



AIRHEADS

LAS VEGAS 2012

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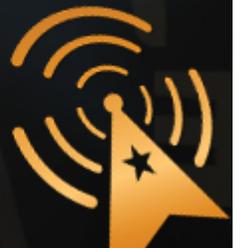
Presented by
Ken Peredia
Aruba Networks
March 2012



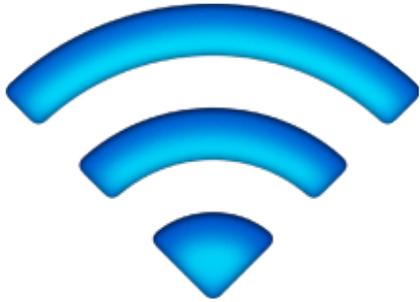
RF TROUBLESHOOTING



Back to Basics



Essential Elements of Healthy RF



Signal Strength

Low Interference



Client NIC



Good Noise Floor

Channel Utilization



What Affects Signal Strength?

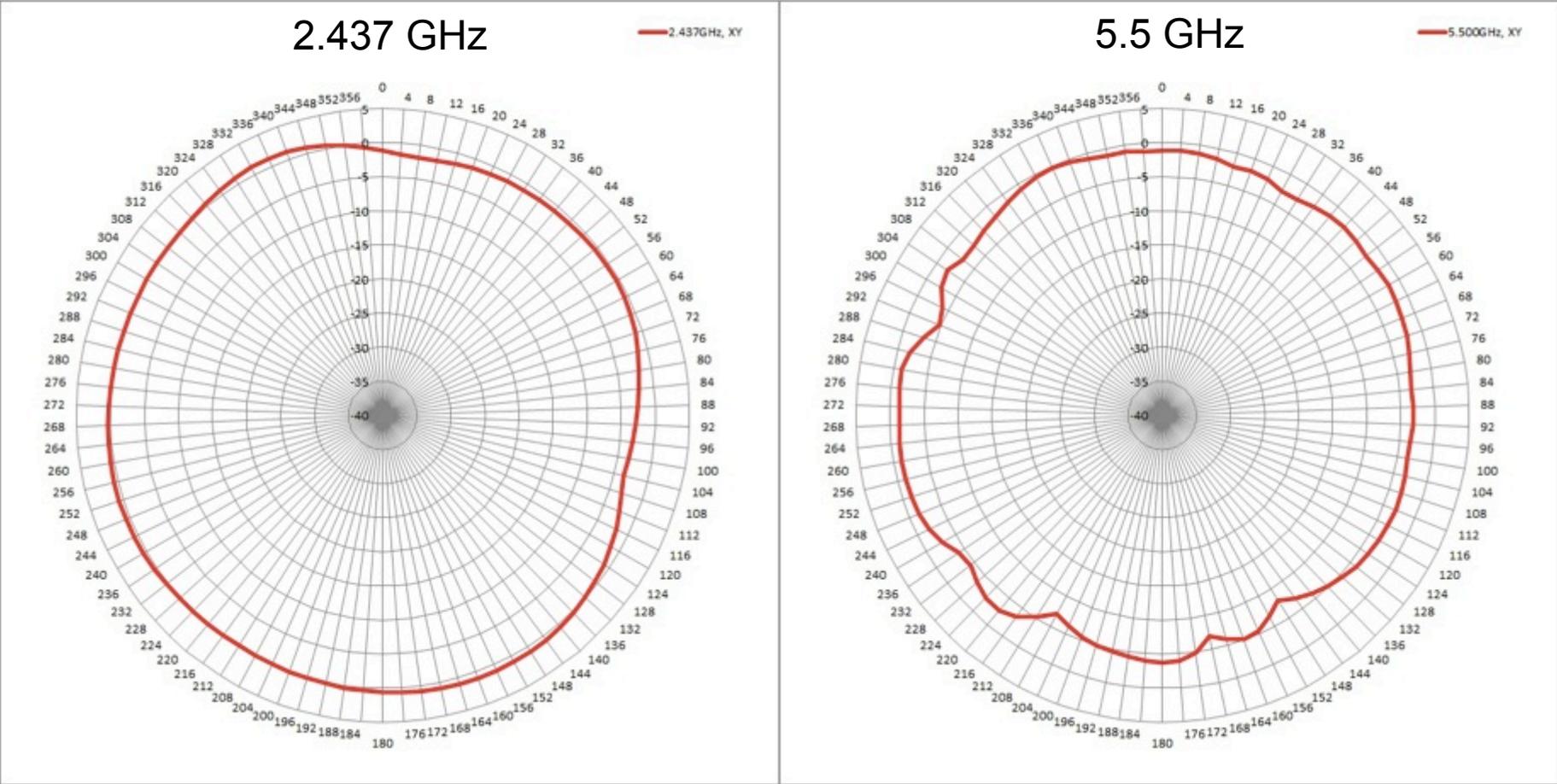
- **AP Characteristics**

- Number and type of Radios (a/b/g/n)
- Max Tx Power
- Receive Sensitivity
- Number of Spatial Streams
- Antenna – Internal/External
- Antenna Pattern
- Number of clients supported

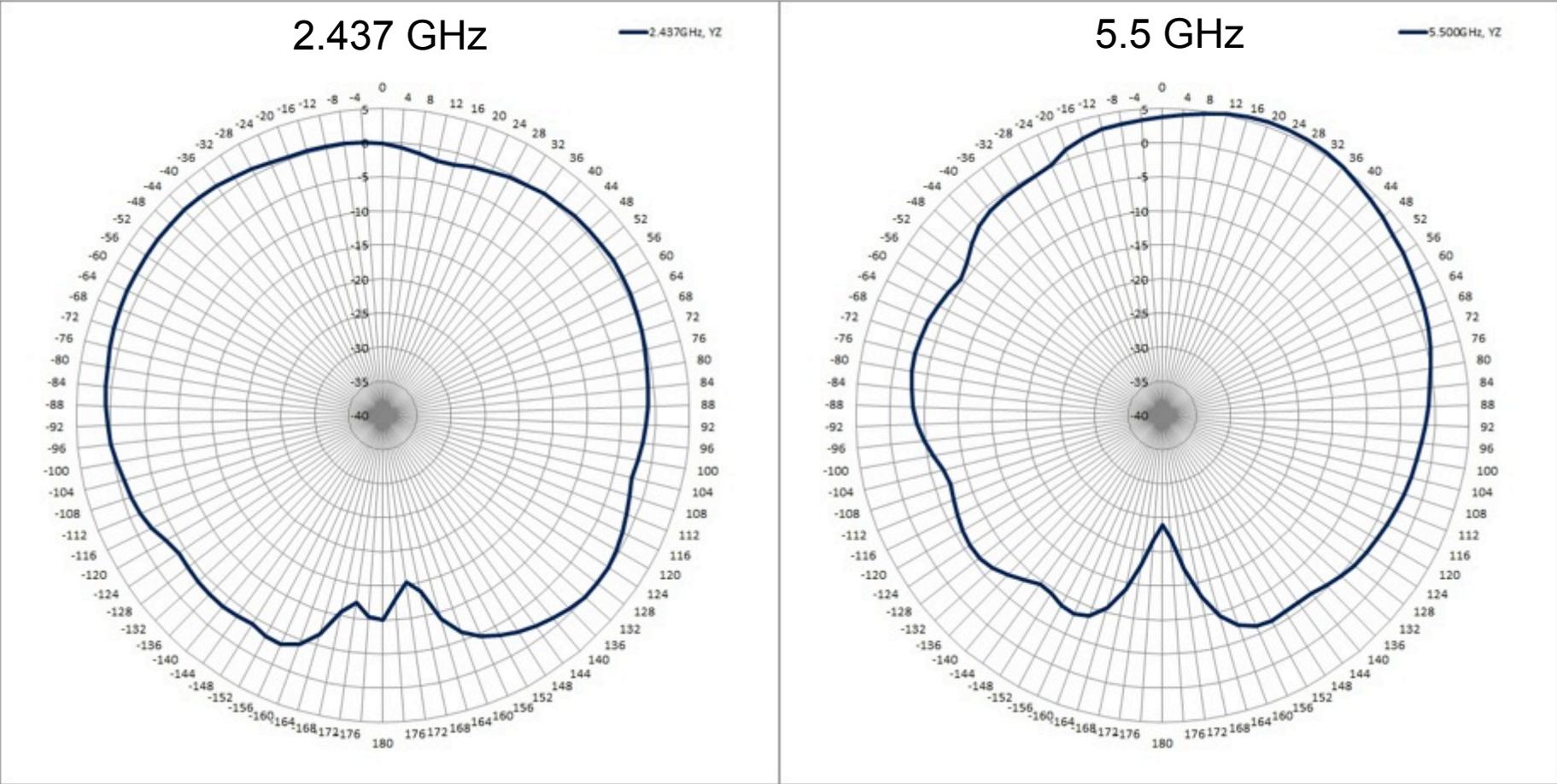
**APs are not created equal
Choose the right AP for the occasion**



