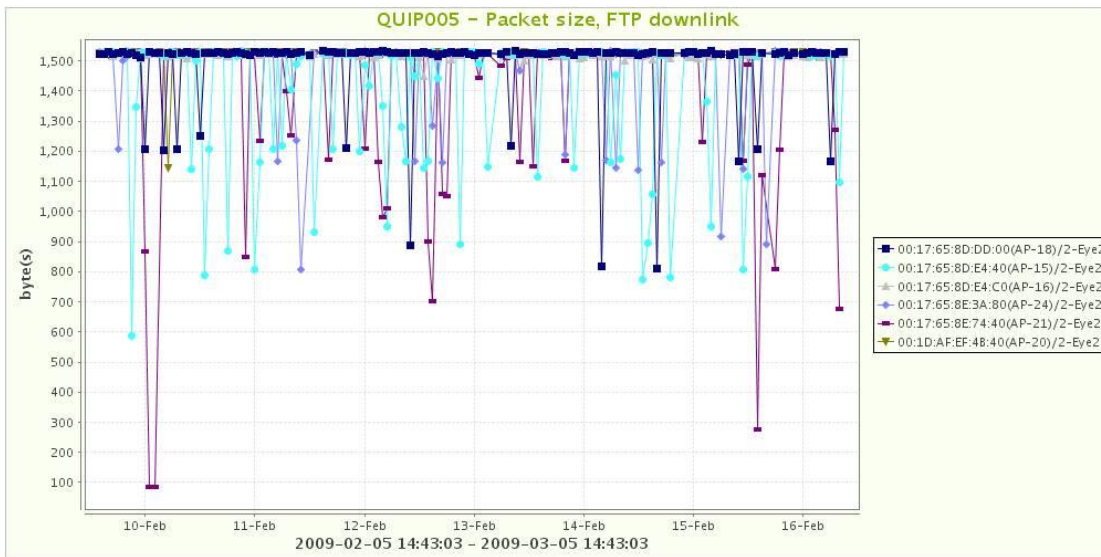
AP-24



AP-21

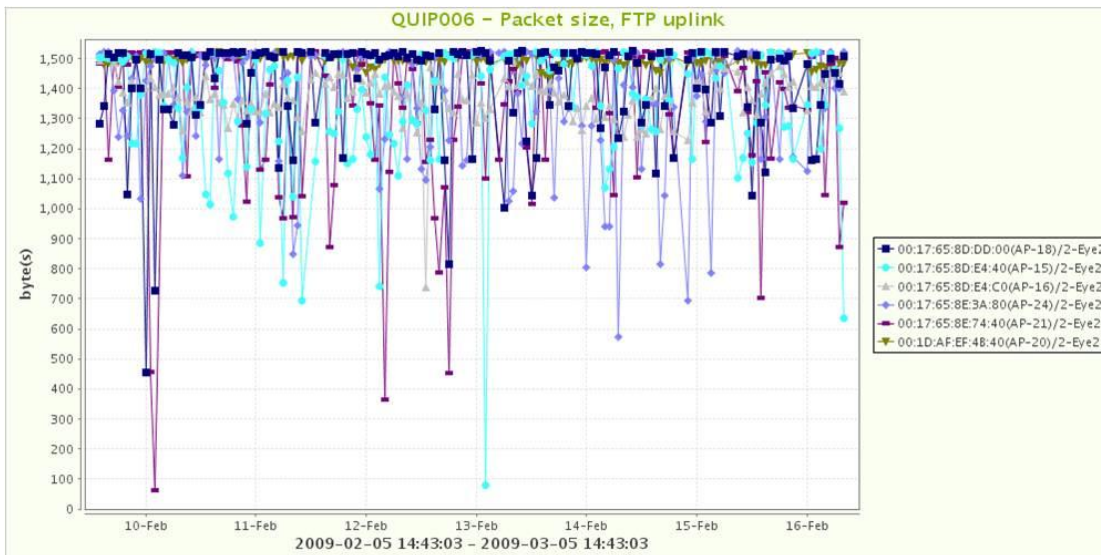
QUIP005 - FTP DL packet size

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



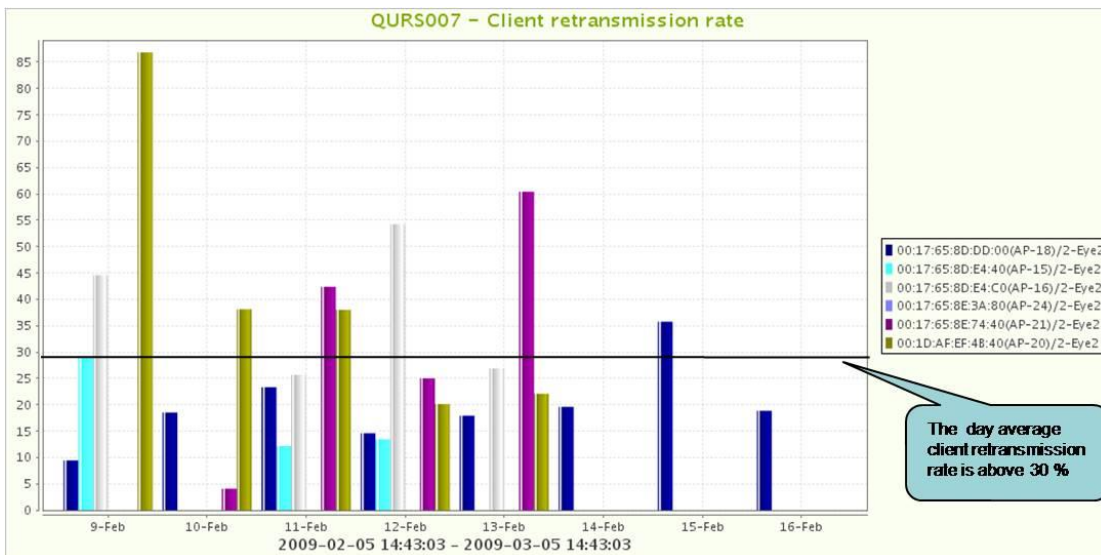
FTP UL packet size (QUIP006)

