

Enterprise



The ArubaOS Spectrum Analyzer Module

The ArubaOS Spectrum Analyzer Module Tech Brief

Table of Contents

Introduction	2
Visibility into the non-802.11 Spectrum	2
Features	3
Record and Playback.....	3
Easy to Use	4
Full Visibility	5
Channel Health.....	5
Interference Classification	6
Real-Time Visibility.....	7
Spectrum Analysis Examples.....	7
Adaptive Radio Management	8
The Aruba Difference.....	9

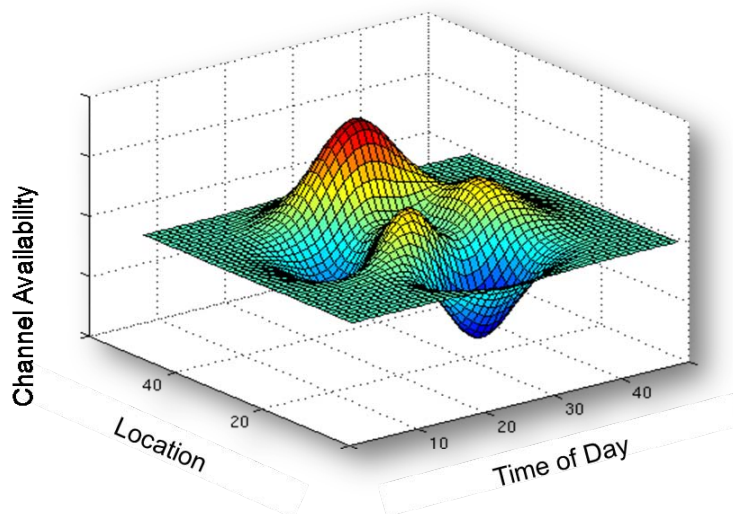
Introduction

Enterprise wireless LAN (WLAN) users expect instant, always-on connectivity for their 802.11n mobile devices – laptops, BlackBerrys, iPhones, iPads, Droids and tablet PCs. As the demand for wireless connectivity continues to grow, reliability and performance across the WLAN infrastructure becomes paramount.

However, radio frequency (RF) interference – which is inevitable and unpredictable – can put WLAN reliability and performance at risk. It can originate from neighboring Wi-Fi networks or non-Wi-Fi sources, such as 2.4-GHz cordless phones, microwave ovens, analog video cameras and wireless telemetry systems.

The characteristics and severity of RF interference can vary based on the type and location of the device. Interference can also occur continuously or intermittently, the latter being the most difficult to isolate.

Full spectrum visibility is imperative to successfully mitigate RF interference in enterprise WLANs and ensure a high-quality user experience. Spectrum analysis functionality should be part of the WLAN infrastructure, requiring no additional hardware and software. Opting for an integrated, infrastructure-based spectrum solution minimizes initial acquisition costs and improves operational efficiency.



RF interference and WLAN channel availability are in part affected by location and time of day.

Visibility into the non-802.11 Spectrum

The Aruba Networks spectrum analyzer provides a critical layer of visibility into non-802.11 sources of RF interference and their effects on WLAN performance. Using Aruba APs to scan the spectral composition of 2.4-GHz and 5-GHz radio bands, the spectrum analyzer remotely identifies RF interference, classifies its source and provides real-time analysis at the point of the problem.

Data collected by the Aruba spectrum analyzer is used to quickly isolate packet transmission problems and traffic congestion issues caused by RF contention with other devices operating in the same band or channel. Appropriate remediation measures can then be put in place to remove the interfering non-802.11 devices from the environment and return the network to optimal performance.

Because the Aruba spectrum analyzer is enabled in the ArubaOS operating system, any Aruba 802.11n AP can perform spectrum analysis. That means any existing Aruba WLAN with hundreds of 802.11n APs also has hundreds of spectrum analyzers that can be instantly activated to remotely monitor the air from a central console dashboard.

