

Wireless LAN Design and Troubleshooting

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Planning and design

- Planning for B,G,A & N
- Planning AP density

Planning - General

- Solid ethernet foundation required
- Organizational Policy
- Legal Requirements
- What do WE really need
- Controller vs Autonomous
- FCC



Planning - Security

- Different wireless networks
- Segregation of traffic
- Authentication

Planning - Operation

- What is current RF landscape
- QoS
- Think about the devices (today)
- Think about the devices (tomorrow, next week, next year)
- End-User expectations



Planning B,G,A,N

Protocol	Frequency	Rate Mb/s	Bandwidth	Released
802.11a	5GHz	6-54	20MHz	Sep. '99
802.11b	2.4GHz	1-11	20MHz	Sep. '99
802.11g	2.4GHz	6-54	20MHz	Jun '03
802.11n	2.4GHz	7.2 - 72.2	20/40* MHz	Oct '09
	5GHz	15 - 150	40MHz	



Planning B & G

- Frequency Range: 2412 - 2462 MHz
- Channels: 1-11
- Bandwidth: 20MHz
- Channels overlap
- Max non-overlapping channels: 3



Planning A & N

- Larger Frequency Ranges
 - 5180-5320, 5500-5580, 5660-5700, 5745-5825 MHz
- More Channels
 - 36-48, 52-64*, 100-116*, 132-140*, 149-165
- Channels do not overlap
- Bandwidth: 20MHz(a) / 40MHz(n)
- Non-overlapping channels: 23 (varies)



Planning 802.11n

- 20MHz or 40MHz bandwidth
- Premise of channel bonding
 - Ch(1) or Ch (-1)
 - Both 2.4GHz and 5GHz