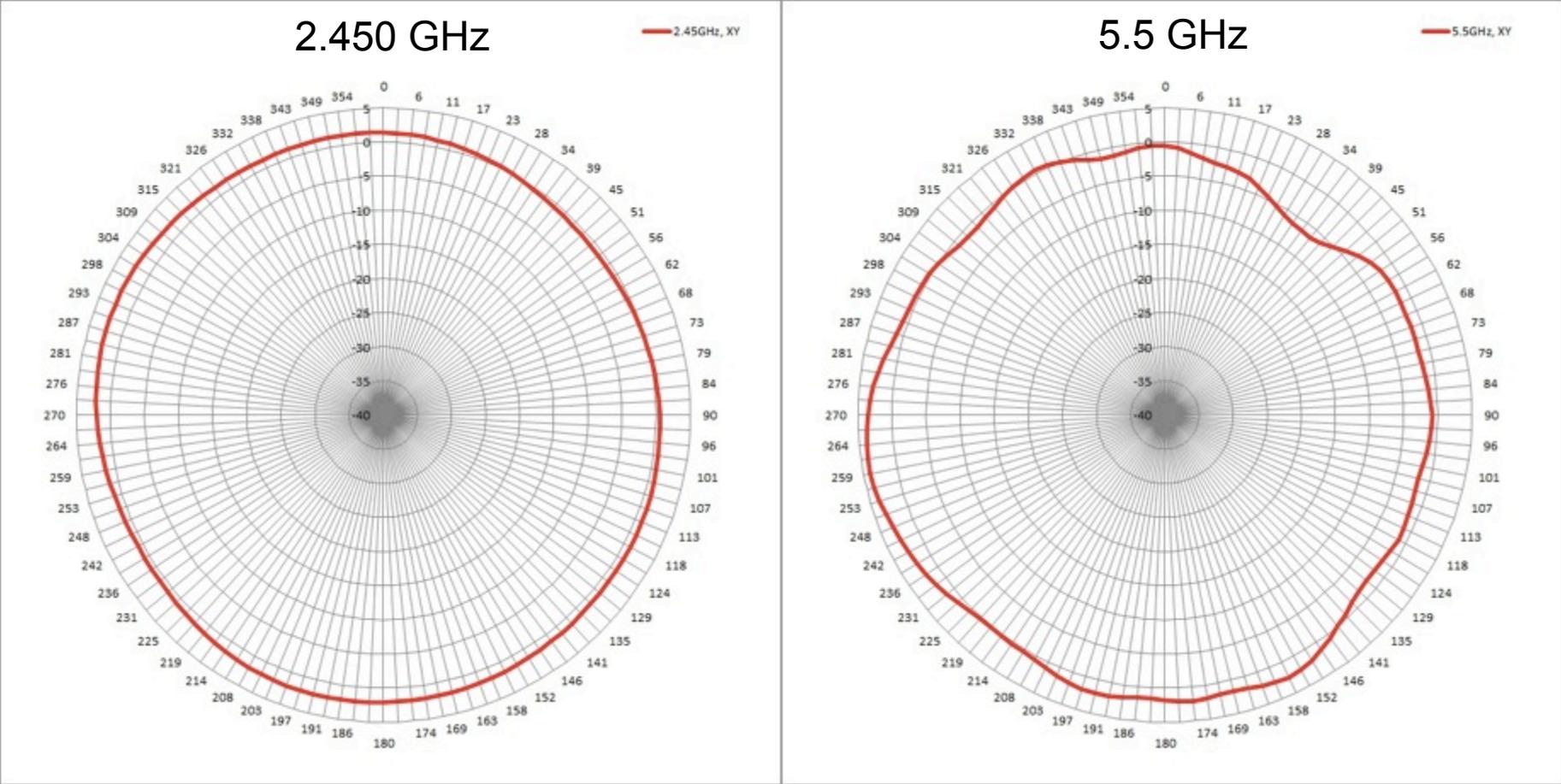
AP-93 Antenna Pattern, H-plane



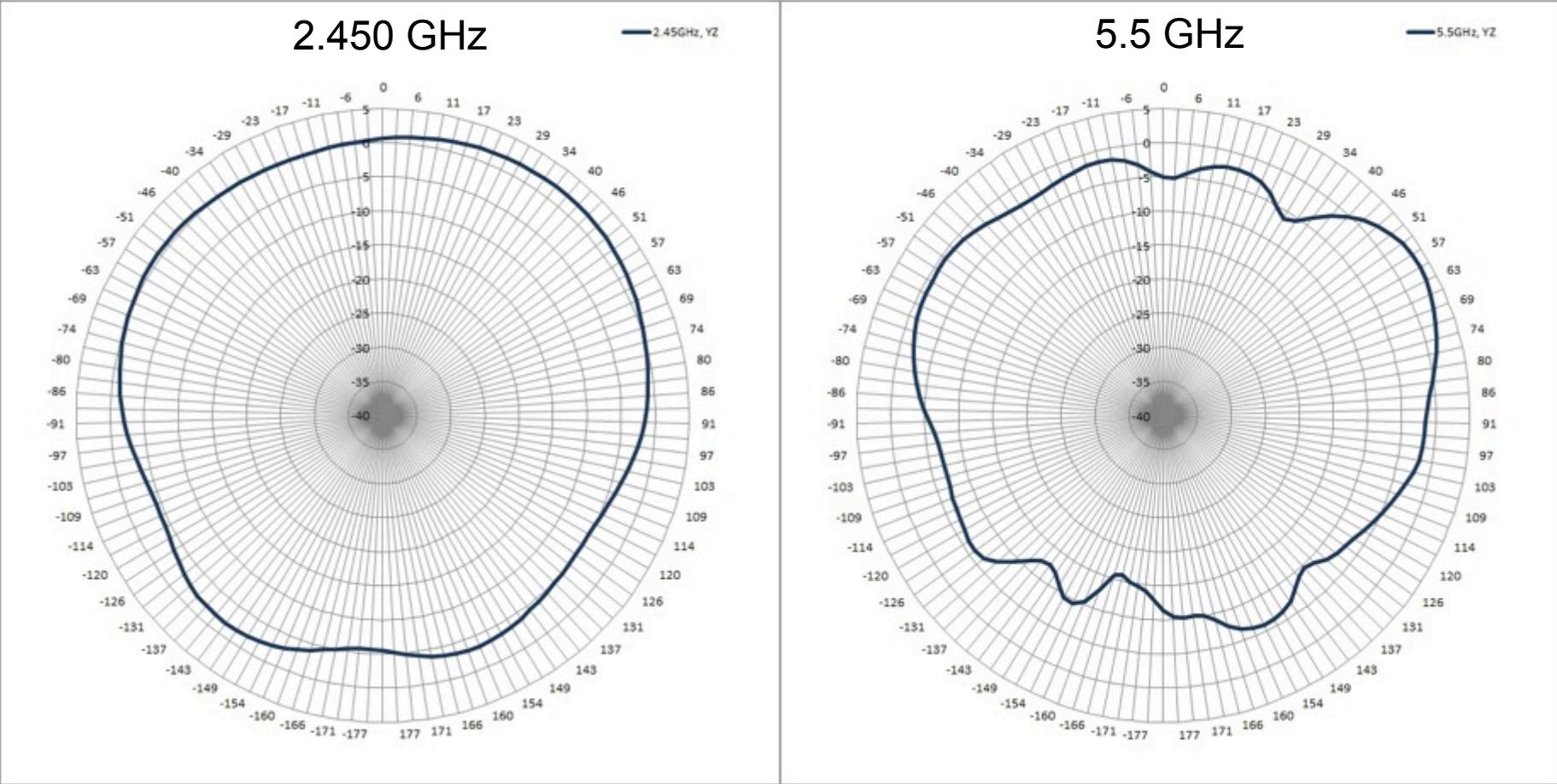
AP-93 Antenna Pattern, E-plane



AP-105 Antenna Pattern, H-plane

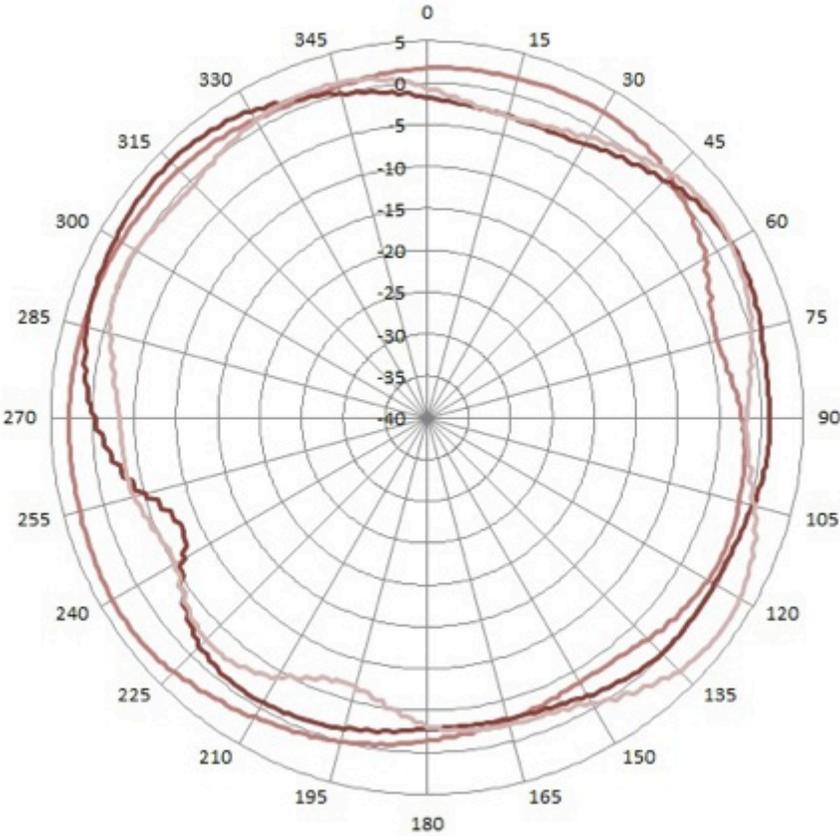


AP-105 Antenna Pattern, E-plane

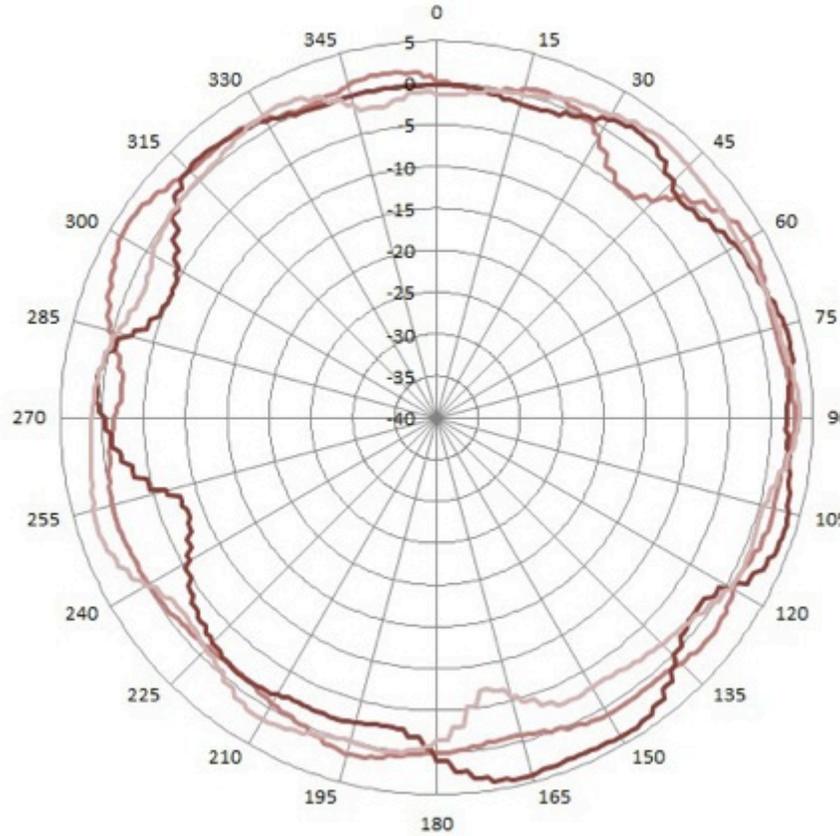


AP-135 Antenna Pattern, H-plane

2.450 GHz

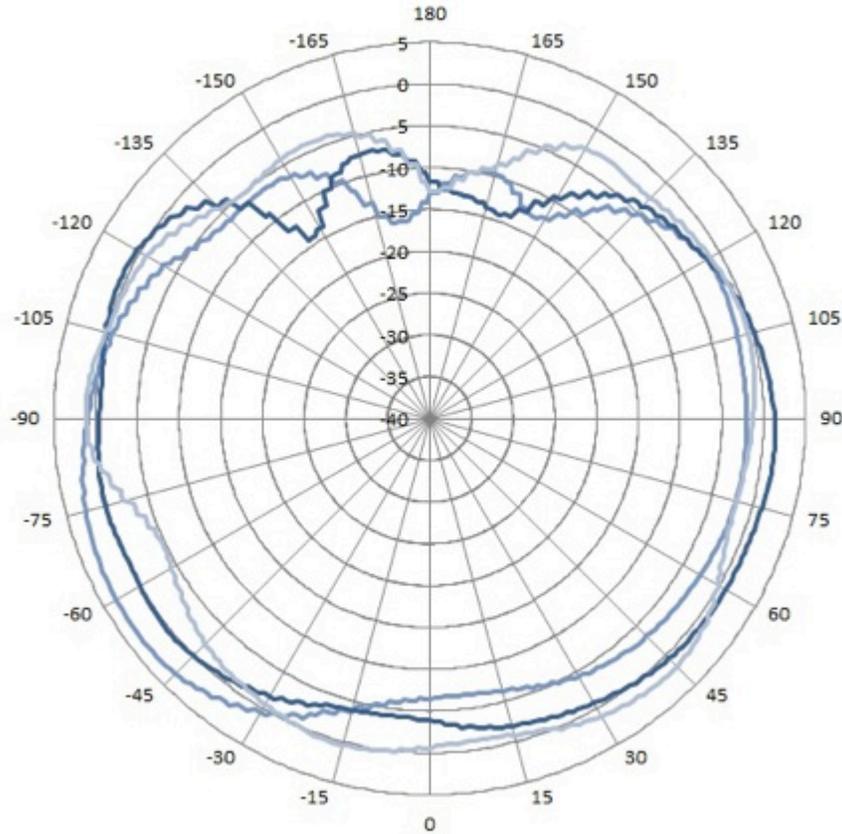


5.5 GHz

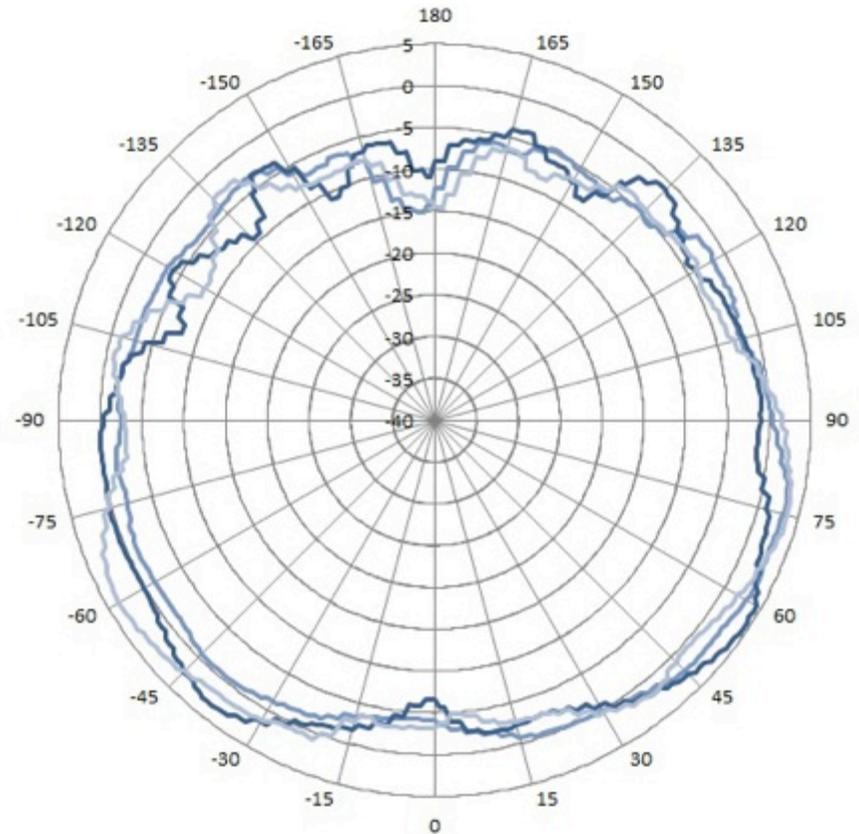


AP-135 Antenna Pattern, E-plane

2.450 GHz



5.5 GHz



What Affects Signal Strength?

AP Radiated Power (EIRP)

= Radio Transmit Power (dBm)

+ Transmit Antenna Gain (dBi)

Antenna is **PASSIVE** – Does Not **ADD** energy
Higher Gain just means energy more focused
Not always a good thing

- AP Regulatory Domain
- Country Code
- Radio Band (2.4GHz/5GHz)
- Channel (different channel has different allowed Max EIRP)

What Affects Signal Strength?

- **Attenuation (Path Loss)**
 - Distance from AP/Line-of-sight
 - Building materials (walls, windows, partitions)
 - Furniture
 - People

Client Received Power (dBm)

= Radiated Power/EIRP (dBm)

- Path Loss (dB)

+ Receiver Antenna Gain (dBi)

Attenuation of Common Building Material

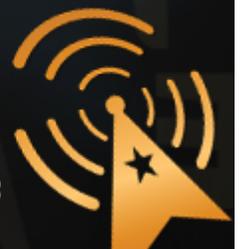
Material	2.4GHz	5.0GHz
Brick 3.5"	6 dB	10 dB
Bullet-Proof Glass 1"	10 dB	20 dB
Concrete Wall 18"	18 dB	30 dB
Concrete Wall 8"	10 dB	13 dB
Cubical Wall (Fabric) 2.25"	1 dB	2 dB
Exterior Double Pane Coated Glass 1"	13 dB	20 dB
Fabric, blinds, ceiling tiles	~1 dB	~1.5 dB
Glass/Window (not tinted)	2-3 dB	6-8 dB
Hollow Wood Door 1.75	4 dB	7 dB
Interior drywall	3-4 dB	3-5 dB

Attenuation of Common Building Material

Material	2.4GHz	5.0GHz
Interior Office Door w/Window 1.75"/0.5"	4 dB	6 dB
Interior Office Window 1"	3 dB	6 dB
Interior Solid Wall 5"	14 dB	16 dB
Marble 2"	6 dB	10 dB
Safety Glass-Wire 0.25"	3 dB	2 dB
Safety Glass-Wire 1.0"	13 dB	18 dB
Solid Wood Door 1.75"	6 dB	10 dB
Steel Fire/Exit Door 1.75"	13 dB	25 dB
Steel Fire/Exit Door 2.5"	19 dB	32 dB
Steel Rollup Door 1.5"	11 dB	19 dB



Noise, Interference, and SNR



Noise & Interference

.... Signals are **corrupted** so they don't make sense to the receiver ...

- **Noise**

- **Random** 'background' that has got mixed up with your signal. Usually doesn't vary too much over time.

- **Interference**

- **Additional** signals are added to the one you want. Can be intermittent or persistent.

Source of Interference

802.11 Source

- Your own APs (over-designed)
- Somebody else's APs (neighbor)
- Municipal Wi-Fi Network
- iPhone Personal Hotspots
- Clients connected to other's APs
- Faulty Clients

Non 802.11 Source

- Blue-tooth (headset, keyboards, mouse, modem)
- Microwave Oven
- Cordless phones, mouse
- Very strong out-of-band source (GSM tower)
- Baby monitor
- WiMax (2.5GHz)
- ZigBee (802.15.4)
- Video or security cameras
- Faulty anything



Signal to Noise Ratio (SNR)

SNR is not actually a ratio

SNR = Signal (Received Power) – Noise floor

Assume:

Signal received is -65 dB; Noise floor is -90 dB

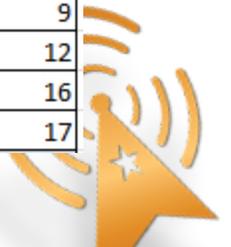
SNR = -65 – (-90) = 25

A minimum of 25-30 is essential to decode high 11n data rate

Why SNR is Important

SNR determines the ability of wireless devices to demodulate data rates

AP-104 AND AP-105 RF PERFORMANCE TABLE							
	Subcarrier Modulation	Max tX Power per Active tX chain	rX sensitivity (dbm)	SNR (NF 100)	Max tX Power per Active tX chain	rX sensitivity (dbm)	SNR (NF 100)
		2.4 GHz			5 GHz		
802.11b							
1 Mbps	BPSK	20	-96	4			
2 Mbps	QPSK	20	-96	4			
5.5 Mbps	CCK	20	-94	6			
11 Mbps	CCK	20	-93	7			
802.11a/g							
6 Mbps	BPSK	20	-96	4	20	-96	4
9 Mbps	BPSK	20	-96	4	20	-96	4
12 Mbps	QPSK	20	-96	4	20	-96	4
18 Mbps	QPSK	20	-95	5	20	-95	5
24 Mbps	16-QAM	20	-92	8	20	-91	9
36 Mbps	16-QAM	19	-89	11	19	-88	12
48 Mbps	64-QAM	18	-85	15	18	-84	16
54 Mbps	64-QAM	17	-83	17	17	-83	17



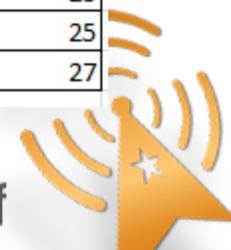
Why SNR is Important

AP-104 AND AP-105 RF PERFORMANCE TABLE							
	Subcarrier Modulation	Max tX Power per Active tX chain	rX sensitivity (dbm)	SNR (NF 100)	Max tX Power per Active tX chain	rX sensitivity (dbm)	SNR (NF 100)
		2.4 GHz			5 GHz		
802.11n HT20							
MCS0	BPSK	20	-96	4	20	-96	4
MCS1	QPSK	20	-95	5	20	-94	6
MCS2	QPSK	20	-93	7	20	-92	8
MCS3	16-QAM	20	-90	10	20	-89	11
MCS4	16-QAM	19	-87	13	19	-86	14
MCS5	64-QAM	18	-82	18	18	-82	18
MCS6	64-QAM	17	-81	19	17	-80	20
MCS7	64-QAM	15	-80	20	15	-79	21
MCS8	BPSK	20	-95	5	20	-95	5
MCS9	QPSK	20	-93	7	20	-92	8
MCS10	QPSK	20	-91	9	20	-90	10
MCS11	16-QAM	20	-87	13	20	-87	13
MCS12	16-QAM	19	-84	16	19	-84	16
MCS13	64-QAM	18	-81	19	18	-80	20
MCS14	64-QAM	17	-80	20	17	-78	22
MCS15	64-QAM	15	-77	23	15	-77	23



Why SNR is Important

AP-104 AND AP-105 RF PERFORMANCE TABLE							
	Subcarrier Modulation	Max tX Power per Active tX chain	rX sensitivity (dbm)	SNR (NF 100)	Max tX Power per Active tX chain	rX sensitivity (dbm)	SNR (NF 100)
		2.4 GHz			5 GHz		
802.11n HT40							
MCS0	BPSK	20	-93	7	20	-92	8
MCS1	QPSK	20	-93	7	20	-92	8
MCS2	QPSK	20	-90	10	20	-89	11
MCS3	16-QAM	20	-86	14	20	-86	14
MCS4	16-QAM	19	-83	17	19	-83	17
MCS5	64-QAM	18	-79	21	18	-80	20
MCS6	64-QAM	17	-77	23	17	-77	23
MCS7	64-QAM	15	-76	24	15	-76	24
MCS8	BPSK	20	-92	8	20	-92	8
MCS9	QPSK	20	-89	11	20	-90	10
MCS10	QPSK	20	-87	13	20	-87	13
MCS11	16-QAM	20	-84	16	20	-84	16
MCS12	16-QAM	19	-82	18	19	-81	19
MCS13	64-QAM	18	-76	24	18	-77	23
MCS14	64-QAM	17	-76	11	17	-75	25
MCS15	64-QAM	15	-73	27	15	-73	27

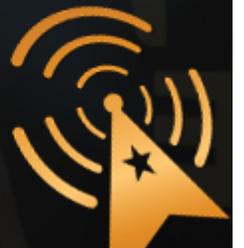


SNR and 11n

802.11n data rates are dependent not only on SNR, but on error rates and the ability to support multiple spatial streams in the environment

A rough guideline is that a minimum SNR of 25 dB is necessary to demodulate higher 802.11n data rates

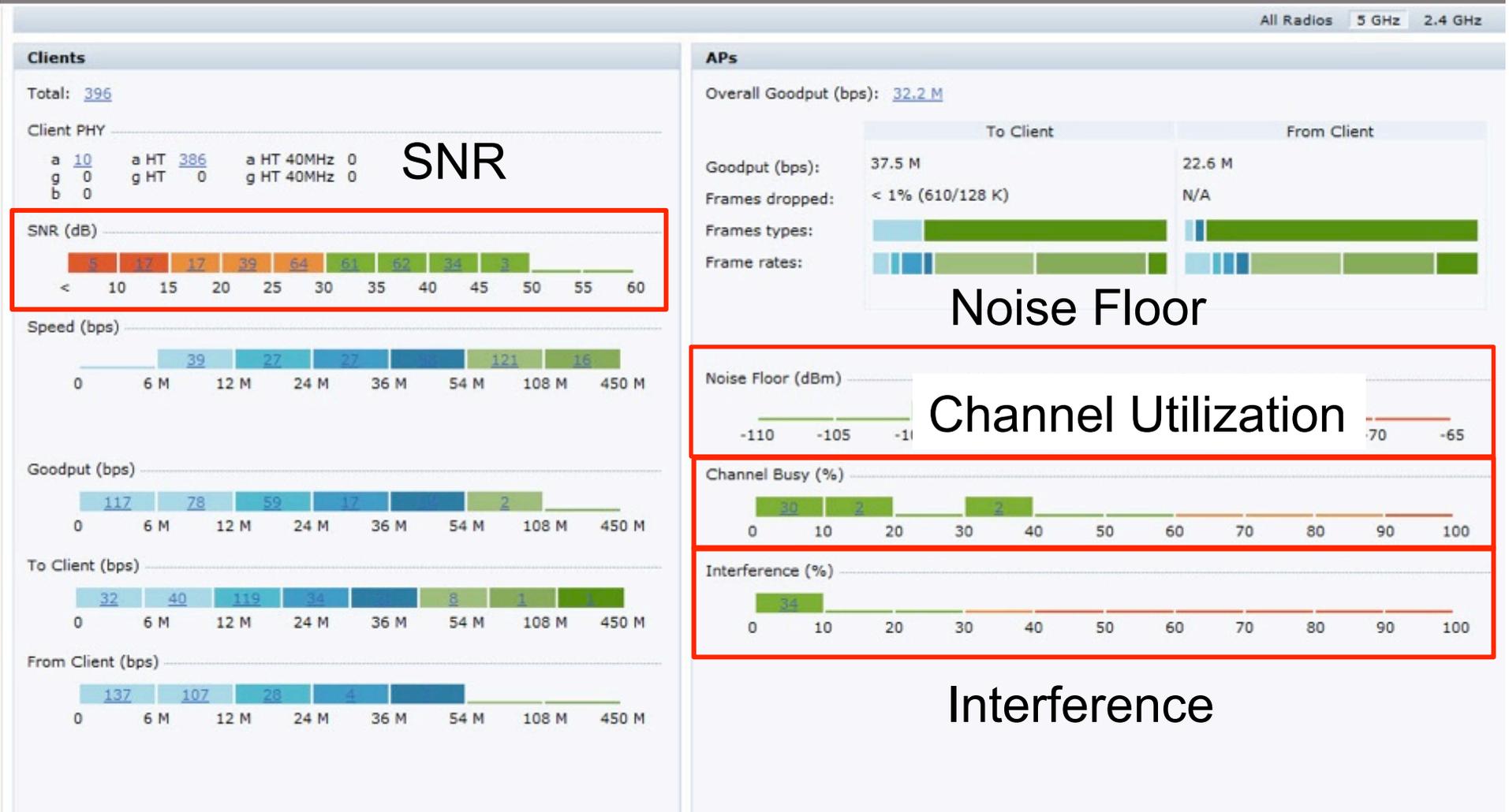
Tools of the Trade



WLAN Engineer Toolkit

- **Network Management/Monitoring Platform**
- **Spectrum Analysis**
- **Site-Survey**
- **Understanding Client NIC**
- **Performance Testing**
- **Packet Capture**
- **Command Line Interface (CLI)**