The spectrum analyzer works with Aruba's Adaptive Radio Management (ARM) technology to ensure network reliability and performance. ARM leverages infrastructure-based controls to move away from sources of Wi-Fi and non-Wi-Fi interference with its built-in intelligence to monitor and store information about 802.11 channel health.

Feature Summary

- Enabled in the ArubaOS operating system via software license.
- Any Aruba 802.11n access point (AP) can be activated to perform spectrum analysis.
- Wi-Fi chipset within Aruba 802.11n APs perform simultaneous scanning for wireless security and spectrum analysis scanning – no time slicing required.
- Controlled from a centralized Aruba Mobility Controller console on a per-radio basis.
- APs continuously scan for wireless security events while performing spectrum analysis.
- Integrates fast Fourier transform (FFT) displays and spectrograms for real-time troubleshooting and visualization.
- Spectrum data recording enables unattended data capture and playback of intermittent interference events.
- Provides 14 different spectrum analysis charts for RF visualization and easy troubleshooting.
- Offers 312-kHz resolution bandwidth to enable the classification of more than 20 different sources of interference in less than five seconds.
- Enables notifications for detected non-Wi-Fi noise events to enable faster problem resolution.

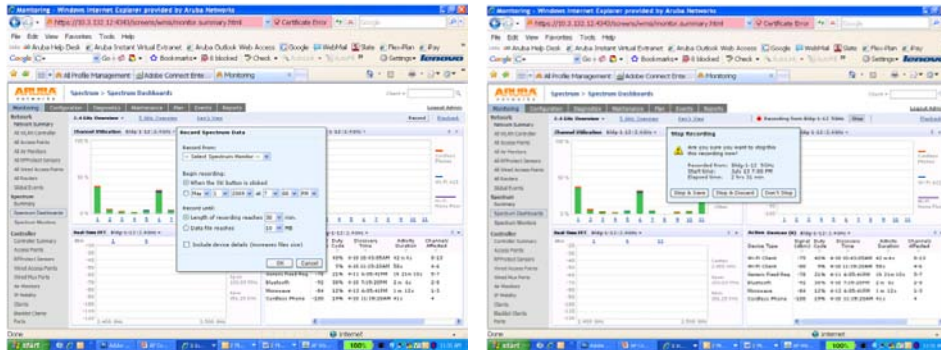
Record and Playback

The Aruba spectrum analyzer includes a vital recording capability that automatically captures RF data over any duration of time. Since occurrences of RF interference can be

unpredictable and intermittent, the recording capability increases the likelihood of capturing transient events without the physical presence of IT personnel.

Initiating a recording of RF data is easy. Simply enter the start date and time, the stop date and time, the AP to be recorded and the maximum allowable file size. RF data recording can be stopped at any time.

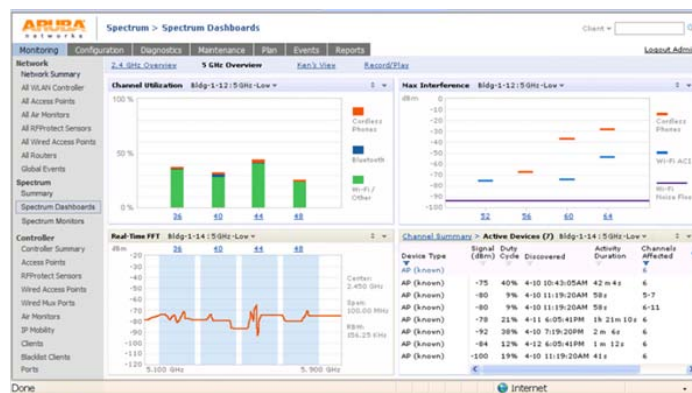
Recorded data can be played back by the IT administrator or Aruba support organization through the use of an Aruba Mobility Controller.



Capture intermittent interference events by recording RF data over any length of time. Simply enter the start and stop dates and times, the AP to be recorded and the maximum file size.

Easy to Use

An intuitive graphical user interface with drop-down selection options and vivid color charts make it simple to set up and use the Aruba spectrum analyzer. A general dashboard provides a summary update about all spectrum analyzer functions and capabilities.