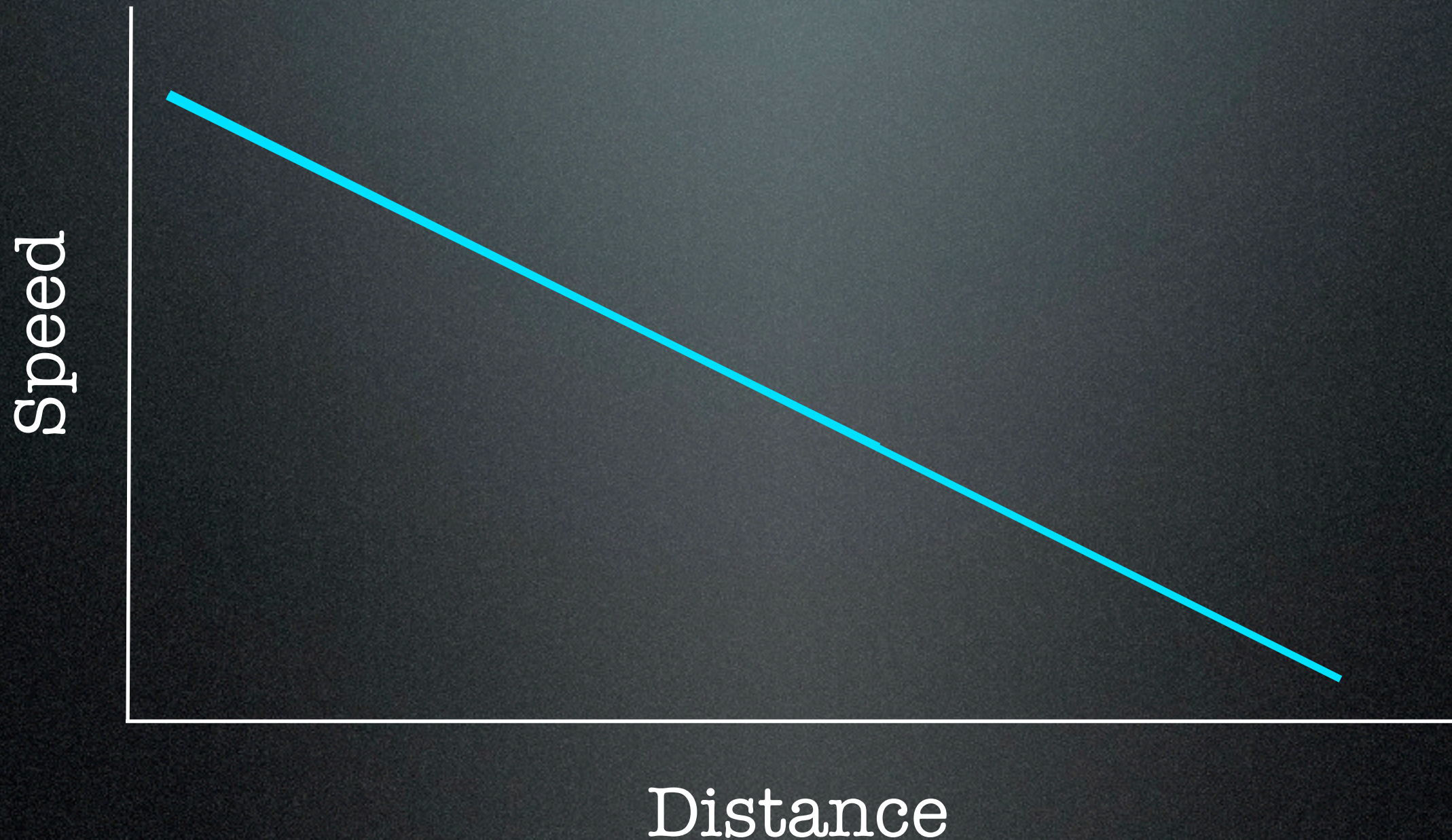


Planning AP Density

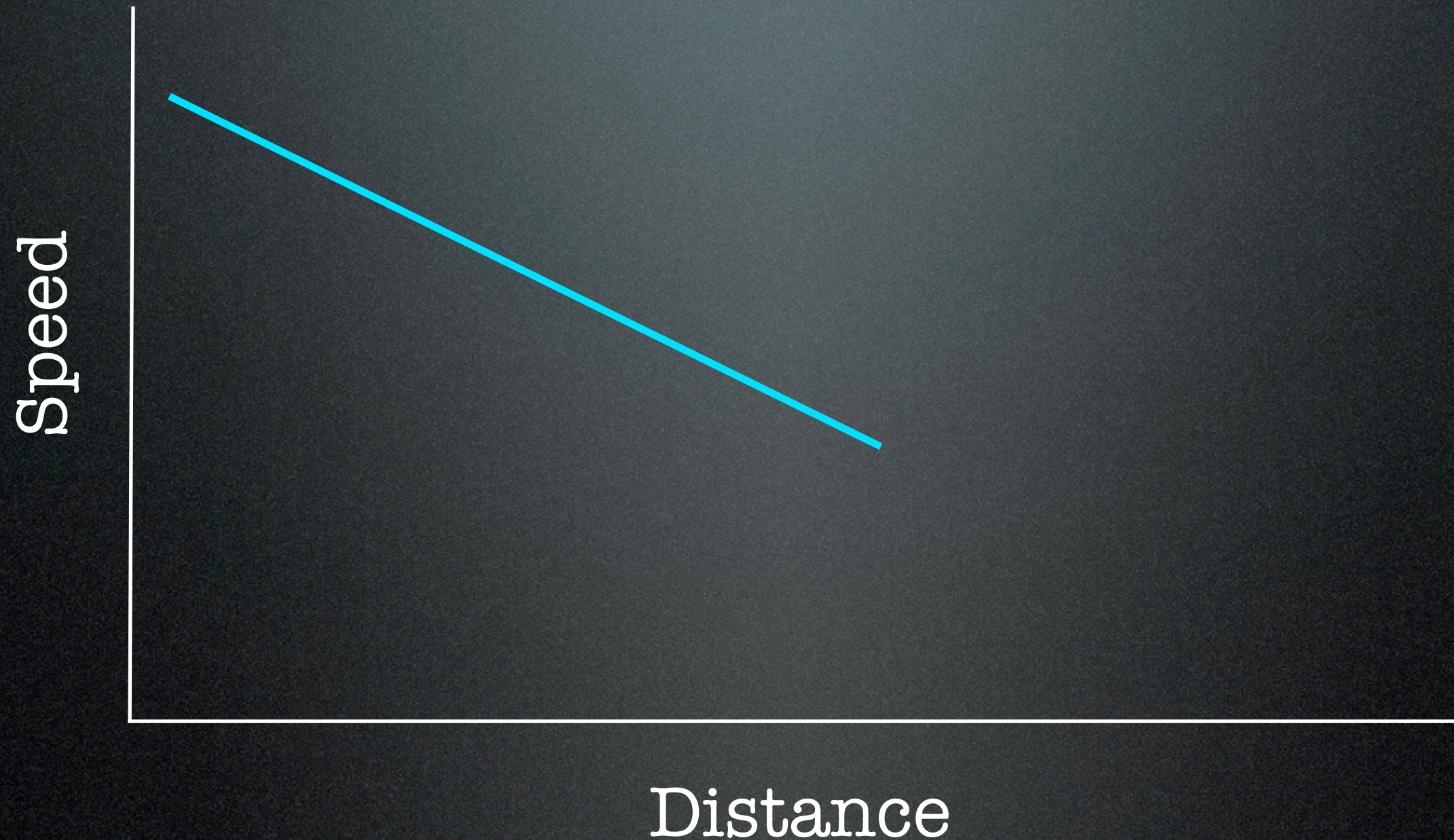
- Shared bandwidth amongst clients
- Consider
 - Physical placement
 - Building structure
- Higher density isn't always better
- Antennas