ArubaOS Dashboard - Performance



AOS RF Dashboard – Usage



MOBILITY CONTROLLER | Monitoring > Usage

Dashboard | Monitoring | Configuration | Diagnostics | Maintenance | Plan

Last updated: 08:03:10 pm | ? | Logout admin

- Performance
- > Usage
- Security
- Potential Issues
- WLANs
- Access Points
- Clients

Clients

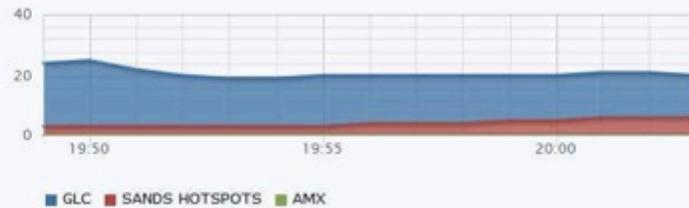
Total & Low Usage Clients

Total: [20](#) Active: 0 Low Usage: [16](#)



Clients per WLAN

GLC [11](#) SANDS HOTSPOTS [6](#)



APs

Total & Usage

Total: [100](#) Down: 0 Low Usage Radios: [157](#) Usage: 59.4 K



Usage per WLAN (bps)

AMX: 0 GLC: 58.4 K SANDS HOTSPOTS: 245



AOS RF Dashboard – Security



- Performance
- Usage
- > **Security**
- Potential Issues
- WLANS
- Access Points
- Clients

Discovered APs & Clients			
		Active APs	Associated Clients
■	Rogue	0	0
■	Suspected Rogue	9	4
■	Interfering	35	67
■	Neighbor	0	0
■	Valid	192	57
■	Manually Contained	0	0
Total		236	128

		Last 4 hrs	Last 24 hrs	All
Containment	Infrastructure	0	0	0
	Client	0	0	0
	Total	0	0	0
Detection	Low	0	0	0
	Med	28	72	669
	High	34	64	334
	Total	62	136	1,003

Discovered Access Points: Active = Yes, AP Classification = Rogue

[Locate](#)
[Contain Manually](#)
[Reclassify](#)
[Delete](#)
[Export](#)

BSSID	Band	PHY Type	SSID	Channel	Clients	AP Classification	Encryption	Marked to
- No matches found -								



AOS RF Dashboard – Potential Issues



- Performance
- Usage
- Security
- > **Potential Issues**
- WLANs
- Access Points
- Clients

Potential Issues

Clients with potential issues: [11 out of 21](#)

Radios with potential issues: [25 out of 198](#)

	2.4 GHz	5 GHz
Low SNR	0	1
Low speed	0	1
Low goodput	5	6

	2.4 GHz	5 GHz
High noise floor	0	0
Busy channel	0	0
High interference	12	0
Low goodput	8	6
High client association	0	0



AOS RF Dashboard – WLAN



MOBILITY CONTROLLER | Monitoring > WLANs

Dashboard Monitoring Configuration Diagnostics Maintenance Plan

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- Performance
- Usage
- Security
- Potential Issues
- > WLANs
- Access Points
- Clients

WLANs (3) Show: Default Columns

WLAN	Clients	APs	Radios	Usage (bps)	Frames	Bytes	Frames Retried (to client)	Frames Dropped (to client)	Goodput (bps)
AMX	0	13	13	0	0	0	0%	0%	--
GLC	14	99	157	277.1 K	8.6 K	2.1 M	17% (625/3.6 K)	< 1% (18/3.6 K)	16.7 M
SANDS HOTSPOTS	2	14	22	78.4 K	896	588.2 K	67% (285/425)	5% (23/448)	3.2 M

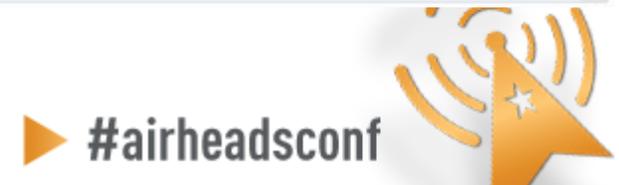
All WLANs (22)

Clients

Usage

AP Name	Band	Clients	Usage (bps)
MIC05-AP20	2.4 GHz	0	--
MIC05-AP20	5 GHz	0	0
MIC04-AP26	2.4 GHz	0	0
MIC04-AP26	5 GHz	0	0
MIC05-AP21	2.4 GHz	0	0
MIC05-AP21	5 GHz	0	0
MIC04-AP28	2.4 GHz	0	--
MIC04-AP28	5 GHz	0	0
MIC04-AP01	2.4 GHz	0	--

Client	Device Type	Client PHY
10.0.0.187	Win 7	a HT
10.0.0.64	Win 7	a HT
10.0.1.30	--	a HT
10.0.1.21	iPhone	g HT
10.0.0.84	iPhone	g HT
30:38:55:4e:4c:3b	--	g
10.165.163.44	iPad	a HT
44:d8:84:66:af:24	--	g HT



AOS RF Dashboard – Access Points



MOBILITY CONTROLLER | Monitoring > Radios

Dashboard Monitoring Configuration Diagnostics Maintenance Plan

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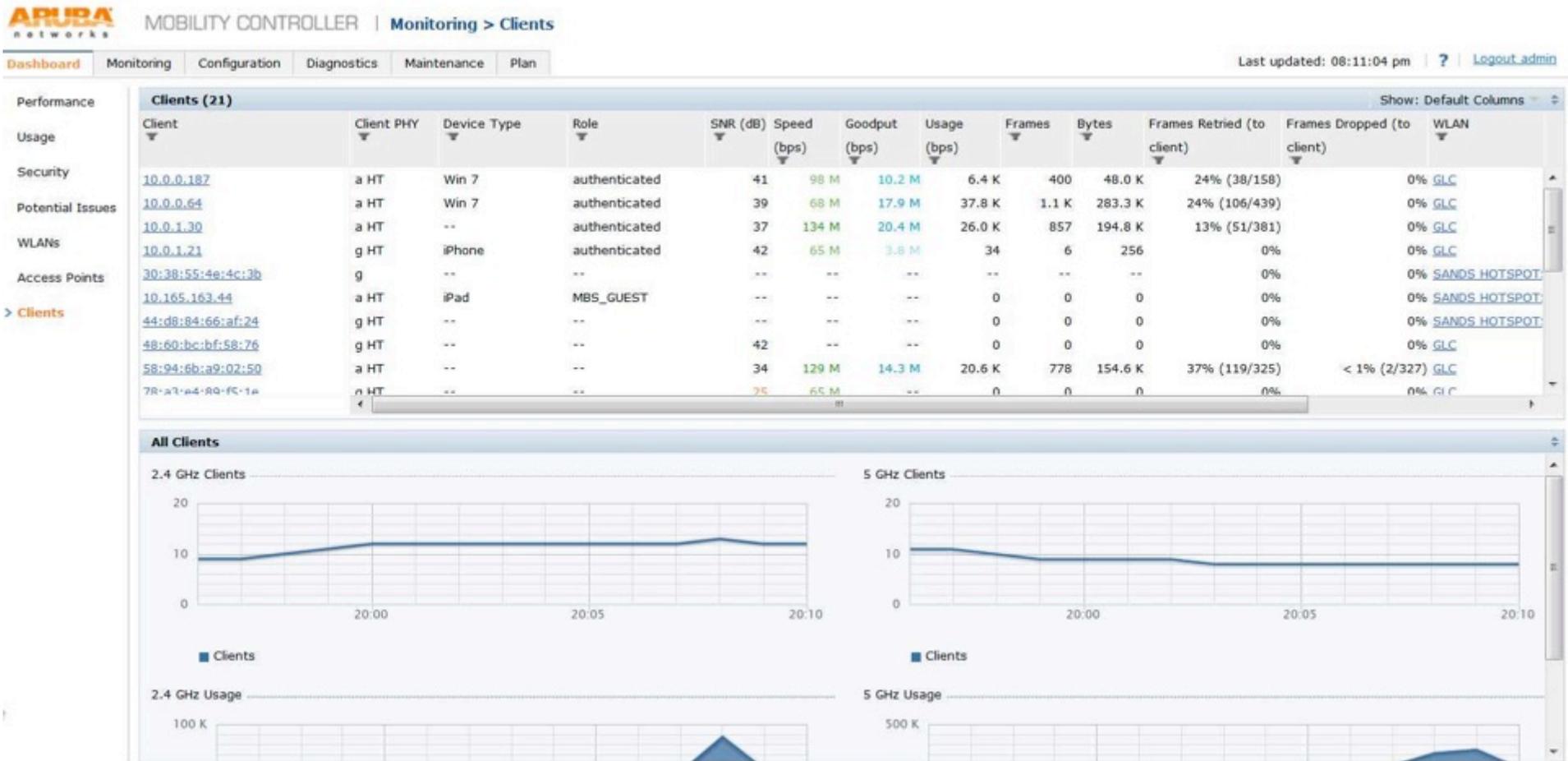
- Performance
- Usage
- Security
- Potential Issues
- WLANs
- > Access Points
- Clients

Radios (157 of 198): Radio Mode = Access

AP Name	Band	Radio Mode	Clients	Channel	Noise Floor (dBm)	EIRP (dBm)	Channel Utilization	Frames	Bytes	Frames (to client)	Frames Retried (to client)	Frames Dropped (to client)	Frames (from Frame Rates (to client))
MIC04-AP01	5 GHz	Access	0	165	-96	20	<div style="width: 0%;"></div>	0	0	0	0%	0%	0
MIC04-AP02	2.4 GHz	Access	2	1	-96	15	<div style="width: 0%;"></div>	63	4.8 K	59	0%	0%	4
MIC04-AP02	5 GHz	Access	1	153	-94	20	<div style="width: 0%;"></div>	452	71.4 K	223	5% (11/223)	0%	229
MIC04-AP03	2.4 GHz	Access	0	6	-94	15	<div style="width: 0%;"></div>	0	0	0	0%	0%	0
MIC04-AP03	5 GHz	Access	0	48	-92	20	<div style="width: 0%;"></div>	0	0	0	0%	0%	0
MIC04-AP04	2.4 GHz	Access	0	11	-93	15	<div style="width: 0%;"></div>	0	0	0	0%	0%	0
MIC04-AP04	5 GHz	Access	0	44	-94	20	<div style="width: 0%;"></div>	0	0	0	0%	0%	0
MIC04-AP05	2.4 GHz	Access	0	11	-95	15	<div style="width: 0%;"></div>	0	0	0	0%	0%	0
MIC04-AP05	5 GHz	Access	0	52	-95	20	<div style="width: 0%;"></div>	0	0	0	0%	0%	0
MIC04-AP06	2.4 GHz	Access	0	1	-96	15	<div style="width: 0%;"></div>	0	0	0	0%	0%	0



AOS RF Dashboard – Clients



RF Health report

ARUBA networks

New Devices: 35 | Up: 563 | Wired: 34 | Down: 191 | Wired: 5

Rogue: 1 | Clients: 221 | Alerts: 22

Log out peter

Search

Home | Groups | APs/Devices | Clients | **Reports** | System | Device Setup | AMP Setup | RAPIDS | VisualRF

Generated | Definitions | **Detail**

1344 RF health report for Group Ethersphere-lms3

2/26/2012 5:00 AM to 2/27/2012 5:00 AM
Generated on 2/27/2012 5:01 AM

XML (XHTML) export
CSV export
Email this report
Print report

Most Noise (5 GHz)

Rank ▲	Device	Average Noise (dBm)	Channel Changes	Average Channel Busy (%)	Number of Clients	Usage (bps)	Location
1	ITC	-87.00	14	7.87	0	0.00	-
2	72C	-87.50	11	7.87	0	0.00	-
3	140C	-88.00	15	6.69	0	0.00	-
4	24C	-89.50	18	6.69	0	0.00	-
5	167C	-89.50	12	3.54	0	0.00	-
6	1341-AP35	-89.50	0	2.36	1	0.00	-
7	41C	-90.00	181	6.30	0	0.00	-
8	AL21 (1344-1-al21.arubanetworks.com)	-90.00	37	1.18	0	0.00	-
9	175C	-90.00	20	4.33	0	0.00	-
10	1344-2-184C	-90.00	0	3.94	0	0.00	-
11	196C	-90.00	0	3.94	0	0.00	-
12	78C	-90.00	17	4.72	0	0.00	-
13	1263	-90.00	0	32.68	0	0.00	-
14	03C	-91.00	29	6.69	0	0.00	-
15	1344-2-12C	-91.50	55	5.12	1	0.00	-

Most Noise (2.4 GHz)

Rank ▲	Device	Average Noise (dBm)	Channel Changes	Average Channel Busy (%)	Number of Clients	Usage (bps)	Location
1	175C	-86.00	5	15.75	0	0.00	-
2	ITC	-87.00	7	41.73	0	0.00	-
3	196C	-89.00	0	33.46	0	0.00	-
4	140C	-90.50	1	55.91	0	0.00	-
5	1344-2-92C	-91.50	2	50.39	0	0.00	TAC
6	78C	-92.00	1	38.98	0	0.00	-
7	1344-2-12C	-91.50	55	5.12	1	0.00	-



Channel utilization trigger

Channel Utilization Trigger

Type: Channel Utilization
Severity: Normal
Duration: 5 minutes
e.g. '15 minutes', '75 seconds', '1 hr 15 mins'

Conditions

Matching conditions: All Any
Available Conditions: Interference (%), Radio Type, Time Busy (%), Time Receiving (%), Time Transmitting (%)

New Trigger Condition

Option	Condition	Value	
Time Busy (%)	>=	75	
Interference (%)	>=	30	

Trigger Restrictions

Folder: Sunnyvale HQ
Include Subfolders: Yes No
Group: - All Groups -

Alert Notifications

Additional Notification Options: Email NMS
Add NMS servers on the [AMP Setup NMS page](#)
Logged Alert Visibility: By Role
Suppress Until Acknowledged: Yes No

AirWave – AP Monitoring

[Home](#)
[Groups](#)
[APs/Devices](#)
[Clients](#)
[Reports](#)
[System](#)
[Device Setup](#)
[AMP Setup](#)
[RAPIDS](#)
[VisualRF](#)

[List](#)
[Monitor](#)
[Manage](#)
[Audit](#)
[Compliance](#)
[New](#)
[Up](#)
[Down](#)
[Mismatched](#)
[Ignored](#)

Device Info

Status: Up (OK)
 Configuration: **Mismatched** (The settings on the device do not match the desired configuration policy.)
 Controller: ethersphere-lms3
 Type: Aruba AP 135
 LAN MAC Address: D8:C7:C8:C0:C7:BC
 IP Address: 10.6.66.71
 Quick Links:

Aruba AP Group: Corp1344-AM
 Remote Device: No
 Serial: AX0025566
 Clients: 5
 Usage: 19.06 Kbps

Upstream Device: 1344-1-AP-alpha-sw1
 Last Contacted: 2/28/2012 9:43 AM
 Upstream Port: gigabitethernet0/0/15
 Uptime: 2 days 8 hrs 12 mins

Notes:

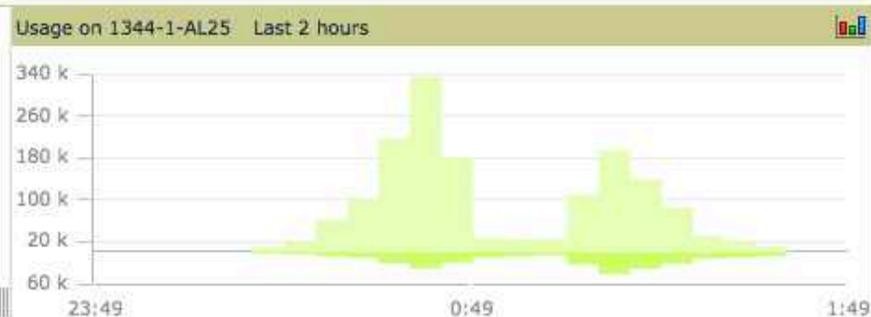
Radios

Index	Name	MAC Address	Clients	Usage (Kbps)	Channel	Tx Power	Antenna Type	Role	Active SSIDs
1	802.11bgn	D8:C7:C8:8C:7B:C0	0	0.00	1	0 dBm	Internal	AirMonitor and Access	-
2	802.11an	D8:C7:C8:8C:7B:D0	4	19.06	149	12 dBm	Internal	Access	ARUBA-VISITOR, et...