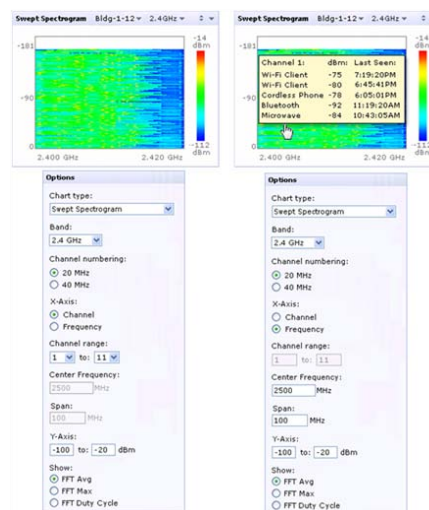
The general dashboard offers a summary update of all spectrum analyzer functions.

IT administrators can navigate down into most dashboard functions to extract additional information and graphical charts, such as spectrograms and their associated configuration menus.

Full Visibility

Graphical charts presented in the spectrum analyzer user interface fall into three key functional areas – channel health, interference classification and real-time visibility.

- **Channel Health:** Provides visibility into the overall health of each 802.11 Wi-Fi channel using a variety of charts that display channel utilization, channel utilization trend, channel quality, channel quality trend and a channel summary.
- **Interference Classification:** Identifies type of devices that are present within the WLAN environment using charts that show active devices, devices vs. channels, active devices trend, interference power and an active devices table.
- **Real-Time Visibility:** FFT duty cycle, channel quality spectrogram, swept spectrogram and real-time FFT charts provide live visualizations of 802.11 channel activity with one-second update intervals and help identify transient noise sources.

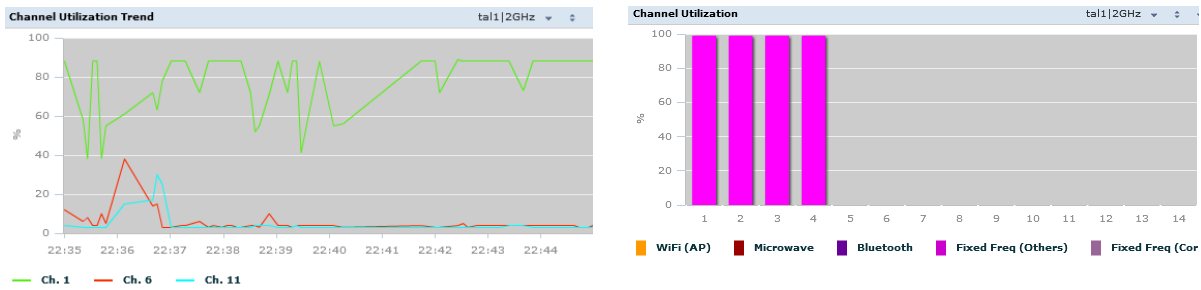


Spectrograms are easily accessible through the Aruba spectrum analyzer dashboard.

Channel health, interference classification and real-time visibility combine to help IT organizations reduce operational overhead by making it easier to identify and troubleshoot 802.11 reliability and performance issues. Information from different graphical charts can be filtered per location, per radio (2.4 GHz or 5 GHz), per type of interference, and per 802.11 channel.

Channel Health

Channel health charts provide a high-level summary of RF quality captured by the Aruba spectrum analyzer. They give visibility into channels that are densely populated with valid, interfering and rogue APs and clients. Channel health charts contain two vital metrics – channel utilization and channel quality – which provide the first steps in troubleshooting unpredictable RF activity.