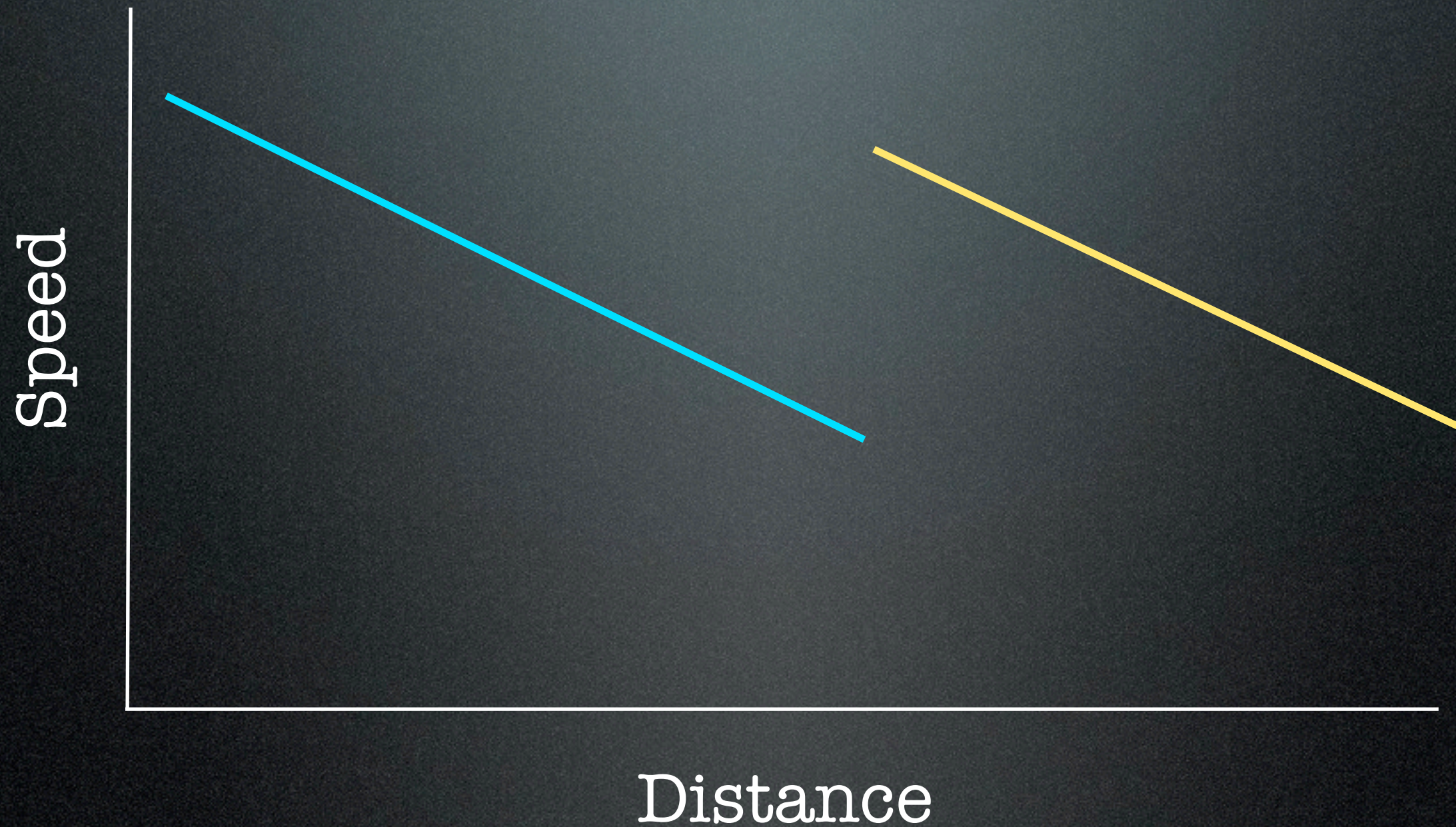
Planning AP density



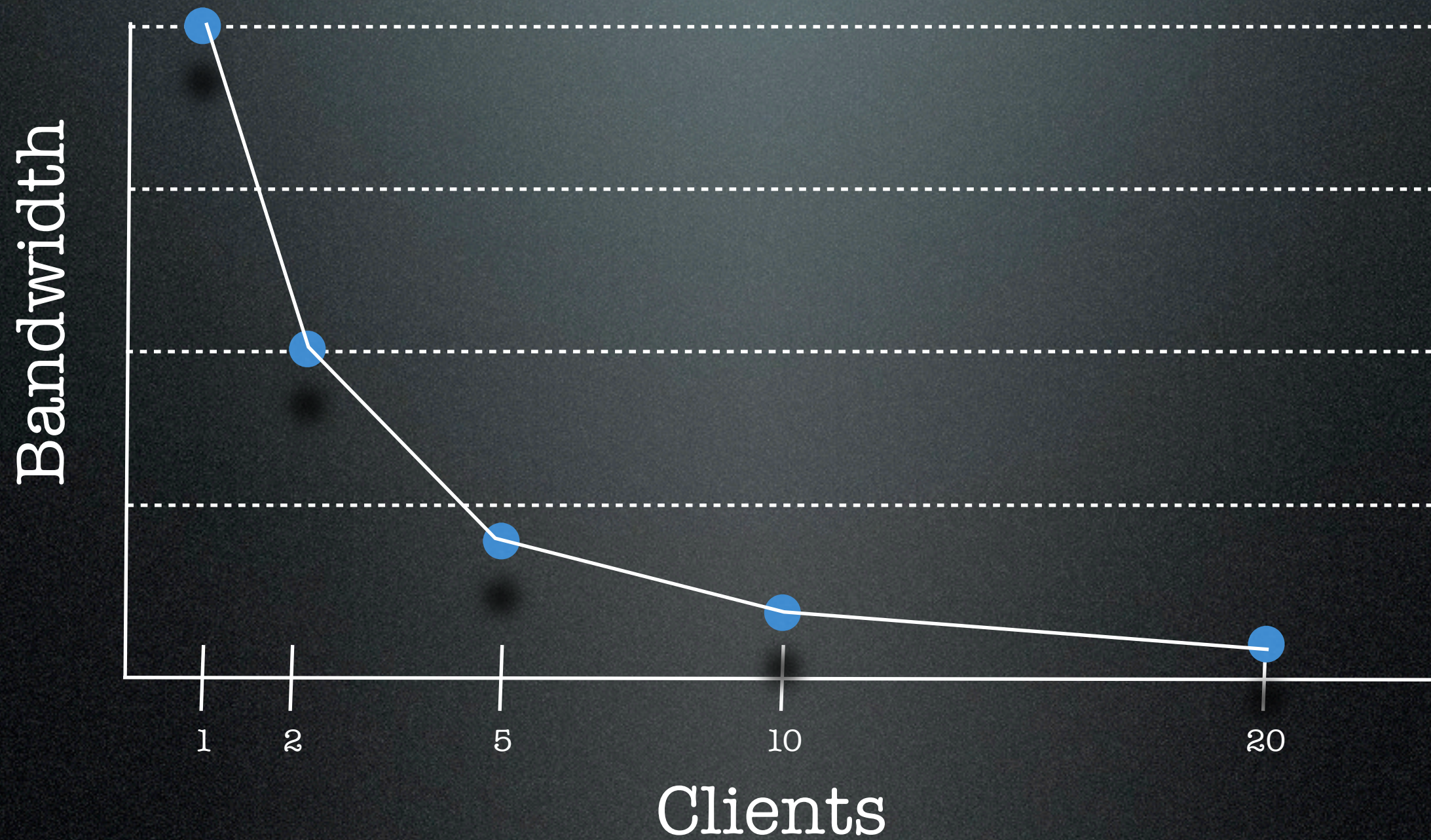
Planning AP density



Planning AP density