Wired Interfaces

Name	MAC Address	Clients	Admin Status	Operational Status	Type	Duplex	Aruba Port Mode	Input Capacity	Output Capacity
Enet0	D8:C7:C8:C0:C7:BC	0	Up	Up	gigabitEthernet	Full	N/A	1000 Mbps	1000 Mbps
Enet1	D8:C7:C8:C0:C7:BD	0	Up	Down	gigabitEthernet	Half	Active Standby	10 Mbps	10 Mbps

View Device Events



Max Clients (Radio 1)
 CONFIDENTIAL
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Radio Details



[New Devices: 35](#)
[Up: 561](#)
[Wired: 34](#)
[Down: 193](#)
[Wired: 5](#)
[Rogue: 1](#)
[Clients: 219](#)
[Alerts: 22](#)

Log out peter

205c

[Home](#)
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[APs/Devices](#)
[Clients](#)
[Reports](#)
[System](#)
[Device Setup](#)
[AMP Setup](#)
[RAPIDS](#)
[VisualRF](#)

[List](#)
[Monitor](#)
[Manage](#)
[Audit](#)
[Compliance](#)
[New](#)
[Up](#)
[Down](#)
[Mismatched](#)
[Ignored](#)

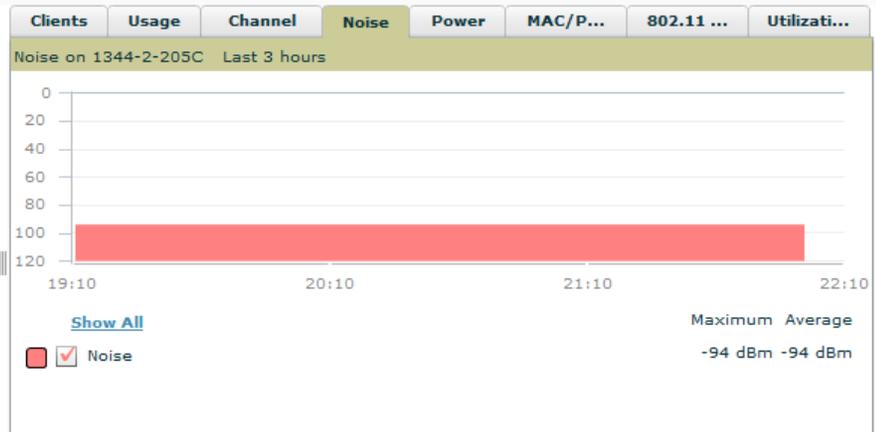
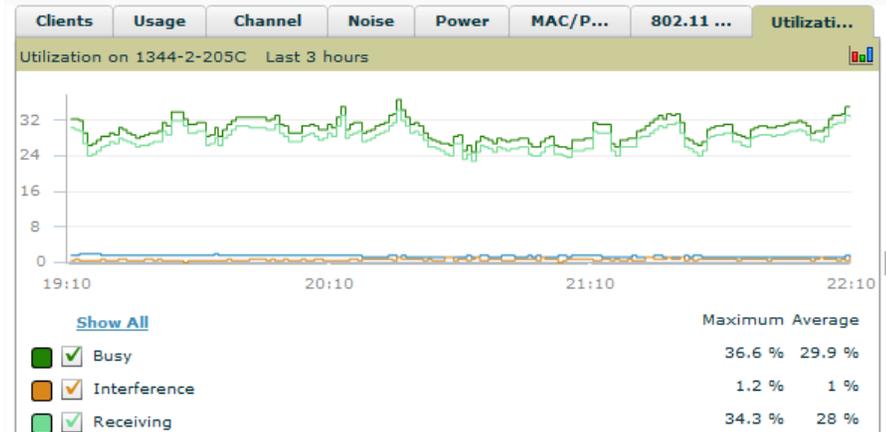
AP Monitoring | Radio Statistics

Monitoring 802.11bgn radio for AP 1344-2-205C

Run a command...

802.11 Radio Counters Summary (frames/sec)

	Current	Last Hour	Last Day	Last Week
Unacked	4	4	58	54
Retries	0	0	17	19
Failures	4	4	8	7
Dup Frames	0	0	0	0
FCS Errors	5	5	34	54



Client Diagnostics



New Devices: 35 Up: 560 Wired: 34 Down: 194 Wired: 5 Rogue: 1 Clients: 210 Alerts: 23

Log out peter

205c

Home Groups APs/Devices **Clients** Reports System Device Setup AMP Setup RAPIDS VisualRF

Connected All Rogue Clients Guest Users Client Detail **Diagnostics** VPN Sessions VPN Users Tags

Client: ARUBANETWORKS\jturner Network: ethersphere-wpa2 AP: 1344-2-92C Controller: ethersphere-lms3

Radio Info

- AP: 1344-2-92C
- AP Type: Aruba AP 135
- Last Contacted: 2/27/12 10:09 PM
- Radio: 802.11an
- Band: 5 GHz
- Channel: 165
- TX Power: 16 dBm
- Antenna:
- MAC Address: D8:C7:C8:83:A3:70
- Notes:
- Floor Plan: [Sunnyvale -> 1344 Crossman -> HQ Floor2](#)

Performance

- Clients: 1
- Noise: -93 dBm
- Total Usage: 1.59 Kbps
- Usage To Clients: 616 bps
- Usage From Clients: 976 bps
- Uptime: 100%

Trends

Clients

Channel Utilization

Usage

Noise (dBm)

Quality

Overall rating: good

Possible Issues (Network)

Indicator	Value	Ideal
Too Many Down Neighbor APs	21	0

Additional Indicators (Network)

Indicator	Value	Ideal
Channel Utilization	5.51%	≤ 60%
Noise floor	-93 dBm	≤ -90 dBm
Avg. SNR	40.02 dB	≥ 35 dB
Avg Frame errors/sec	7 frames/s	≤ 250 frames/s



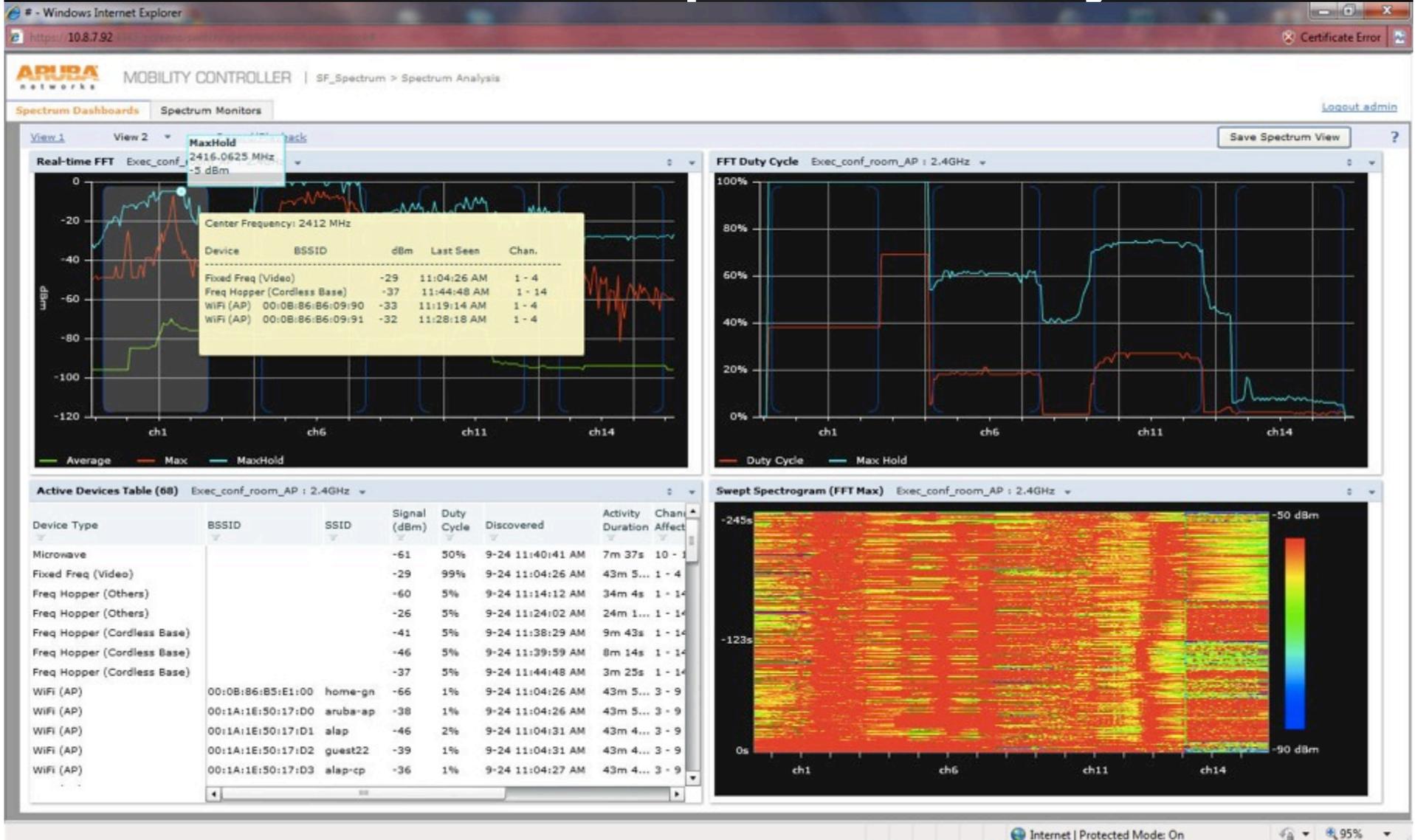
Spectrum Analysis



Spectrum Analysis

- **Aruba AP in Spectrum Mode**
- **Aruba AP in Hybrid Spectrum Mode**
 - AP-9x/10x/13x
 - Software configurable
- **Dedicated Spectrum Analysers**
 - Fluke Networks – AirMagnet Spectrum XT
 - Metageek – Wi-Spy
 - Others
- **Airwave VisualRF**

Wireless Tools – Spectrum Analysis



Wireless Tools – Spectrum Analysis



Wireless Tools – Visual RF



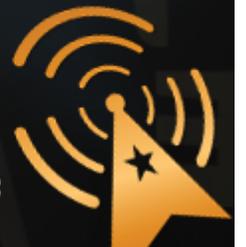
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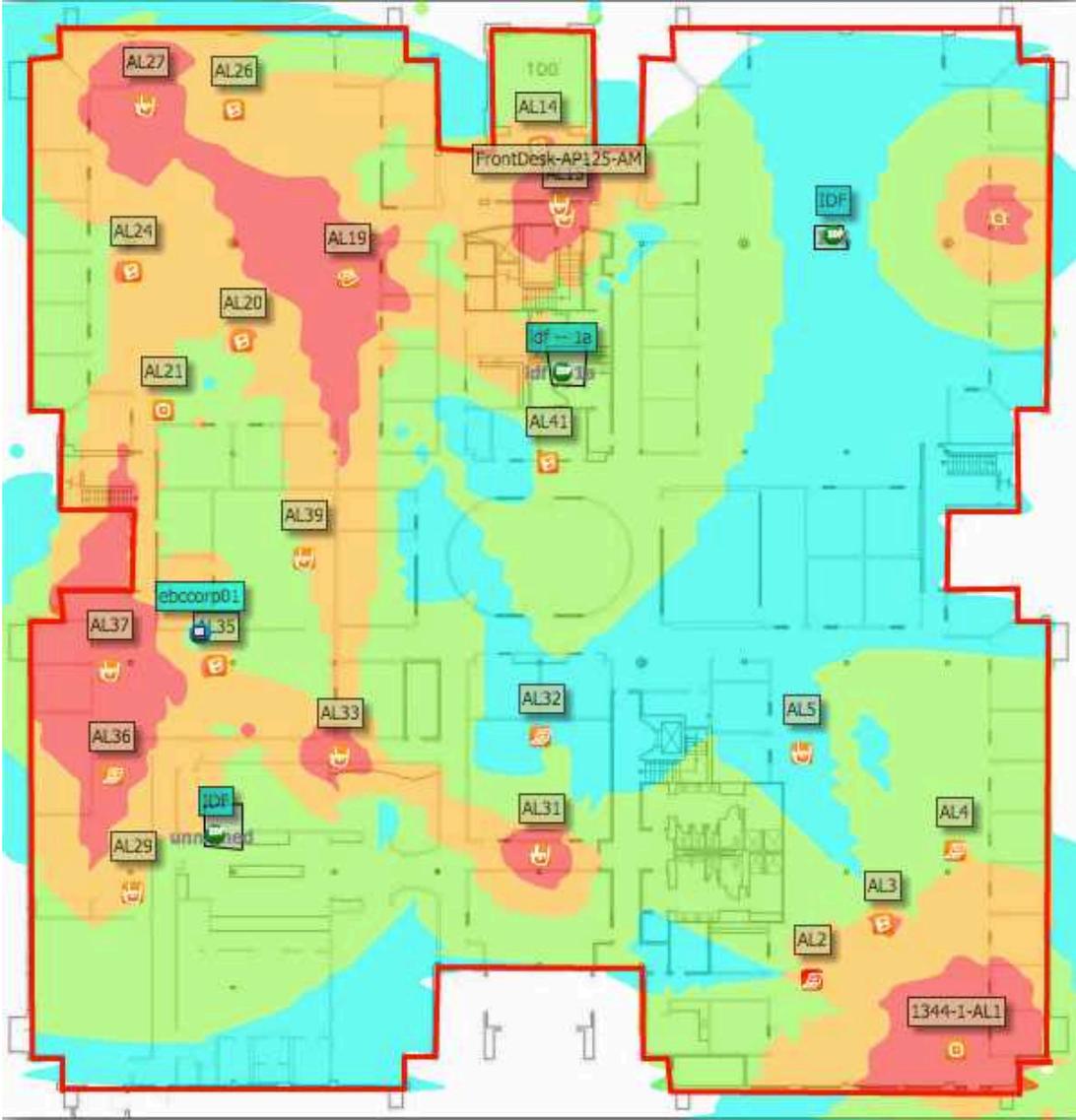
▶ #airheadsconf



Wi-Fi Heatmap & Site-Survey



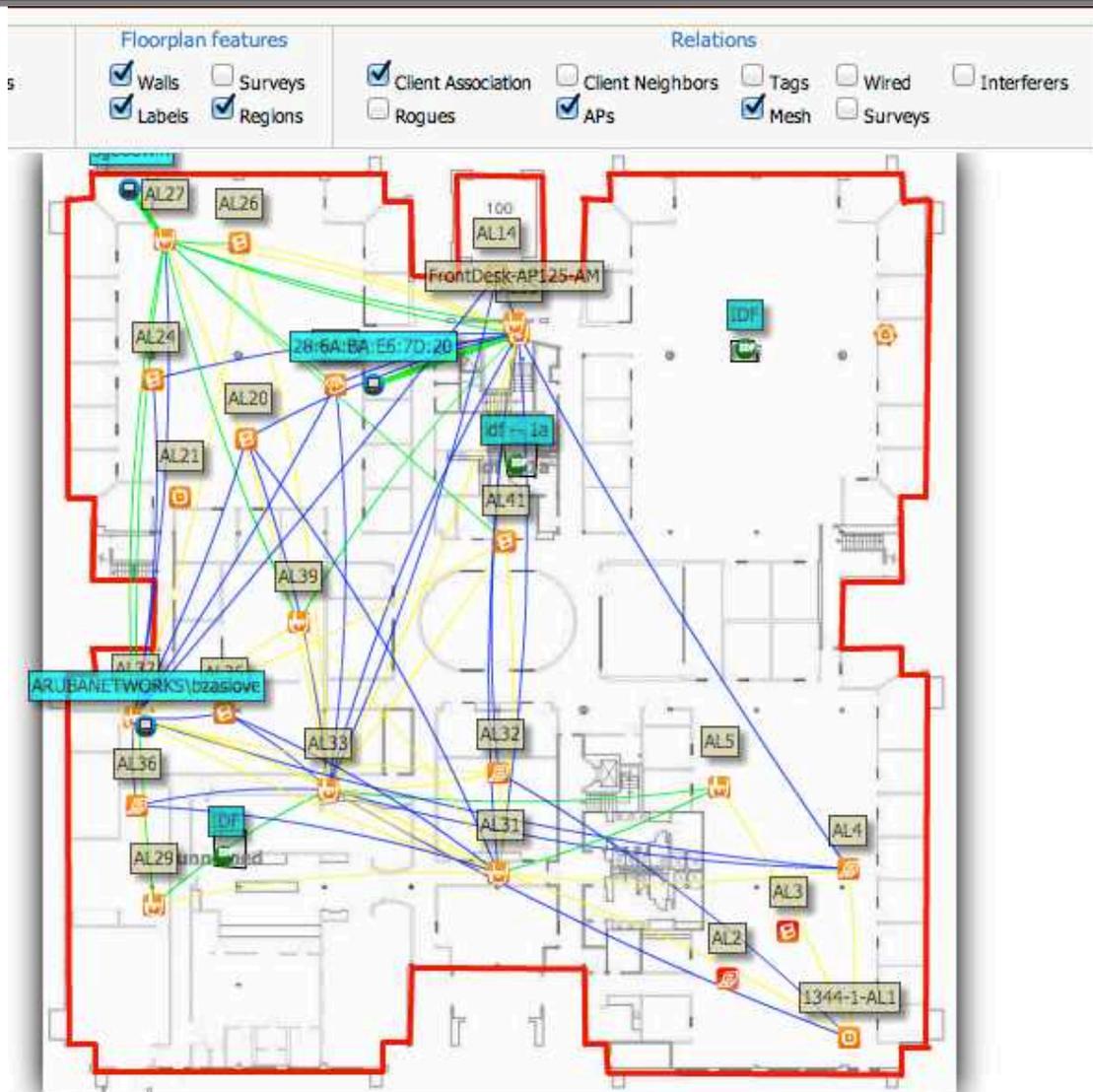
Heatmap (AirWave VisualRF)