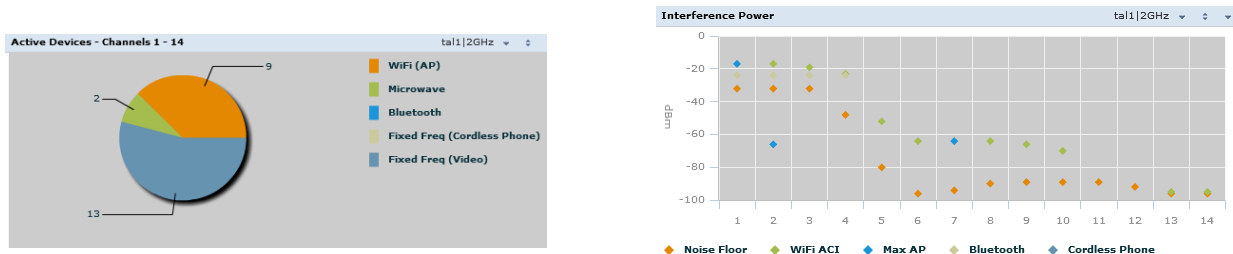


The Aruba spectrum analyzer offers five charts to monitor channel health:

- *Device Duty Cycle* chart shows usage per channel, including the percentage of time transmissions from devices occur on each channel.
- *Channel Utilization Trend* chart helps to distinguish transient interference from chronic interference on a channel over 10-, 30- or 60-minute intervals.
- *Channel Metric* chart summarizes channel utilization, channel quality and channel availability statistics for all monitored channels based on noise floor, duty cycle, error rates and other parameters.
- *Channel Quality Trend* chart helps to distinguish transient interference from chronic interference on a channel in intervals from 10 minutes to 60 minutes.
- *Channel Summary* chart offers a tabular overview of all channels scanned by the spectrum monitor.

Interference Classification

Active-devices charts offer greater detail into the causes of interference and can be used to enhance the predictability of WLAN performance. The charts uniquely identify and classify interfering devices so that the most harmful ones can be mitigated.

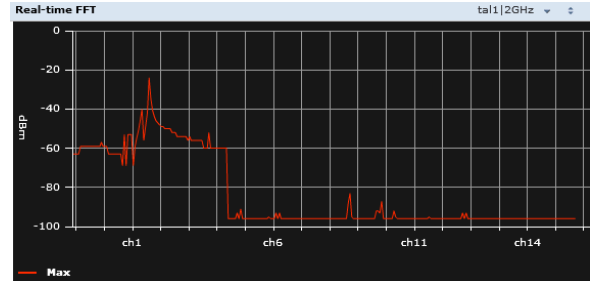
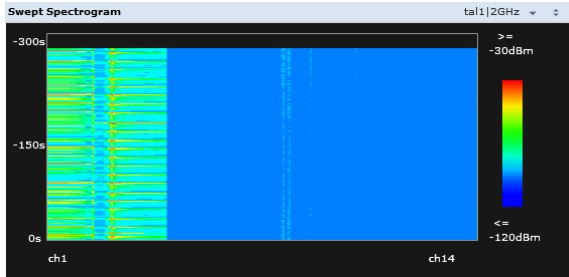


The Aruba spectrum analyzer includes five active-devices charts:

- *Active Devices* chart shows various types of devices that are transmitting on a given set of 802.11 channels.
- *Devices vs. Channels* chart presents the information gathered in the active-devices chart on a per-channel basis.
- *Active Devices Trend* chart displays the number of RF devices on each 802.11 channel over 10-, 30- or 60-minute intervals.
- *Interference Power* chart shows the strength of interference on each 802.11 channel from different interfering devices.
- *Active Devices Table* lists interfering devices across all channels and indicates which 802.11n channels would be impacted by each device.

Real-Time Visibility

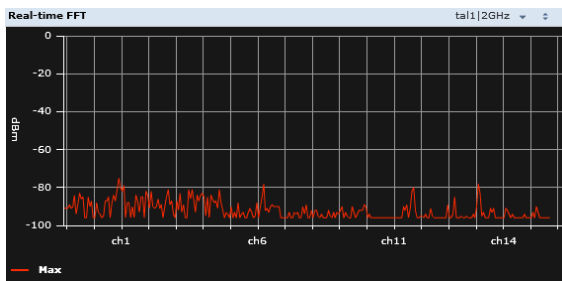
Real-time interference characterization graphs show spectral occupancy and activity levels of potential interfering devices and their impact on adjacent 802.11 channels. These parameters are the signature of an interfering device and use a classification algorithm to identify unique sources of interference.