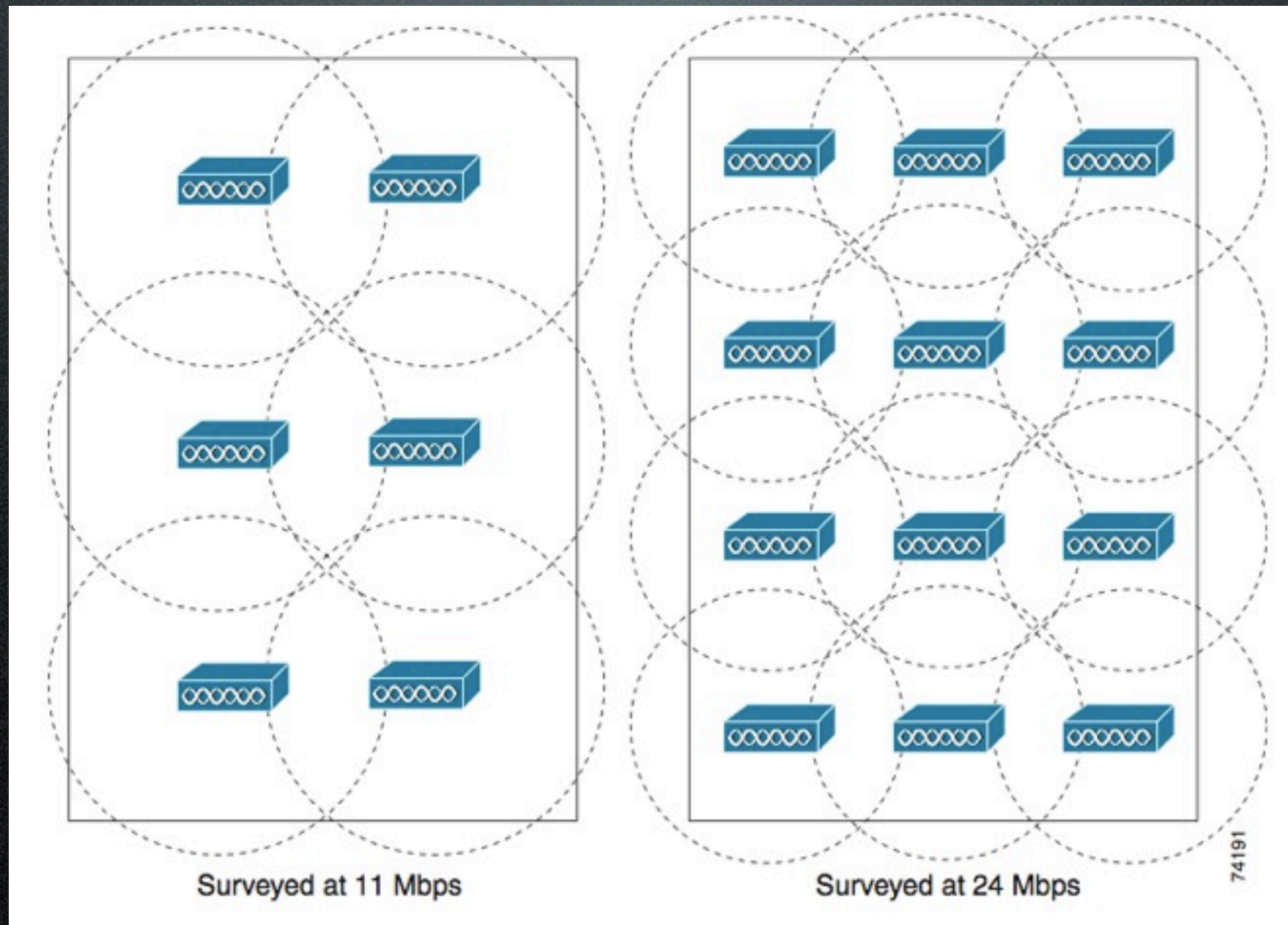


Planning AP density



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Density / Rate Example

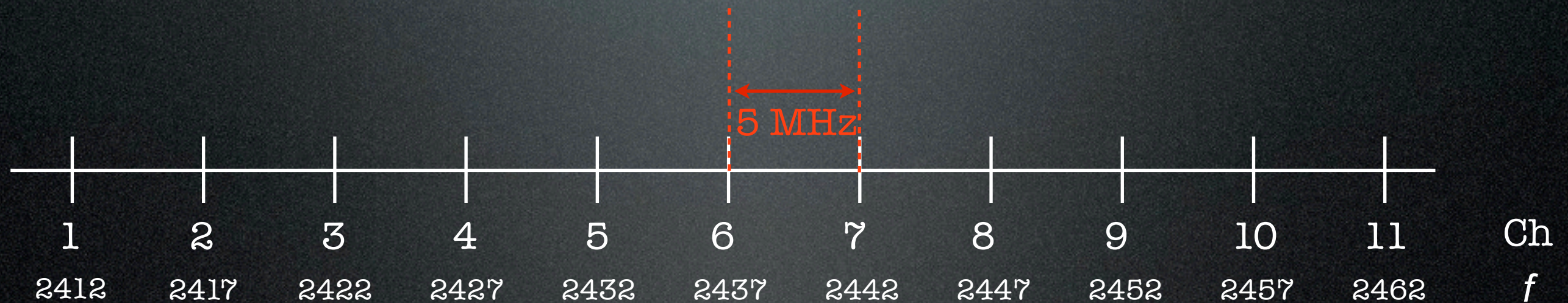