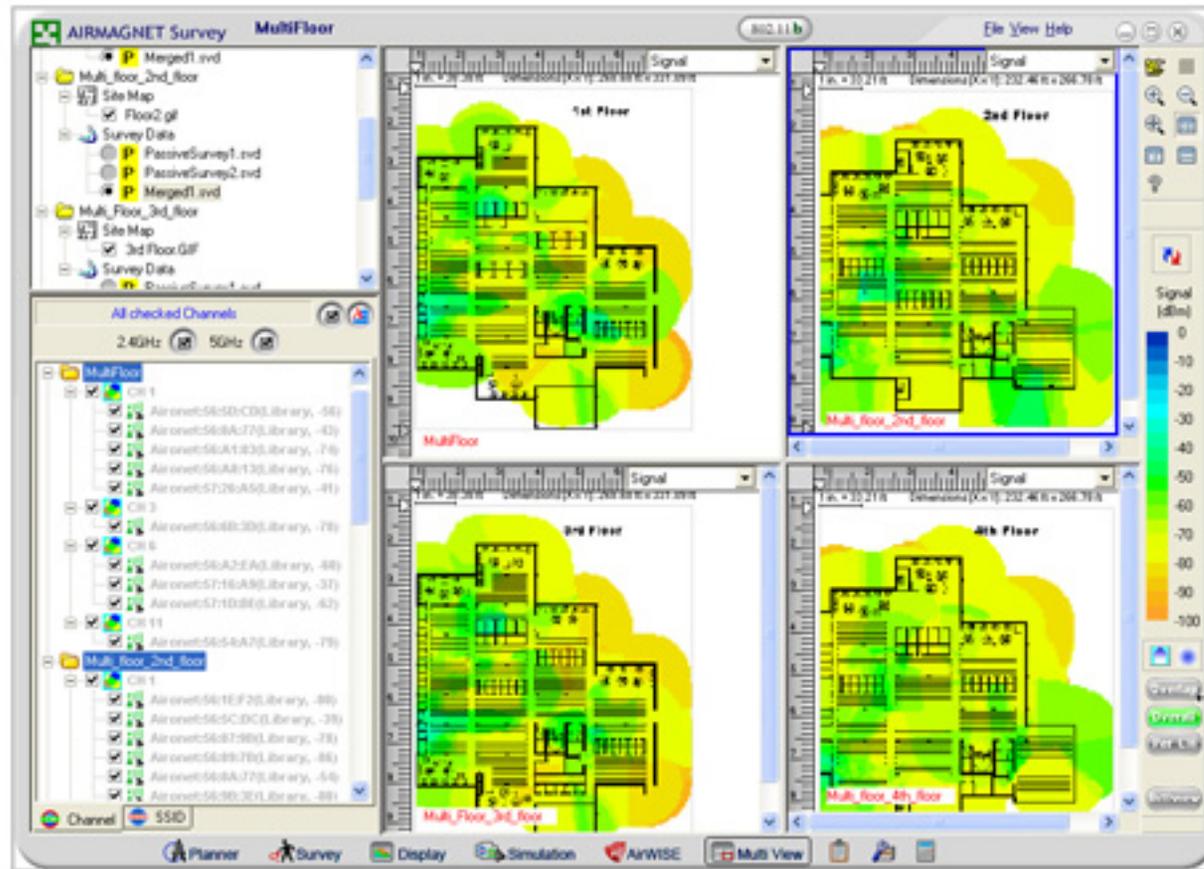
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Airwave (Client Association)

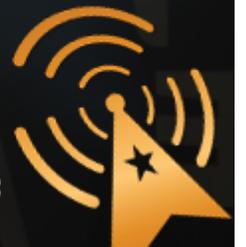


Site-Survey (AirMagnet Survey Pro)



Takes two to Tango

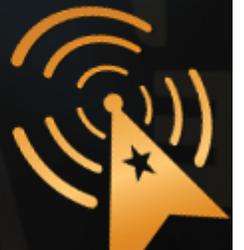
Understanding the client NIC



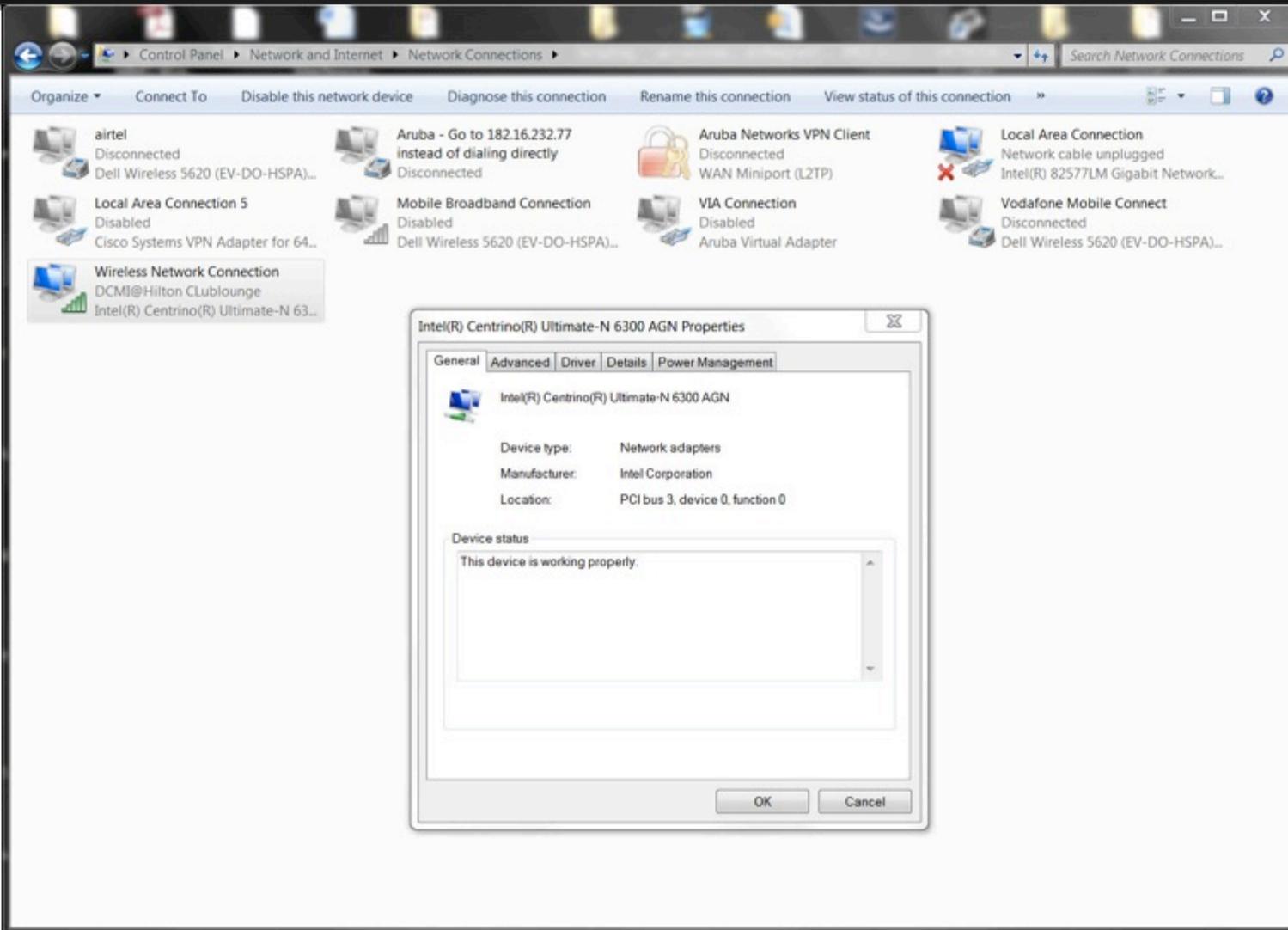
Understanding the Client NIC

- **Client devices have different characteristics and capabilities**
 - Is it 802.11a, 802.11g, b/g/n, a/b/g/n?
 - If the client supports 11n, is it one spatial stream, 2 spatial streams, or 3 spatial streams?
 - Is the wireless NIC using the latest driver?
 - Smartphones often use lower transmit power to save battery
 - SNR works in **both directions**—the client needs sufficient SNR to demodulate 802.11 data rates—noise close to the client can hurt performance
 - Sometimes, the client can hear the AP, but the AP cannot hear the client

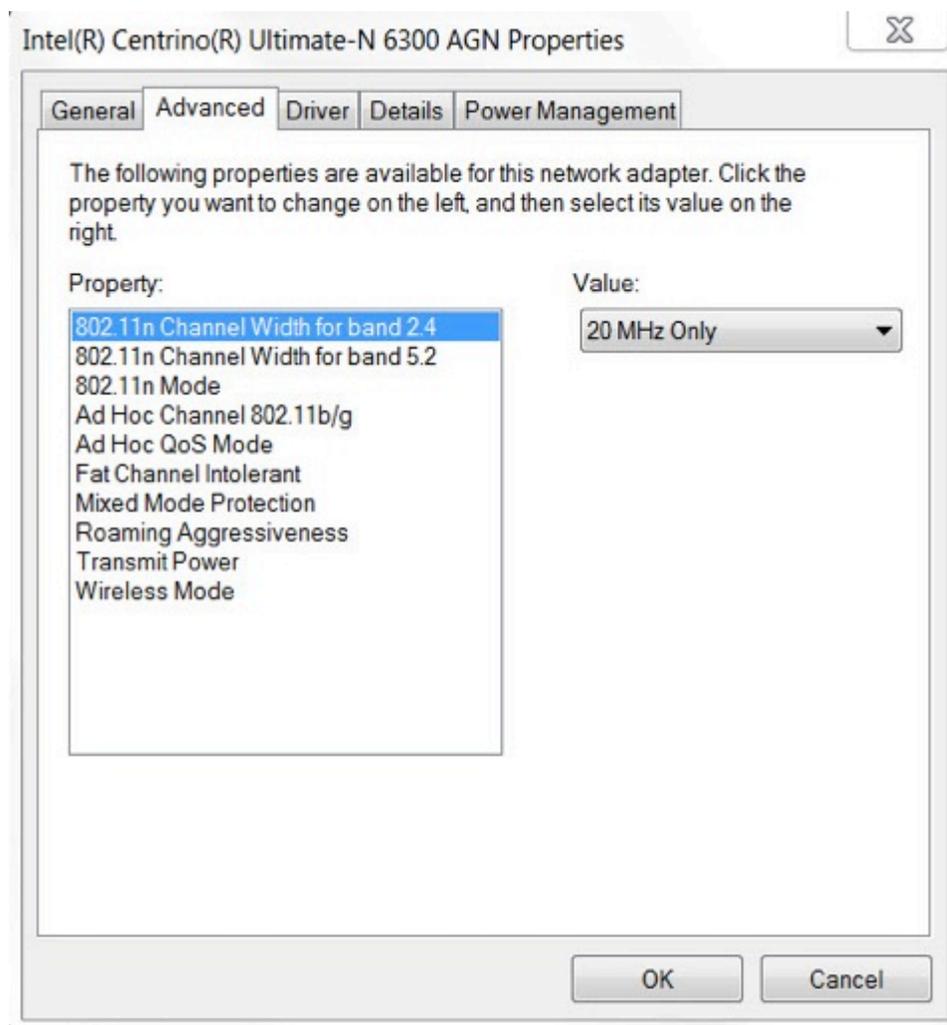
Win7 OS



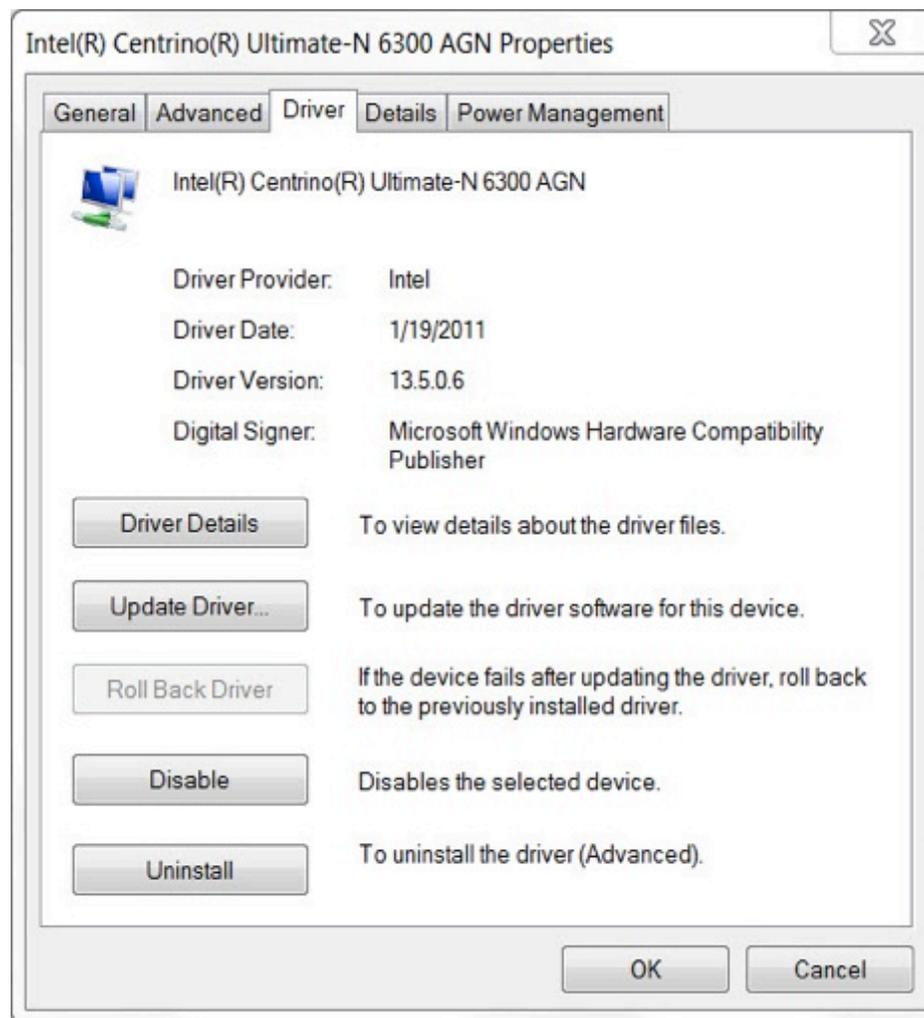
Wireless NIC Details



Wireless NIC Details Cont.



Wireless NIC Details Cont.



Wireless NIC Details Cont.

```
C:\Users\kperedia.ARUBANETWORKS>netsh wlan show driver

Interface name: Wireless Network Connection

Driver                : Intel(R) Centrino(R) Ultimate-N 6300 AGN
Vendor                : Intel Corporation
Provider              : Intel
Date                  : 10/27/2011
Version               : 14.3.0.6
INF file              : C:\Windows\INF\oem63.inf
Files                 : 4 total
                      C:\Windows\system32\DRIVERS\NETwNs64.sys
                      C:\Windows\system32\NETwNc64.dll
                      C:\Windows\system32\NETwNw64.dll
                      C:\Windows\system32\drivers\vwifibus.sys

Type                  : Native Wi-Fi Driver
Radio types supported : 802.11a 802.11b 802.11g
FIPS 140-2 mode supported : Yes
Hosted network supported : Yes
Authentication and cipher supported in infrastructure mode:
  Open                None
  Open                WEP-40bit
  Open                WEP-104bit
  Open                WEP
  Shared              WEP-40bit
  Shared              WEP-104bit
  Shared              WEP
  WPA-Enterprise     TKIP
  WPA-Enterprise     CCMP
  WPA-Personal       TKIP
  WPA-Personal       CCMP
  WPA2-Enterprise    TKIP
  WPA2-Enterprise    CCMP
  WPA2-Personal      TKIP
  WPA2-Personal      CCMP
  Open                Vendor defined
Authentication and cipher supported in ad-hoc mode:
  Open                None
  Open                WEP-40bit
  Open                WEP-104bit
  Open                WEP
  Shared              WEP-40bit
  Shared              WEP-104bit
  Shared              WEP
  WPA2-Personal      CCMP
```



Wireless NIC Connectivity (Windows 7)

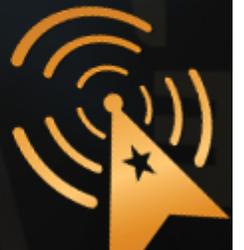
```
C:\Users\kperedia.ARUBANETWORKS>netsh wlan show interface

There is 1 interface on the system:

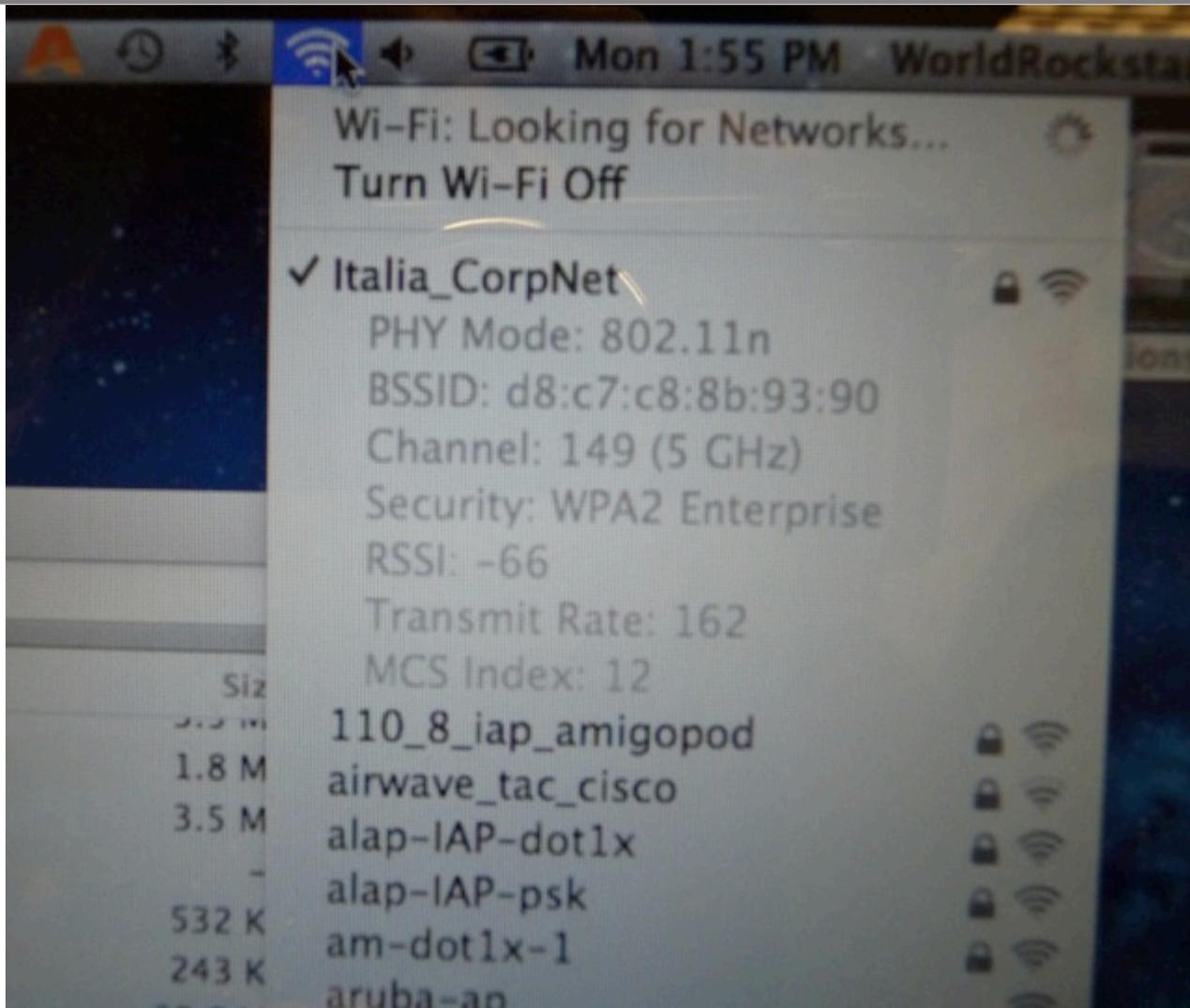
Name                : Wireless Network Connection
Description         : Intel(R) Centrino(R) Ultimate-N 6300 AGN
GUID                : 988c7779-aeb4-41d1-af4f-c9af8d2d92b9
Physical address    : 24:77:03:3b:aa:d0
State               : connected
SSID                : Roppongi Des
BSSID               : 00:07:ab:77:a7:9f
Network type       : Infrastructure
Radio type         : 802.11g
Authentication     : WPA2-Personal
Cipher              : CCMP
Connection mode    : Profile
Channel             : 4
Receive rate (Mbps) : 72
Transmit rate (Mbps) : 72
Signal              : 99%
Profile             : Roppongi Des

Hosted network status : Not available
```