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.

17 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.	#
AV008	Beacon availability in managed AP scan	Measures beacon signal transmission from each monitored managed AP. The KPI is the relative amount of received and expected beacons. The test is called SCAN_MANAGED. Results from SCAN_RADIO-tests are ignored	%
AV009	Access point beacon availability in global AP scan	Measures beacon signal transmission from all heard APs. The KPI is the relative amount of received and expected beacons. The scan is called SCAN_RADIO. Results from SCAN_MANAGED are ignored	%
AV010	Channel number average of selected element	Channel number average of selected element	#
AV011	Channel congestion	Channel number of an AP as a function of signal strength. Presents channel congestion information over selected time period	#
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.	%	7signal Sapphire Loupe User Guide Release 3.1
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	
AC006	Authentication success rate	The KPI is calculated as the amount of successful authentications divided by all the requests by Eye	%	
AC007	Radio authentication time	Time it takes to authenticate to the Access Point	ms	
AC008	Association success rate	The KPI is calculated as the amount of successful associations divided by all the requests by Eye.	%	
AC009	Radio association time	Time it takes to associate to the Access Point	ms	
RE001	FTP download success rate	Measures FTP download completion rate.	%	
RE002	FTP upload success rate	Measures FTP upload completion rate.	%	
RE004	FTP test success rate	Measures the successful completion rate of all FTP tests. Combines download and upload tests	%	
RE005	VoIP test success rate	Measures the successful completion rate of VoIP tests. Combines download and upload tests	%	
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.	%
QUAP016	Requested QoS category in FTP tests	Requested QoS category in an FTP test. The QoS categories are defined by the IEEE 802.11e amendment.	#
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.	#
QUAP032	TCP connection time	Time in which TCP connection between Eye and Sonar has been established.	us
QUIP005	WLAN radio frame size, FTP downlink	RF frame size distribution in FTP downlink transfer test. If possible, WLAN devices try to use the maximum transmission unit. Due to radio interference, WLAN devices might reduce the frame size, which leads to relatively larger frame overhead, and eventually to lower data throughput. Note that this indicator measures the size of the data link layer frame, which is defined by IEEE 802.11, thus, this indicator doesn't measure the size of TCP/IP packets.	byte(s)

QUIP006	WLAN radio frame size, FTP uplink	RF frame size distribution in FTP uplink transfer test. If possible, WLAN devices try to use the maximum transmission unit. Due to radio interference, WLAN devices might reduce the frame size, which leads to relatively larger frame overhead, and eventually to lower data throughput. Note that this value is the size of the data link layer frame, which is defined by IEEE 802.11, thus, this indicator doesn't indicate the size of TCP/IP packets.	byte(s)
QUIP013	WLAN radio frame size, HTTP downlink	RF frame size distribution in HTTP downlink transfer test. If possible, WLAN devices try to use the maximum transmission unit. Due to radio interference, WLAN devices might reduce the frame size, which leads to relatively larger frame overhead, and eventually to lower data throughput. Note that this value is the size of the data link layer frame, which is defined by IEEE 802.11, thus, this indicator doesn't indicate the size of TCP/IP packets.	byte(s)
QURS001	Channel noise level at Eye	RF noise level in dBm, measured by Eye.	dBm
QURS002	Managed AP signal level at Eye	Measures the AP transmitted power level of radio signal from the Eye point of view.	dBm
QURS003	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
QURS004	AP radio retransmission rate	Number of retransmitted frames divided by the number of all the frames sent to downlink by an AP.	
QURS009	Global AP signal level at Eye	Measures the AP transmitted power level of radio signal from the Eye point of view.	dBm
QURS026	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

QURS027	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	7signal Sapphire Loupe User Guide Release 3.1
QURS028	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	
QURS029	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	
QURS030	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	
QURS032	Retransmissions in FTP test	Measures the round trip time between an Eye and a Sonar server. The test pings a server N times with zero wait time between the pings. The default ping packet size is 32 kilobytes. The default ping count N is 10.	ms	
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.	#
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
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
QURS007	Client radio 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 data uplink rate	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 frame size	Measures the IEEE802.11 frame sizes during a monitoring per client.	byte
TR0019	Average QoS category in client traffic monitor	The average of all the used QoS-categories during client monitoring.	#