Deployment Best Practices



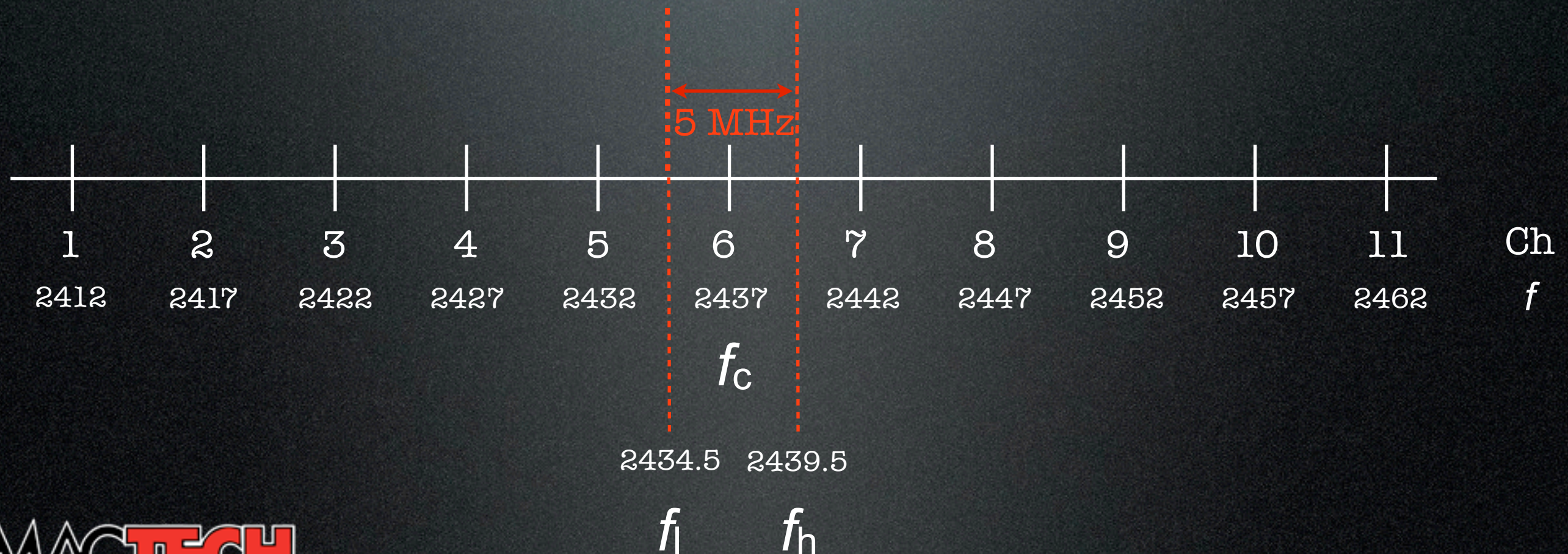
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802.11b/g - Channels