MacOS



Wireless NIC Connectivity (MacOS)



Wireless NIC Connectivity (MacOS)

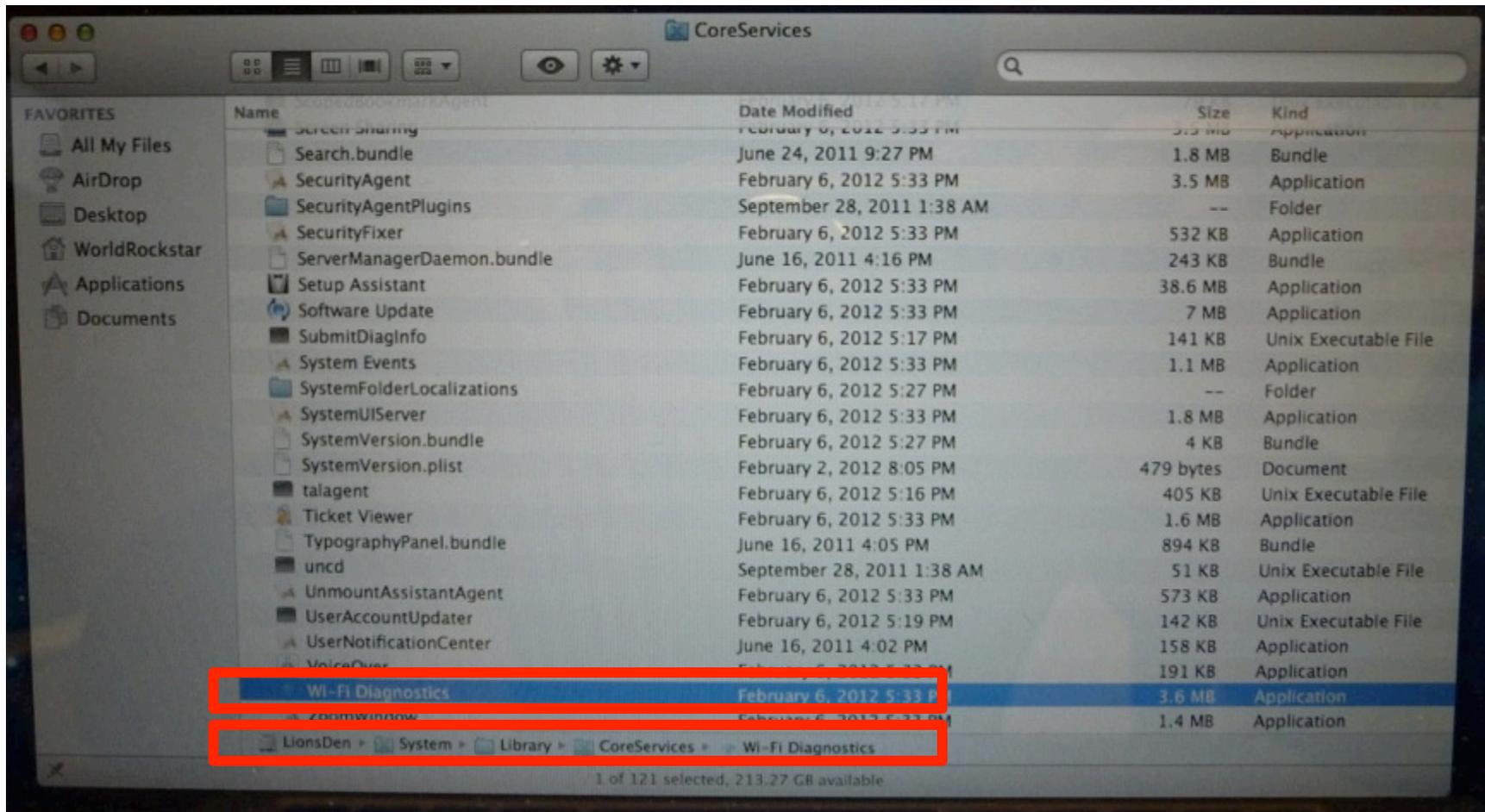
- **\$ sudo ln -sf /System/Library/PrivateFrameworks/Apple80211.framework/Versions/A/Resources/airport /usr/sbin/airport**

- \$ airport -l
- agrCtlRSSI: -57
- agrExtRSSI: 0
- agrCtlNoise: -89
- agrExtNoise: 0
- state: running
- op mode: station
- lastTxRate: 243
- maxRate: 300
- lastAssocStatus: 0
- 802.11 auth: open
- link auth: wpa2
- BSSID: d8:c7:c8:80:1d:f0
- SSID: Italia_CorpNet
- MCS: 14
- channel: 44,1

Wireless Diagnostics (MacOS)

- **Turn on logging**
 - `sudo /usr/libexec/airportd debug +alluserland +alldriver +allvendor`
 - When issue happens send the kernel.log file (that is located in /var/log directory) to TAC plus system profiler
- **Export System Profiler**

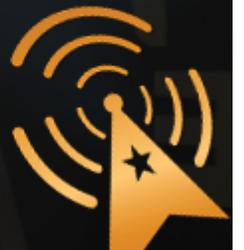
Wireless Diagnostics (MacOS Lion)



Wireless Diagnostics (MacOS Lion)



iOS



iOS Diagnostics (IPCUI)



The screenshot shows a web browser window with the URL <http://support.apple.com/kb/DL1466>. The page title is "iPhone Configuration Utility 3.5 for Windows". The page features a navigation bar with links for Store, Mac, iPod, iPhone, iPad, iTunes, and Support. The main content area includes a download icon, a product image of an iPhone, and a section titled "About iPhone Configuration Utility 3.5 for Windows". The text describes the utility's functions: creating, maintaining, encrypting, and installing configuration profiles; tracking and installing provisioning profiles and authorized applications; and capturing device information including console logs. It also explains that configuration profiles are XML files containing device security policies, VPN configuration information, Wi-Fi settings, APN settings, Exchange account settings, mail settings, and certificates that permit iPhone and iPod touch to work with enterprise systems. On the right side, there is a "Download" button and a list of metadata: Version: 3.5, Post Date: March 07, 2012, Download ID: DL1466, File Size: 40.58 MB, System Requirements (Windows XP SP3, Windows Vista SP1, Windows 7, .NET 3.5 SP1), and Supported Languages (Deutsch, English, Français, 日本語, Español, Italiano, Nederlands). A "Languages" dropdown menu is set to "English".

iPhone Configuration Utility 3.5 for Windows



About iPhone Configuration Utility 3.5 for Windows

iPhone Configuration Utility lets you easily create, maintain, encrypt, and install configuration profiles, track and install provisioning profiles and authorized applications, and capture device information including console logs.

Configuration profiles are XML files that contain device security policies, VPN configuration information, Wi-Fi settings, APN settings, Exchange account settings, mail settings, and certificates that permit iPhone and iPod touch to work with your enterprise systems.

Download

Version: 3.5
Post Date: March 07, 2012
Download ID: DL1466
File Size: 40.58 MB
System Requirements
Windows XP SP3
Windows Vista SP1
Windows 7
.NET 3.5 SP1
Supported Languages
Deutsch, English, Français, 日本語, Español, Italiano, Nederlands

Languages
English

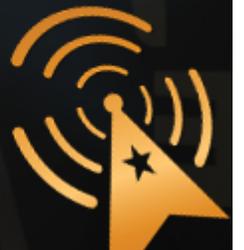
iOS Diagnostics (IPCU)

The screenshot shows the iPhone Configuration Utility (iPCU) interface. The 'Console' tab is selected and highlighted with a red box. The console displays a series of system logs. A red box highlights a specific section of logs starting with 'Mar 22 10:08:01' and ending with 'Mar 22 10:08:08'. The highlighted logs include:

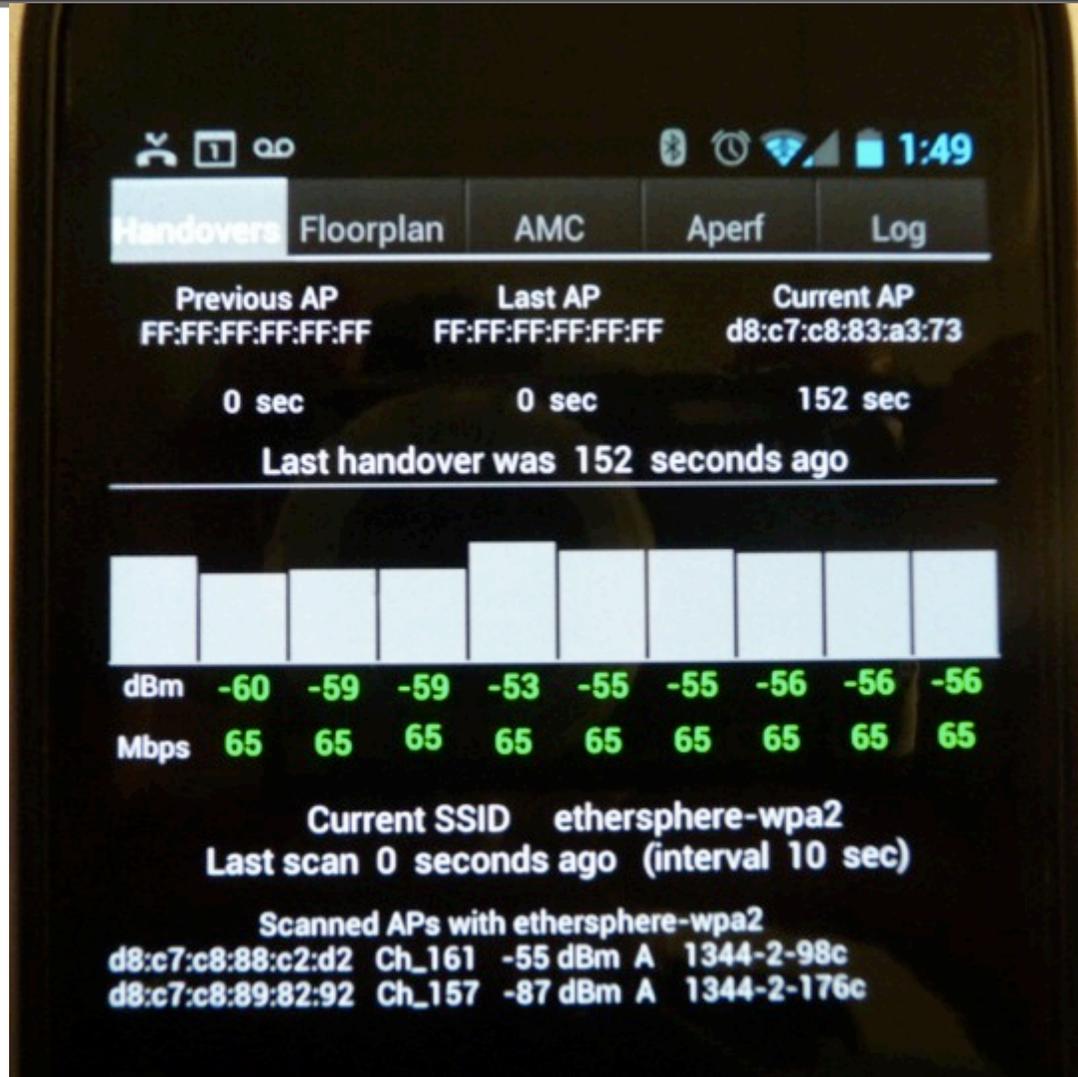
```
Mar 22 10:08:01 unknown Preferences[95] <Warning>: (-VPNBundleController_vpnConfigurationChanged) [0xc1e94e0<VPNBundleController: 0xc1e94e0>]: _serviceCount(0), serviceCount(0), toggleInRootMenu(0), RootMenuItem(1)
Mar 22 10:08:04 unknown kernel[0] <Debug>: AppleBCMWWLANCorestartRoamScan(): 2949 Delaying RoamScan; because Join Mgr Busy 0 isWaitingforIP 1
Mar 22 10:08:04 unknown kernel[0] <Debug>: AppleBCMWWLANCorestartRoamScan(): 2949 Delaying RoamScan; because Join Mgr Busy 0 isWaitingforIP 1
Mar 22 10:08:04 unknown Preferences[95] <Warning>: WiFi: Joined Aruba-Airheads
Mar 22 10:08:04 unknown Preferences[95] <Warning>: (-VPNBundleController_vpnConfigurationChanged) [0xc1e94e0<VPNBundleController: 0xc1e94e0>]: _serviceCount(0), serviceCount(0), toggleInRootMenu(0), RootMenuItem(1)
Mar 22 10:08:08 unknown configd[45] <Notice>: network configuration changed.
Mar 22 10:08:08 unknown kernel[0] <Debug>: [185.937166500]: AppleBCMWWLANNetManager:receivedIPv4Address(): Received address 10.230.179.207, entering powersave mode 2
Mar 22 10:08:08 unknown kernel[0] <Debug>: AppleBCMWWLANCorestartRoamScan(): 2963 starting RoamScan; MultiAPEnvr01sdualBand1 isOn5G1
Mar 22 10:08:08 unknown configd[45] <Notice>: Captive: en0: Probing 'Aruba-Airheads'
```



Android



Android Diagnostics (Aruba Utility)



Performance Testing



Performance Testing

When testing, it is best to do **wired** to **wireless** client testing.

This allows testing the performance of the wireless LAN, and not depending on Internet access and limited bandwidth.

Pure performance can be measured.



Performance Testing

- **iperf/jperf**
- **ixChariot**
- **Veriwave – WaveDeploy**

- **iperf (Traffic flow is from client to server)**
 - Server (receiver)
 - `iperf -s -w 512k -i 1`
 - Client (sender)
 - `iperf -c <Server IP> -w 512k -i 1 -t 60 -P 4`

Performance Testing

- **Our Aruba QA team quickly ran chariot tcp performance test against an iPad1, iPad2 and iPad3 on our AP-135 inside a RF chamber.**
 - The following are the results of that test. All ipads were running iOS 5.1 version. Please note they currently only support 20MHz 1ss and no sgi so maximum PHY data rate is 65 Mbps. Please note upstream is lower than expected on our system with this specific test.

TYPE	Downstream	Upstream	Comments
IPAD1	27+	10+	No upstream aggregation. Most robust downstream rate is 52. 65 is not robust; Chipset 4329
IPAD2	37+	14+	No upstream aggregation. Most robust downstream rate is 58.5. 65 is not robust. Chipset 4329
IPAD3	46+	46+	65mbps is robust in upstream and downstream. upstream aggregation is enabled. Chipset 4330



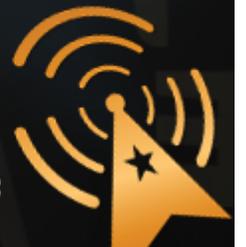
Packet Capture



Packet Capture

- **Local Packet Capture**
 - Tools running on laptop (Omnipeek/Wireshark)
 - You have to be where the problem is
- **Remote Packet Capture**
 - Use Aruba AP as remote agent
 - Anywhere with network access to AP
- **Session and port Mirroring**

Advanced RF Troubleshooting with CLI



Running Controller CMD from AWMS

Device Info

Status: Up (OK)

Configuration: **Mismatched** (The settings on the device do not match the desired configuration policy.)

Controller: [ethersphere-lms3](#) Aruba AP Group: corp1344 Upstream Device: [1344-1-AP-alpha-sw1](#) Upstream Port: [gigabitethernet0/0/35](#)
Type: Aruba AP 135 Remote Device: No Last Contacted: 2/23/2012 2:22 AM Uptime: 4 days 16 hrs 9 mins
LAN MAC Address: D8:C7:C8:C0:B4:C6 Serial: AX0023139
IP Address: 10.6.66.32 Clients: 2 Usage: -

Quick Links:

[Open controller web UI...](#)

[Run a command...](#)

Notes:

Radios

Index	Name	MAC Address	Clients	Usage (Kbps)	Channel	Tx Power	Antenna Type	Role	Active SSIDs
1	802.11bgn	D8:C7:C8:8B:4C:60	0	0.00	1	20 dBm	Internal	Access	ARUBA-VISITOR, et...
2	802.11an	D8:C7:C8:8B:4C:70	2	0.00	149	20.5 dBm	Internal	Access	ARUBA-VISITOR, et...