The Aruba spectrum analyzer provides four real-time interference characterization graphs:

- *Real-Time FFT* chart captures the impact of interference by detecting the energy levels at each frequency component on an 802.11 channel.
- *FFT Duty Cycle* chart displays the percentage of time that an interfering device is active to accurately assess its channel impact.
- *Channel Quality Spectrogram* offers a summary of channel number, channel quality and time.
- *Swept Spectrogram* gives a color-coded view of the FFT data – including views of channel, interference strength and time – with trending over 300 seconds.

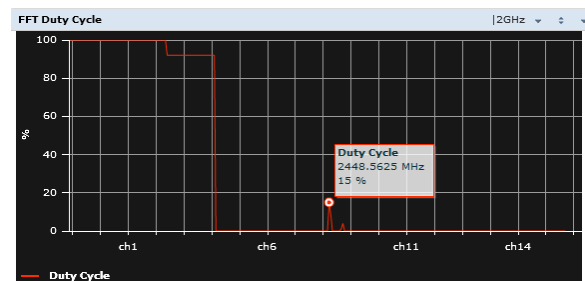
Spectrum Analysis Examples



No channel activity

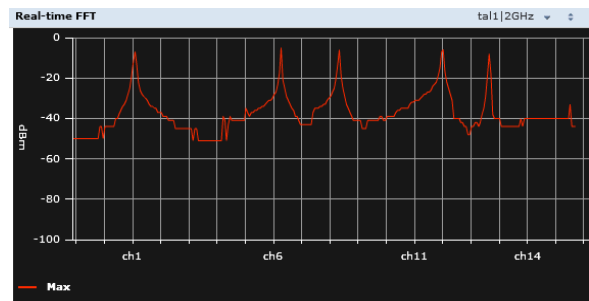
This real-time FFT snapshot of ambient channel conditions shows that there is almost no channel activity.

This chart shows the signature of a fixed-frequency cordless phone operating on Channel 1. The 100% duty cycle means that the emission on Channel 1 is continuous and will not allow Wi-Fi transmissions.

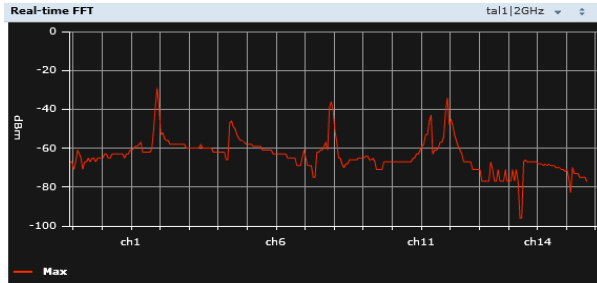


Cordless phone

This graph shows the signature of a frequency-hopping device. It spends just a few milliseconds on a channel before moving on to the next. As a result, the duty cycle of the interfering device is low, but the emission amplitude on each frequency is at the maximum. This type of interference is the most disruptive because no amount of avoidance on the part of the AP can adequately mitigate its effects.



The signature of a frequency-hopping device.



Xbox 360 controller

This signature of an Xbox 360 controller indicates frequency-hopping behavior with a very low duty-cycle. As a result, its impact on a WLAN is not severe and the two can co-exist.

Adaptive Radio Management

While the Aruba spectrum analyzer remotely identifies and classifies sources of Wi-Fi and non-Wi-Fi interference, Aruba's Adaptive Radio Management (ARM) technology delivers crucial RF management capabilities that optimize WLAN reliability.