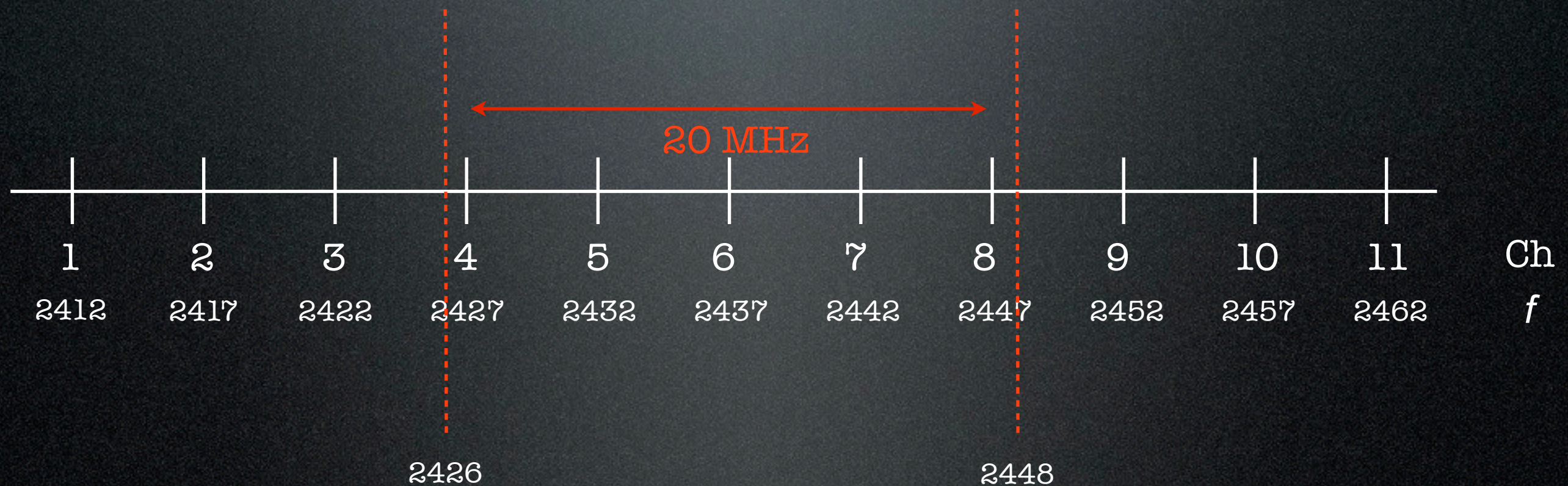
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802.11b/g - Channels



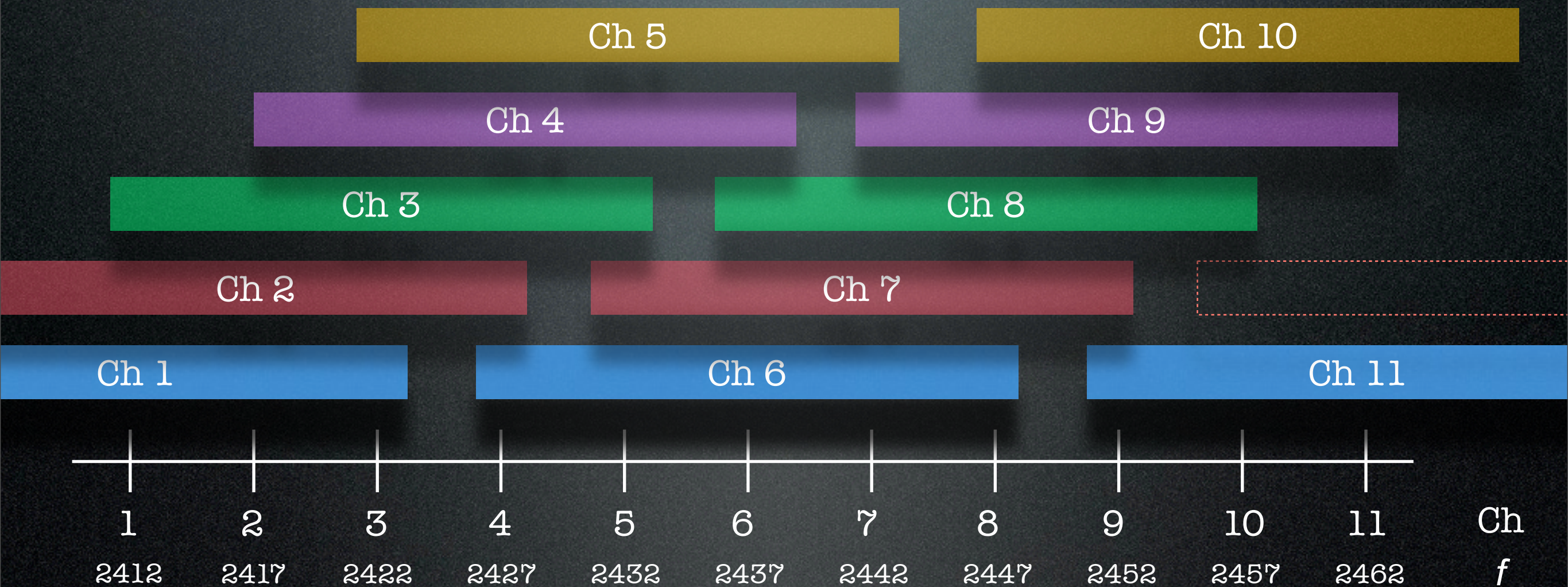
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802.11b/g - Channels