Wired Interfaces

Name	MAC Address	Clients	Admin Status	Operational Status	Type	Duplex	Aruba Port Mode	Input Capacity	Output Capacity
Enet0	D8:C7:C8:C0:B4:C6	0	Up	Up	gigabitEthernet	Full	N/A	1000 Mbps	1000 Mbps
Enet1	D8:C7:C8:C0:B4:C7	0	Up	Down	gigabitEthernet	Half	Active Standby	10 Mbps	10 Mbps

Useful AOS CLI (run from AirWave)

Monitoring **AL21 (1344-1-al21.arubanetworks.com)** in group **Ethersphere-lms3** in folder **Top > Sunnyvale HQ** Poll Control

This Device is in monitor-only-with-firmware-upgrades mode.

Device Info

Status: Up (OK)
Configuration: **Mismatched** (The settings on the device do not match the desired configuration policy.)

Controller:	ethersphere-lms3	Aruba AP Group:	corp1344	Upstream Device:	1344-1-A
Type:	Aruba AP 135	Remote Device:	No	Last Contacted:	2/23/201
LAN MAC Address:	D8:C7:C8:C0:B4:C6	Serial:	AX0023139		
IP Address:	10.6.66.32	Clients:	2	Usage:	-

Quick Links:

Notes:

Radios

Index	Name	MAC Address	Clients
1	802.11bgn	D8:C7:C8:8B:4C:60	0
2	802.11an	D8:C7:C8:8B:4C:70	2

Wired Interfaces

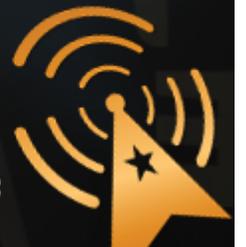
Name	MAC Address	Clients	Admin Sta
Enet0	D8:C7:C8:C0:B4:C6	0	Up
Enet1	D8:C7:C8:C0:B4:C7	0	Up

✓ Run a command...

- show ap association ap-name "1344-1-AL21"
- show ap debug counters ap-name "1344-1-AL21"
- show ap debug client-table ap-name "1344-1-AL21"
- show datapath session ap-name "1344-1-AL21" table
- show datapath session ap-name "1344-1-AL21" counters
- show ap debug bandwidth-management ap-name "1344-1-AL21"
- show ap tech-support ap-name "1344-1-AL21"
- show ap arm bandwidth-management ap-name "1344-1-AL21"
- show ap arm state ap-name "1344-1-AL21"
- show ap arm scan-times ap-name "1344-1-AL21"
- show ap arm rf-summary ap-name "1344-1-AL21"



Advanced CLI Examples



Verify All Known APs are UP

```
(Aruba3600_Milano) #  
(Aruba3600_Milano) #  
(Aruba3600_Milano) #  
(Aruba3600_Milano) #  
(Aruba3600_Milano) #  
(Aruba3600_Milano) #show ap active
```

Active AP Table

Name	Group	IP Address	11g Clients	11g Ch/EIRP/MaxEIRP	11a Clients	11a Ch/EIRP/MaxEIRP	AP Type	Flags	Uptime	Outer IP
AP135-5	Castello_APs	10.8.7.59	0	AP:HT:1/9/20	0	AP:HT:153-/18/20.5	135	A	27m:12s	N/A
AP135-2	Castello_APs	10.8.7.106	0	AP:HT:11/9/20	0	AP:HT:157+/18/20.5	135	A	27m:8s	N/A
AP135-3	Castello_APs	10.8.7.67	0	AP:HT:11/9/20	0	AP:HT:153-/20.5/20.5	135	A	27m:7s	N/A
AP135-4	Castello_APs	10.8.7.115	0	AP:HT:11/15/20	0	AP:HT:44+/16/16	135	A	26m:48s	N/A
AP135-1	Spectrum_Monitors	10.8.7.70	0	Spectrum	0	Spectrum	135	A	1d:6h:31m:3s	N/A
AP135-6	Castello_APs	10.8.7.73	0	AP:HT:1/15/20	0	AP:HT:149+/20.5/20.5	135	A	27m:11s	N/A

Flags: a = Reduce ARP packets in the air; A = Enet1 in active/standby mode;
B = Battery Boost On; C = Cellular; D = Disconn. Extra Calls On;
d = Drop Mcast/Bcast On; E = Wired AP enabled; K = 802.11K Enabled; n = Don't convert IPv6 Mcast RA to Ucast
L = Client Balancing Enabled; M = Mesh; N = 802.11b protection disabled;
P = PPPoE; R = Remote AP; X = Maintenance Mode;
1 = 802.1x authenticated AP; F = AP failed 802.1x authentication; 2 = Using IKE version 2;

Channel followed by "*" indicates channel selected due to unsupported configured channel.
"Spectrum" followed by "^" indicates Local Spectrum Override in effect.

Num APs:6

```
(Aruba3600_Milano) #
```



Verify All Known SSIDs are Broadcasting

```
(Aruba3600_Milano) #show ap bss-table
```

```
fm (forward mode): T-Tunnel, S-Split, D-Decrypt Tunnel, B-Bridge (s-standard, p-persistent, b-backup, a-always)
```

```
Aruba AP BSS Table
```

bss	ess	s/p	ip	phy	type	ch/EIRP/max-EIRP	cur-cl	ap name	in-t(s)	tot-t	mtu	acl-state	acl	fm
d8:c7:c8:88:d1:e0	Italia_CorpNet	1/3	10.8.7.115	g-HT	ap	11/15/20	0	AP135-4	0	31m:43s	1500	-	52	T
d8:c7:c8:88:d1:e1	Italia_CorpGuest	1/3	10.8.7.115	g-HT	ap	11/15/20	0	AP135-4	0	8s	1500	-	56	T
d8:c7:c8:80:1d:f0		1/3	10.8.7.70	a-HT	Spectrum	??/?	0	AP135-1	0	1d:6h:36m:35s	1500	-	1	Bs
d8:c7:c8:87:ee:10	Italia_CorpNet	1/3	10.8.7.73	a-HT	ap	149+/20.5/20.5	0	AP135-6	0	32m:17s	1500	-	52	T
d8:c7:c8:80:1d:e0		1/3	10.8.7.70	g-HT	Spectrum	??/?	0	AP135-1	0	1d:6h:36m:35s	1500	-	1	Bs
d8:c7:c8:87:d8:b0	Italia_CorpNet	1/3	10.8.7.59	a-HT	ap	153-/18/20.5	0	AP135-5	0	32m:17s	1500	-	52	T
d8:c7:c8:87:ef:10	Italia_CorpNet	1/3	10.8.7.67	a-HT	ap	153-/20.5/20.5	0	AP135-3	0	32m:14s	1500	-	52	T
d8:c7:c8:8b:93:90	Italia_CorpNet	1/3	10.8.7.106	a-HT	ap	40-/16/16	0	AP135-2	0	31m:48s	1500	-	52	T
d8:c7:c8:87:ee:00	Italia_CorpNet	1/3	10.8.7.73	g-HT	ap	1/15/20	0	AP135-6	0	32m:17s	1500	-	52	T
d8:c7:c8:87:ee:01	Italia_CorpGuest	1/3	10.8.7.73	g-HT	ap	1/15/20	0	AP135-6	0	8s	1500	-	56	T
d8:c7:c8:88:d1:f0	Italia_CorpNet	1/3	10.8.7.115	a-HT	ap	40-/16/16	0	AP135-4	0	31m:43s	1500	-	52	T
d8:c7:c8:87:d8:a0	Italia_CorpNet	1/3	10.8.7.59	g-HT	ap	1/12/20	0	AP135-5	0	32m:17s	1500	-	52	T
d8:c7:c8:87:d8:a1	Italia_CorpGuest	1/3	10.8.7.59	g-HT	ap	1/12/20	0	AP135-5	0	8s	1500	-	56	T
d8:c7:c8:87:ef:00	Italia_CorpNet	1/3	10.8.7.67	g-HT	ap	11/9/20	0	AP135-3	0	32m:14s	1500	-	52	T
d8:c7:c8:87:ef:01	Italia_CorpGuest	1/3	10.8.7.67	g-HT	ap	11/9/20	0	AP135-3	0	8s	1500	-	56	T
d8:c7:c8:8b:93:80	Italia_CorpNet	1/3	10.8.7.106	g-HT	ap	11/9/20	0	AP135-2	0	31m:48s	1500	-	52	T
d8:c7:c8:8b:93:81	Italia_CorpGuest	1/3	10.8.7.106	g-HT	ap	11/9/20	0	AP135-2	0	7s	1500	-	56	T

```
Channel followed by "*" indicates channel selected due to unsupported configured channel.  
"Spectrum" followed by "^" indicates Local Spectrum Override in effect.
```

```
Num APs:17  
Num Associations:0
```

```
(Aruba3600_Milano) #
```

Check Device's 802.11 status

```
(ethersphere-lms3) #show ap association client-mac 00:26:bb:1c:0c:db  
Flags: W: WMM client, A: Active, K: 802.11K client, B: Band Steerable  
PHY Details: HT: High throughput; 20: 20MHz; 40: 40MHz  
<n>ss: <n> spatial streams
```

Association Table

Name	ssid	mac	auth	assoc	aid	l-int	ssid	vlan-id	tunnel-id	phy	assoc. time	num assoc	Flags
1341-AP09	d8:c7:c8:89:72:92	00:26:bb:1c:0c:db	y	y	15	10	ethersphere-wpa2	651	0x1195	a-HT-20sg1-2ss	11h:34m:0s	1	WAB

00:26:bb:1c:0c:db-d8:c7:c8:89:72:92 Stats

Parameter	Value
Channel	161
Channel Frame Retry Rate(%)	0
Channel Frame Low Speed Rate(%)	0
Channel Frame Non Unicast Rate(%)	0
Channel Frame Fragmentation Rate(%)	0
Channel Frame Error Rate(%)	11
Channel Bandwidth Rate(kbps)	0
Channel Noise	92
Client Frame Retry Rate(%)	0
Client Frame Low Speed Rate(%)	0
Client Frame Non Unicast Rate(%)	0
Client Frame Fragmentation Rate(%)	0
Client Frame Receive Error Rate(%)	0
Client Bandwidth Rate(kbps)	0
Client Tx Packets	285366
Client Rx Packets	165644
Client Tx Bytes	23194081
Client Rx Bytes	232608911
Client SNR	18

```
(ethersphere-lms3) #
```

View Device's 802.11 Performance

- **show ap debug client-table ap-name <ap name>**

```
(ethersphere-lms3) #show ap debug client-table ap-name 1341-AP09
```

Client Table

MAC	ESSID	BSSID	HT_State	PS_State	Tx_Pkts	Rx_Pkts	PS_Qlen	Tx_Retries	Tx_Rate	Rx_Rate	Last_ACK_SNR	Last_RX_SNR
00:26:bb:1c:0c:db	ethersphere-wpa2	d8:c7:c8:89:72:92	WSSM	Power-save	165593	323235	0	3330	130	117	35	25
e0:f8:47:0e:6b:64	ethersphere-wpa2	d8:c7:c8:89:72:92	AwSSmB	Awake	4	163017	0	0	130	216	36	36
ec:55:f9:c7:2a:9b	ethersphere-cpass	d8:c7:c8:89:72:83	WSSM	Power-save	6	145	0	3	43	1	41	38

```
UAPSD:(VO,VI,BK,BE,Max SP,Q Len)
```

```
HT Flags: A - LDPC Coding; W - 40Mhz; S - Short GI HT40; s - Short GI HT20
```

```
          D - Delayed BA; G - Greenfield; R - Dynamic SM PS
```

```
          Q - Static SM PS; N - A-MPDU disabled; B - TX STBC
```

```
          b - RX STBC; M - Max A-MSDU; I - HT40 Intolerant
```

```
(ethersphere-lms3) #
```

View Device's 802.11 Performance

```
(ethersphere-lms3) #show ap ht-rates bssid d8:c7:c8:89:72:92  
AP "1341-AP09" Radio 0 BSSID d8:c7:c8:89:72:92 High-throughput Rates (Mbps)
```

MCS	Streams	20 MHz	20 MHz SGI	[40 MHz]	[40 MHz SGI]
0	1	6.5	7.2	[13.5]	[15.0]
1	1	13.0	14.4	[27.0]	[30.0]
2	1	19.5	21.7	[40.5]	[45.0]
3	1	26.0	28.9	[54.0]	[60.0]
4	1	39.0	43.3	[81.0]	[90.0]
5	1	52.0	57.8	[108.0]	[120.0]
6	1	58.5	65.0	[121.5]	[135.0]
7	1	65.0	72.2	[135.0]	[150.0]
8	2	13.0	14.4	[27.0]	[30.0]
9	2	26.0	28.9	[54.0]	[60.0]
10	2	39.0	43.3	[81.0]	[90.0]
11	2	52.0	57.8	[108.0]	[120.0]
12	2	78.0	86.7	[162.0]	[180.0]
13	2	104.0	115.6	[216.0]	[240.0]
14	2	117.0	130.0	[243.0]	[270.0]
15	2	130.0	144.4	[270.0]	[300.0]
16	3	19.5	21.7	[40.5]	[45.0]
17	3	39.0	43.3	[81.0]	[90.0]
18	3	58.5	65.0	[121.5]	[135.0]
19	3	78.0	86.7	[162.0]	[180.0]
20	3	117.0	130.0	[243.0]	[270.0]
21	3	156.0	173.3	[324.0]	[360.0]
22	3	175.5	195.0	[364.5]	[405.0]
23	3	195.0	216.7	[405.0]	[450.0]

```
Range for 20 MHz: 6.5 - 216.7 Mbps
```

```
Items enclosed in [ ] are disabled.
```

```
(ethersphere-lms3) #
```

Check 802.11 and non-802.11 Interference

```
(ethersphere-lms3) #show ap arm rf-summary ap-name 1341-AP09
```

Channel Summary

channel	retry	phy-err	mac-err	noise	cov-idx	intf_idx
161	0	0	16	93	16/0	65/78//0/1
1	16	0	0	94	53/1	422/0//18/0
48	0	0	0	92	0/0	0/9//0/0
165	0	0	0	99	21/0	129/20//0/0
5	0	0	0	90	0/0	0/142//0/5
7	0	0	0	91	0/0	0/23//0/1
11	0	0	0	89	8/0	66/0//3/0
149	0	0	0	87	9/0	165/29//1/0
36	0	0	0	92	8/0	42/0//0/0
153	0	0	0	89	11/0	86/90//0/1
40	0	0	0	91	0/0	0/14//0/0
157	0	0	0	90	17/0	104/51//2/0
44	0	0	0	92	0/0	0/0//0/0

HT Channel Summary

channel_pair	Pairwise_intf_index
1-5	587
7-11	93
149-153	372
36-40	56
157-161	301
44-48	9

```
Interface Name      :wifi0
Current ARM Assignment :161/15
Covered channels a/g :5/0
Free channels a/g    :0/0
ARM Edge State      :enable
Last check channel/pwr :7h:5m:1s/27s
Last change channel/pwr :7h:5m:1s/7h:5m:1s
Next Check channel/pwr :0s/6m:53s
```

```
Interface Name      :wifi1
Current ARM Assignment :1/9
Covered channels a/g :0/1
Free channels a/g    :0/0
```

Advanced RF Troubleshooting

- **General AP/Client**

- show ap active [ap-name] <AP name>
- show ap bss-table [ap-name] <AP name>
- show ap association [ap-name] <AP name>
- show ap association client-mac <client MAC>
- show ap debug client-table ap-name <AP name>
- show ap debug client-table ap-name <AP name> | include <client MAC>
- show ap debug client-stats <client MAC> advanced
- show ap remote debug mgmt-frames client-mac <client MAC>
- show ap remote debug mgmt-frames ap-name <AP name>

Advanced RF Troubleshooting Cont.

- **ARM**

- show ap monitor ap-list ap-name <AP name>
- show ap arm rf-summary ap-name <AP name>
- show ap arm history ap-name <AP name>
- show ap arm scan-times ap-name <AP name>
- show ap arm state ap-name <AP name>

- **RF**

- show ap debug radio-stats ap-name <AP name> radio [0 or 1] advanced

Advanced RF Troubleshooting Cont.

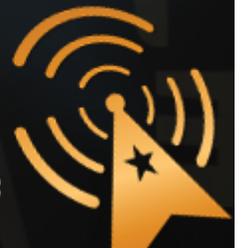
- **User**

- show user [IP address or client MAC]
- show user-table verbose
- show auth-tracebuf [client MAC or count]
- show datapath session table <user IP address>

- **System**

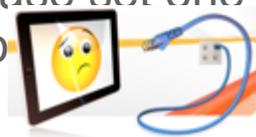
- show ap debug system-status ap-name <AP name>
- show ap tech-support ap-name <AP name>
- show ap spectrum tech-support ap-name <AP name>
- show tech-support
- tar logs tech-support

What To Do Before You Call TAC? (to help resolve problems faster)



What to do before you call TAC?

- **Provide the Aruba WLAN Controller logs and output of show tech-support**
 - CLI Example:
 - tar logs tech-support
 - copy flash: logs.tar tftp:<tftp server IP address> <file name>
- **If this information is not available, then at a minimum, please provide:**
 - ArubaOS Version (including build number)
 - Controller Model
 - Client Type
 - Radio band and Channel width
 - ESSID Opmode
- **Provide the Syslog Server file of the Aruba WLAN Controller at the time of the problem.**
 - If no Syslog Server is available to capture log output from the Aruba WLAN Controller then please set one up as soon as possible since it is a highly suggested troubleshooting and monitoring best practice.