Wi-Fi clients do not always work together cooperatively or select the optimal band, channel and AP. ARM uses automatic, infrastructure-based controls to maximize client performance and enhance the stability and predictability of the entire WLAN. It includes a powerful array of impressive RF management capabilities:

- Adaptive RF automates RF setup and optimization, maximizes capacity and increases RF coverage.
- Spectrum load balancing of Wi-Fi clients across 802.11 channels improves fairness
- Band steering automatically load balances clients to between 2.4GHz and 5GHz frequency bands to improve fairness.
- Airtime fairness ensures equal channel-time access for all Wi-Fi clients on a radio to improve fairness.
- Co-channel interference mitigation coordinates Wi-Fi client access on a single channel to maximize capacity.
- Dynamic receive sensitivity mitigates adjacent channel interference to maximize multiple AP capacity and enables channel re-use to improve single-channel capacity.

The Aruba Difference

Aruba's integrated spectrum analyzer opens a window into the RF environment that isn't present in other wireless LANs. In doing so, it leapfrogs traditional and single-channel wireless LAN architectures that are susceptible to interference yet blind to its sources.

Without an integrated spectrum analyzer it is virtually impossible for administrators of these systems to isolate interference in sites with high client densities, latency-sensitive multimedia applications or electromagnetically challenging RF environments like factories.

The Aruba spectrum analyzer is the foundation for a wide range of services that enhance enterprise WLAN performance and functionality. Combined with ARM technology, the Aruba spectrum analyzer fully automates interference detection, classification and mitigation without requiring manual intervention or additional hardware.

Aruba's infrastructure-based spectrum analyzer is far more efficient and useful than handheld spectrum monitoring tools, which require IT staff to spend a sizable amount of time onsite to manually capture intermittent RF interference events.

The Aruba solution is also a departure from spectrum monitoring systems that require multiple management servers, additional APs and dedicated sensors. Instead, Aruba offers fully functional spectrum analysis capabilities by utilizing the existing WLAN infrastructure – 802.11n APs, Mobility Controllers and ArubaOS – to preserve capital investments and reduce operating costs.

Aruba 802.11n APs utilize Wi-Fi chipsets with integrated high definition spectrum analysis capabilities. This allows the implementation of spectrum analysis at less than half the cost of solutions that require dedicated access point hardware.

Instead of requiring external laptops for real-time spectrum monitoring, the Aruba Mobility Controller is utilized for live visualization, classification and troubleshooting. Unlike solutions that utilize a dedicated spectrum analysis chipset within the AP, Aruba 802.11n APs perform spectrum analysis and wireless security scanning simultaneously – providing 10 times more spectrum analysis data.

The pervasiveness of 802.11n WLANs is revolutionizing enterprise workforce productivity by delivering high-performance wire-free access for everyone, everywhere. As organizations rely more on WLANs to do business, spectrum analysis becomes critical to ensuring predictable and reliable Wi-Fi performance.

About Aruba Networks, Inc.

Aruba is the global leader in distributed enterprise networks. Its award-winning portfolio of campus, branch/teleworker, and mobile solutions simplify operations and secure access to all corporate applications and services - regardless of the user's device, location, or network. This dramatically improves productivity and lowers capital and operational costs.

Listed on the NASDAQ and Russell 2000® Index, Aruba is based in Sunnyvale, California, and has operations throughout the Americas, Europe, Middle East, and Asia Pacific regions. To learn more, visit Aruba at <http://www.arubanetworks.com>. For real-time news updates follow Aruba on [Twitter](#), [Facebook](#), or the [Green Island News Blog](#).

© 2010 Aruba Networks, Inc. AirWave®, Aruba Networks®, Aruba Mobility Management System®, Bluescanner, For Wireless That Works®, Mobile Edge Architecture®, People Move. Networks Must Follow®, RFprotect®, The All Wireless Workplace Is Now Open For Business, Green Island, and The Mobile Edge Company® are trademarks of Aruba Networks, Inc. All rights reserved. Aruba Networks reserves the right to change, modify, transfer, or otherwise revise this publication and the product specifications without notice. While Aruba uses commercially reasonable efforts to ensure the accuracy of the specifications contained in this document, Aruba will assume no responsibility for any errors or omissions. Note: All scaling metrics outlined in this document are maximum supported values. The scale may vary depending upon the deployment scenario and features enabled.