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802.11b/g - Channels



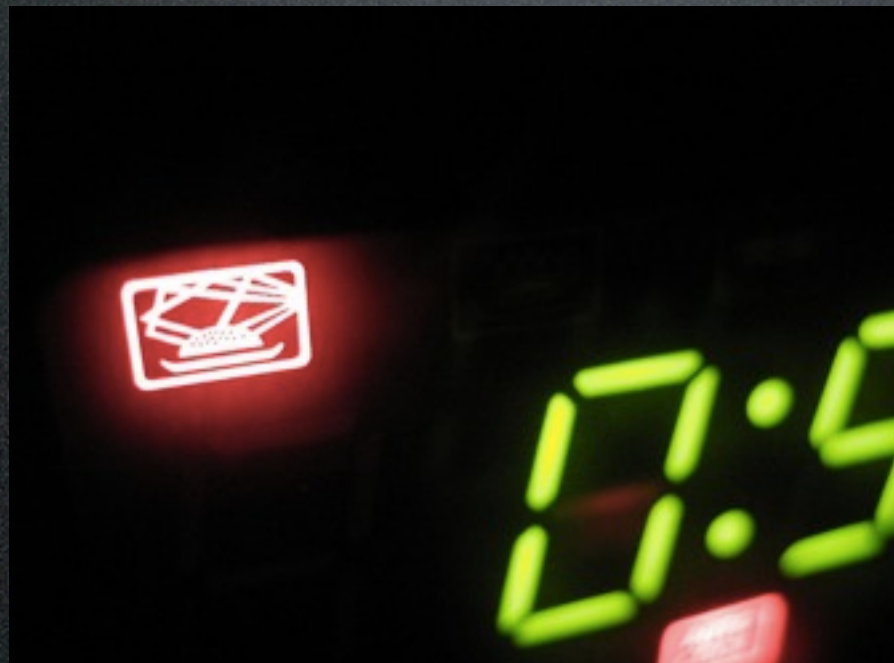
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802.11 a/n - Channels

- More channels
- Non-overlapping in 5GHz
- Pick (1) or (-1) for channel bonding
- Lower channels have lower max power



Interference



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Tweaking Bandwidth

- Channel Bonding in 5GHz
- Eliminate lower transmission speeds
- Density comes into play

Transmitter Power

- 2.4GHz generally more range
- 5GHz *can* deliver longer range
- Density
 - May not want a radio on 100%
 - Planned Overlap