What to do before you call TAC? (cont'd)

- **State if this is a new or existing installation.**
 - This will help the support team to take different troubleshooting approaches depending on whether the customer has:
 - An outage in the network that worked in the past
 - A network configuration that has never worked
 - A brand new install
- **State if anything has recently changed in the network (external to Aruba) or if anything has recently changed in the Aruba WLAN Controller or AP configuration.**
- **If there was a configuration change then please list the exact configuration steps and commands used.**
- **State the date and time (if possible) when the problem first occurred**
- **Is the problem reproducible?**
 - If the problem is reproducible please list the exact steps taken to recreate the problem



What to do before you call TAC? (cont'd)

- **Provide the wireless device's make, model number, and its OS version including any service packs or patches,**
- **Provide the Wireless LAN Card's make, model number, driver date, driver version, and configuration on the wireless device.**
- **Highly Useful Information:**
 - (Information below should be provided as an addition to the previous slides that contain critical Information needed)
 - **Provide a detailed network topology (including all the devices in the network between the user and the Aruba WLAN Controller with IP addresses and Interface numbers if possible)**
 - The diagram can be in format of Visio, PowerPoint, JPEG, TIF, etc. or it can even be hand written and then faxed to support "1-408-227-4550"
 - **Provide any wired or wireless sniffer traces taken during the time of the problem.**



▶ #airheadsconf



What to do before you call TAC? (cont'd)

- **Get the following log output during the problem IF Syslog server output can't be provided**
 - show log errorlog all
 - show log network all | include '<wireless device's mac address>'
 - show log security all | include '<wireless device's mac address>'
 - show log system all
 - show log user-debug all | include '<wireless device's mac address>'
 - show log user all | include '<wireless device's mac address>'
 - show log wireless all



What to do before you call TAC? (cont'd)

- **Provide customer site access information to the Aruba WLAN Controller if possible.**
 - This is another highly suggested troubleshooting best practice that should be implemented.
 - The customer site access should only be enabled when a problem occurs (or if Aruba support is monitoring the device).
 - The most common access given by customers is through Adobe Acrobat Connect or WebEx.
 - Otherwise customers will provide a VPN (PPTP, L2TP, SSL) connection that limits the support person to only have IP access to the Aruba WLAN Controller, AP, and AWMS.
 - Analog dialup or SSH access to the Aruba Controller are other access methods that the support person can use to reach the Aruba WLAN Controller too.



▶ #airheadsconf





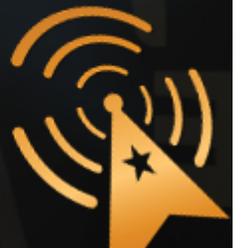
AIRHEADS
LAS VEGAS 2012

Coming Up:
Break
Deploying BYOD
Designing Outdoor Mesh Networks

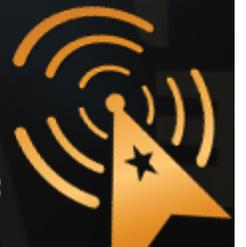
▶ community.arubanetworks.com

▶ [#airheadsconf](https://twitter.com/airheadsconf)

Backup Slides



Remote Packet Capture with Aruba AP



Remote Packet Capture with Aruba AP

- Using any Aruba AP (AP or AM, CAP or RAP) to perform remote packet capture
- Wireshark 1.6 (or above) running on any computer
- **IP connectivity** between AP/AM and capturing computer

Setting Up Remote Packet Capture

Controller > Air Monitors

Local Air Monitors Search

AM Name ▲	AP Group ▲	AM IP ▲	AP Type ▲	IPSEC ▲	Uptime ▲
ap105-35	am	172.18.163.144	105	Enable	3d:0h:3m:44s

1 | 1-1 of 1 10 ↕

Overview Packet Capture Launch AirMagnet

Monitoring > Air Monitor: 172.18.163.144 > Packet Capture ◀ Back

Search Result

<input type="checkbox"/>	ID	Type	Radio	Channel	Packets	Status	Target	Filter
None found.								

Refresh Stop Delete Pause Resume New

New Raw Packet Capture [Launch WildPackets](#)

Raw Packet Capture

WildPackets Ethereal | Target IP: | Port: | Channel: |

Start Cancel

To send packets to WildPackets, you need to use Air Monitor IP Address 172.18.163.144.



Setting Up Remote Packet Capture

Monitoring > Air Monitor: 172.18.163.144 > Packet Capture

Search Result

<input type="checkbox"/>	ID	Type	Radio	Channel	Packets	Status	Target	Filter
<input type="checkbox"/>	1	RAW	80211b/g-HT-40	6		in-progress	172.18.164.171/5000	

 [Launch WildPackets](#)

Set-up computer as receiver

The image shows the Wireshark 1.7.0 interface. The 'Capture' menu is highlighted in the main window. A 'Wireshark: Capture Interfaces' dialog box is open, showing a table of available interfaces. The 'Options' button in the dialog is highlighted. The background shows a list of captured packets.

No.	Time	Device	Description	IP	Packets	Packets/s	Info
5524	128.324304	en0		none	0	0	1 Beacon frame,
5525	128.325647	fw0		none	0	0	4 Beacon frame,
5526	128.326550	en1		fe80::e2f8:47ff:fe37:f44e	0	0	50 Beacon frame,
5527	128.327539	p2p0		none	0	0	50 Beacon frame,
5528	128.361732	en3		fe80::5855:caff:fedf:8a2b	0	0	37 Beacon frame,
5529	128.364199	lo0		fe80::1	0	0	20 Beacon frame,
5530	128.366253				0	0	20 Beacon frame,
5531	128.368825				0	0	20 Beacon frame,
5532	128.372249				0	0	32 Beacon frame,
5533	128.373046				0	0	37 Beacon frame,
5534	128.398151				0	0	4 Beacon frame,
5535	128.401213				0	0	37 Beacon frame,
5536	128.402662	ArubaNet_56:8f:01	Broadcast		802.11	320	Beacon frame,
5537	128.407723	ArubaNet_40:7c:ef	Spanning-tree-(for-bridges)		802.11	164	Data, SN=894,
5538	128.425784	ArubaNet_63:d3:40	Broadcast		802.11	172	Beacon frame,

Set-up computer as receiver

Wireshark: Capture Options

Capture

Capture	Interface	Link-layer header	Prom. Mode	Snaplen [B]	Buffer [MB]	Mon. Mode	Capture Filter
<input type="checkbox"/>	en0	Ethernet	enabled	default	1	n/a	
<input type="checkbox"/>	fw0	Apple IP-over-IEEE 1394	enabled	default	1	n/a	
<input checked="" type="checkbox"/>	en1 fe80::e2f8:47ff:fe37:f44e 172.18.164.171 2001:470:fb07:2:e2f8:47ff:f... 2001:470:fb07:2:d827:1cae...	Ethernet	enabled	default	1	disabled	port 5000

Capture on all interfaces Capture all in promiscuous mode

Capture File(s)

File: Browse...

Use multiple files Use pcap-ng format

Next file every

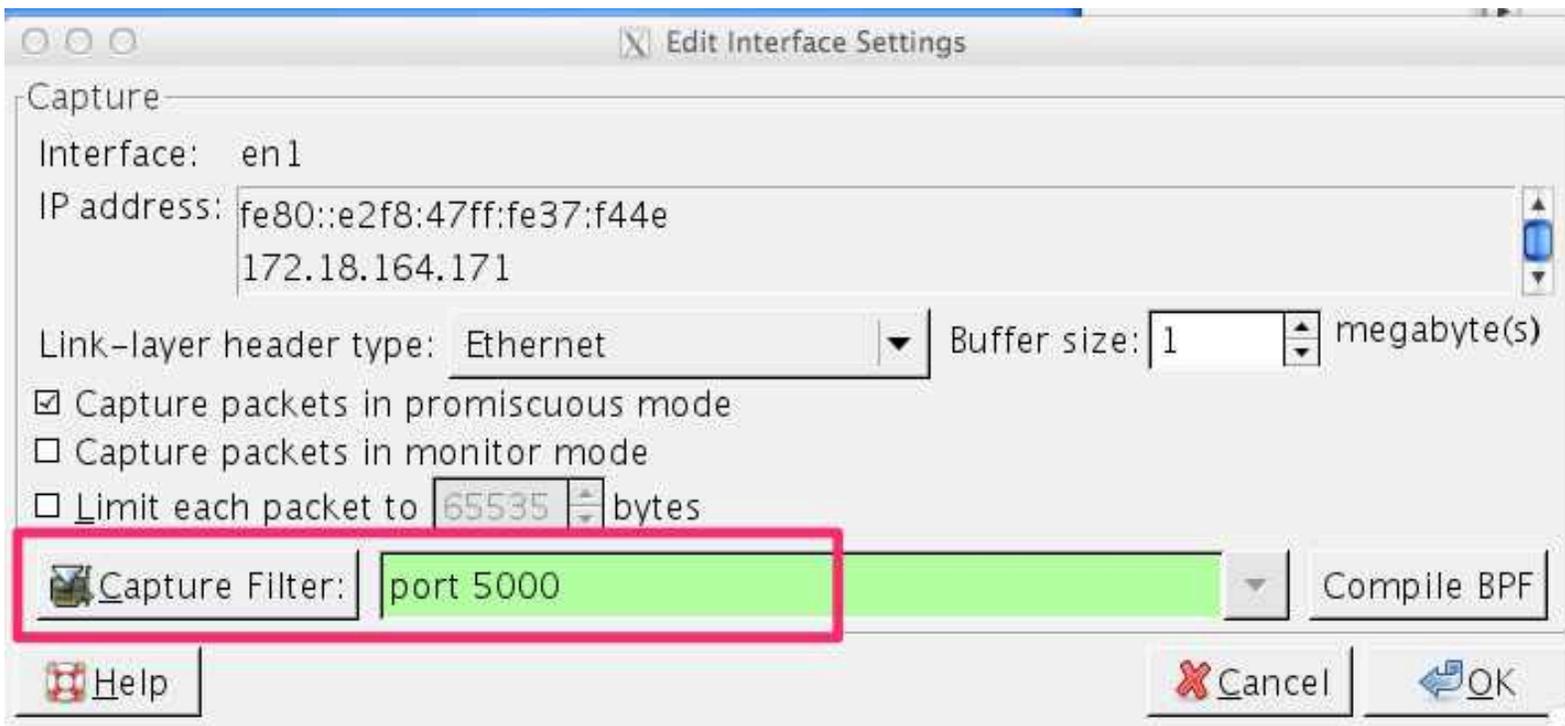
Display Options

Update list of packets in real time

Automatic scrolling in live capture

Set-up computer as receiver

- **Filter on traffic on port 5000**



Set-up computer as receiver

- **Decode as AIROPEEK**

The screenshot shows the Wireshark interface with the 'Analyze' menu open. The 'Decode As...' option is highlighted with a red box. Below it, the 'Wireshark: Decode As' dialog box is open. The 'Decode' radio button is selected. The 'Network' tab is active, showing 'UDP Both (5000↔5000) port(s) as' with a dropdown menu open, highlighting 'AIROPEEK'. The 'Transport' tab is also visible. The dialog box has buttons for 'Show Current', 'Clear', 'Help', 'OK', 'Apply', and 'Close'.

Packet Capture

en1 (port 5000) [Wireshark 1.7.0 (SVN Rev 39768 from /trunk)]

File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help

Filter: Expression... Clear Apply Save

No.	Time	Source	Destination	Protocol	Length	Info
5519	128.313209	ArubaNet_63:d3:43	IntelCor_98:6a:b0	802.11	144	Probe Response, SN=886, FN=0, Flags=.....C, BI=100, SSID=K-
5520	128.313966	ArubaNet_63:d3:44	IntelCor_98:6a:b0	802.11	144	Probe Response, SN=887, FN=0, Flags=.....C, BI=100, SSID=K-
5521	128.319645	ArubaNet_56:8f:01	IntelCor_98:6a:b0	802.11	314	Probe Response, SN=3624, FN=0, Flags=.....C, BI=100, SSID=e
5522	128.322260	ArubaNet_56:8f:02	IntelCor_98:6a:b0	802.11	314	Probe Response, SN=3597, FN=0, Flags=.....C, BI=100, SSID=e
5523	128.323715	ArubaNet_63:d3:40	Broadcast	802.11	172	Beacon frame, SN=888, FN=0, Flags=.....C, BI=100, SSID=brid
5524	128.324504	ArubaNet_63:d3:41	Broadcast	802.11	171	Beacon frame, SN=889, FN=0, Flags=.....C, BI=100, SSID=spli
5525	128.325647	ArubaNet_63:d3:42	Broadcast	802.11	174	Beacon frame, SN=890, FN=0, Flags=.....C, BI=100, SSID=MTK-
5526	128.326550	ArubaNet_63:d3:43	Broadcast	802.11	150	Beacon frame, SN=891, FN=0, Flags=.....C, BI=100, SSID=K-12
5527	128.327539	ArubaNet_63:d3:44	Broadcast	802.11	150	Beacon frame, SN=892, FN=0, Flags=.....C, BI=100, SSID=K-12
5528	128.361732	ArubaNet_80:3b:a0	Broadcast	802.11	287	Beacon frame, SN=2782, FN=0, Flags=.....C, BI=100, SSID=gue
5529	128.364199	ArubaNet_80:3b:a1	Broadcast	802.11	320	Beacon frame, SN=2781, FN=0, Flags=.....C, BI=100, SSID=eth
5530	128.366253	ArubaNet_80:3b:a2	Broadcast	802.11	320	Beacon frame, SN=2781, FN=0, Flags=.....C, BI=100, SSID=eth
5531	128.368825	ArubaNet_36:2b:e2	Broadcast	802.11	332	Beacon frame, SN=3842, FN=0, Flags=.....C, BI=100, SSID=ins
5532	128.372249	ArubaNet_36:2b:e3	Broadcast	802.11	337	Beacon frame, SN=3837, FN=0, Flags=.....C, BI=100, SSID=ins
5533	128.373046	ArubaNet_36:2b:e4	Broadcast	802.11	314	Beacon frame, SN=3834, FN=0, Flags=.....C, BI=100, SSID=ins
5534	128.398151	ArubaNet_56:8f:00	Broadcast	802.11	287	Beacon frame, SN=925, FN=0, Flags=.....C, BI=100, SSID=gues
5535	128.401213	ArubaNet_56:8f:01	Broadcast	802.11	320	Beacon frame, SN=924, FN=0, Flags=.....C, BI=100, SSID=ethe
5536	128.402662	ArubaNet_56:8f:02	Broadcast	802.11	320	Beacon frame, SN=924, FN=0, Flags=.....C, BI=100, SSID=ethe
5537	128.407723	ArubaNet_40:7c:ef	Spanning-tree-(for-bridges)	802.11	164	Data, SN=894, FN=0, Flags=p....F.C
5538	128.425784	ArubaNet_63:d3:40	Broadcast	802.11	172	Beacon frame, SN=895, FN=0, Flags=.....C, BI=100, SSID=brid
5539	128.426580	ArubaNet_63:d3:41	Broadcast	802.11	171	Beacon frame, SN=896, FN=0, Flags=.....C, BI=100, SSID=spli

Frame 1: 76 bytes on wire (608 bits), 76 bytes captured (608 bits)

- Ethernet II, Src: ArubaNet_c0:6d:b6 (d8:c7:c8:c0:6d:b6), Dst: Apple_37:f4:4e (e0:f8:47:37:f4:4e)
- Internet Protocol Version 4, Src: 172.18.164.103 (172.18.164.103), Dst: 172.18.164.171 (172.18.164.171)
- User Datagram Protocol, Src Port: complex-main (5000), Dst Port: complex-main (5000)
- Airopeek encapsulated IEEE 802.11
- IEEE 802.11 Clear-to-send, Flags:C

Packet (beacon)

File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help

Filter: Expression... Clear Apply Save

No.	Time	Source	Destination	Protocol	Length	Info
5524	128.324504	ArubaNet_63:d3:41	Broadcast	802.11	171	Beacon frame, SN=889, FN=0, Flags=.....C, BI=100, SSID=spli
5525	128.325647	ArubaNet_63:d3:42	Broadcast	802.11	174	Beacon frame, SN=890, FN=0, Flags=.....C, BI=100, SSID=MTK-
5526	128.326550	ArubaNet_63:d3:43	Broadcast	802.11	150	Beacon frame, SN=891, FN=0, Flags=.....C, BI=100, SSID=K-12
5527	128.327539	ArubaNet_63:d3:44	Broadcast	802.11	150	Beacon frame, SN=892, FN=0, Flags=.....C, BI=100, SSID=K-12
5528	128.361722	ArubaNet_80:2b:20	Broadcast	802.11	287	Beacon frame, SN=2782, FN=0, Flags=.....C, BI=100, SSID=ue

subtype: 0
Flags: 0x0
Duration: 0
Destination address: Broadcast (ff:ff:ff:ff:ff:ff)
Source address: ArubaNet_63:d3:42 (00:0b:86:63:d3:42)
BSS Id: ArubaNet_63:d3:42 (00:0b:86:63:d3:42)
Fragment number: 0
Sequence number: 890
Frame check sequence: 0x7fdb3303 [correct]

IEEE 802.11 wireless LAN management frame

- Fixed parameters (12 bytes)
 - Timestamp: 0x0000003c15338aa5
 - Beacon Interval: 0.102400 [Seconds]
 - Capabilities Information: 0x0431
- Tagged parameters (72 bytes)
 - Tag: SSID parameter set: MTK-test
 - Tag: Supported Rates 1(B), 2(B), 5.5, 11, 6, 9, 12, 18, [Mbit/sec]
 - Tag: DS Parameter set : Current Channel: 11
 - Tag: Traffic Indication Map (TIM): DTIM 0 of 0 bitmap
 - Tag: ERP Information
 - Tag: Extended Supported Rates 24, 36, 48, 54, [Mbit/sec]
 - Tag: RSN Information
 - Tag: Vendor Specific: AtherosC: Unknown

Starting PCAP from CLI

- **Example**

1. The AP-105 has an IP address of 172.18.163.144
2. There is a laptop with IP address 172.18.164.171 and has Wireshark 1.7.0 and listening on port 5000
3. The syntax specifies 1 for the last value because it is telling the AP to send the frames in AIROPEEK pcap format.

```
(Aruba3600) #pcap raw-start 172.18.164.144 172.18.164.171 5000 1  
pcap-id:1
```



Useful Wireshark Display Filters

- **Show only 802.11 traffic**
 - wlan
- **Show 802.11 traffic to/from a client**
 - wlan.addr==<mac address>
- **Hide (or show) beacon frames**
 - wlan.fc.type_subtype != 0x08 / wlan.fc.type_subtype == 0x08
- **Show management frames for a specific SSID**
 - wlan_mgt.ssid == “SSID_NAME”
- **Show everything except beacon and ACK frames**
 - (!wlan.fc.type_subtype == 0x08) && (!wlan.fc.type_subtype == 0x1d)