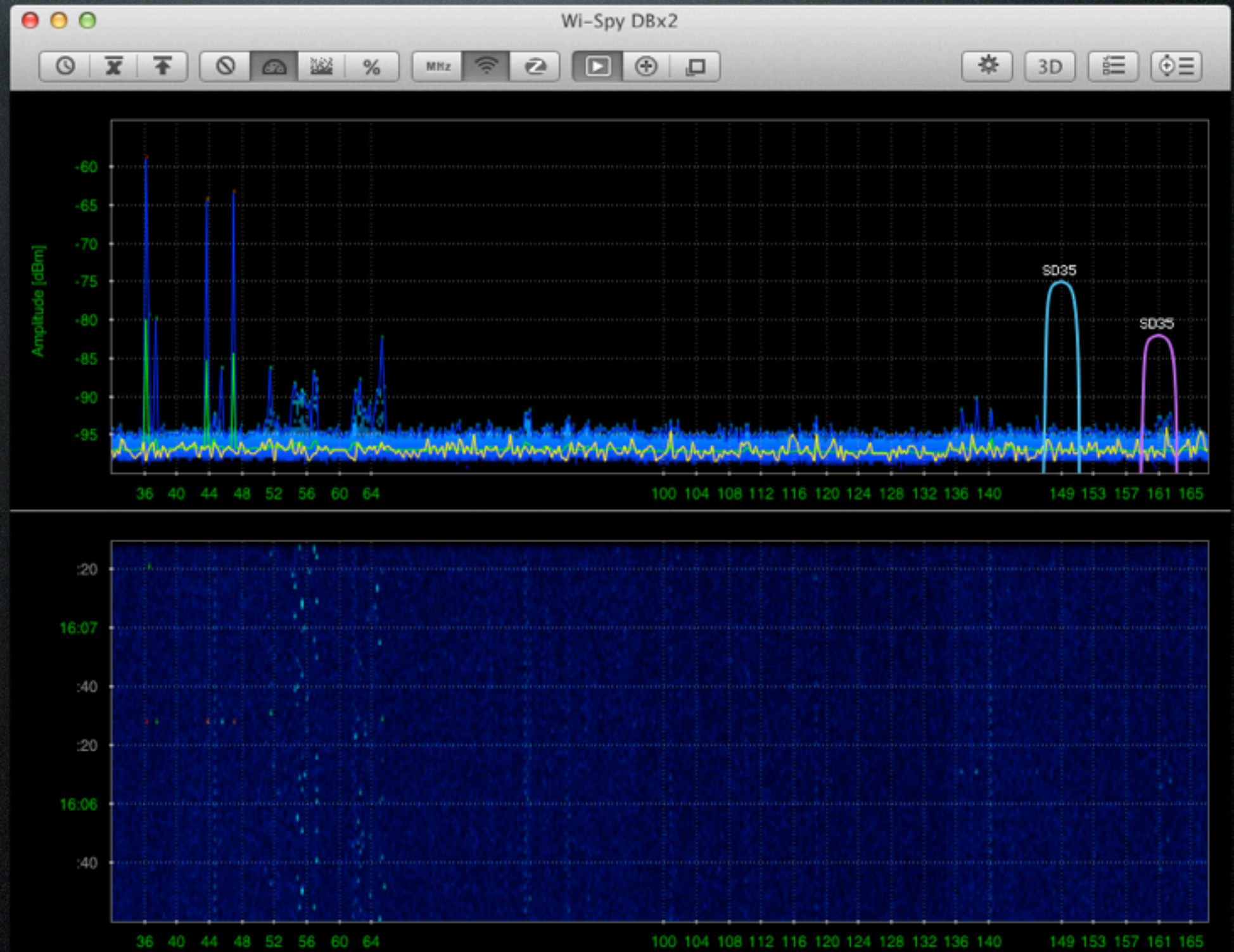
Wireless Repeater

- Extends Range
- Generally not connected to LAN
- Throughput cut in half for each device

RF Level Tools

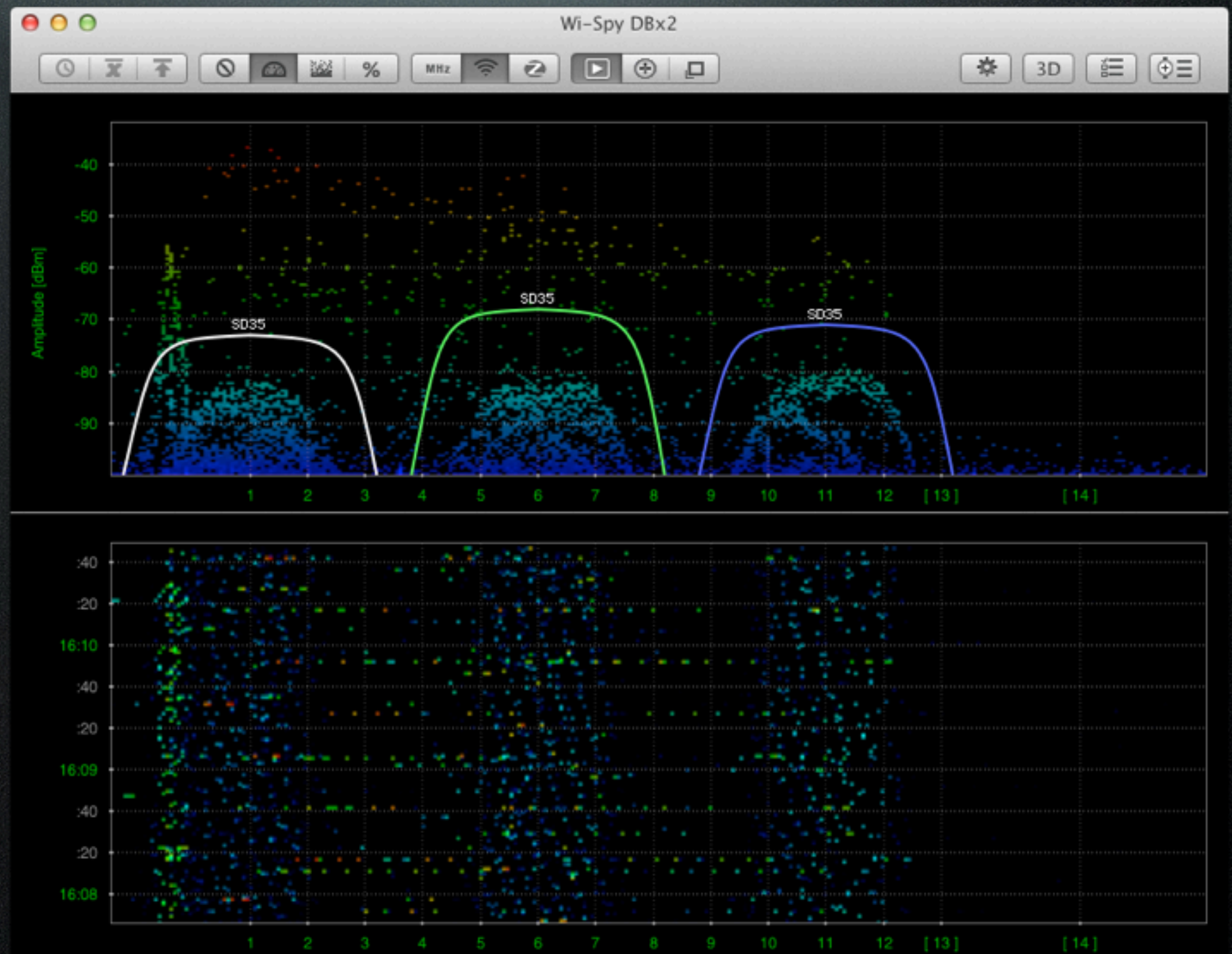
- “Look” at the physical RF landscape.
 - Allows insight into channels, SSIDs, other noise
 - WiSpy
 - NetSpot

WiSpy



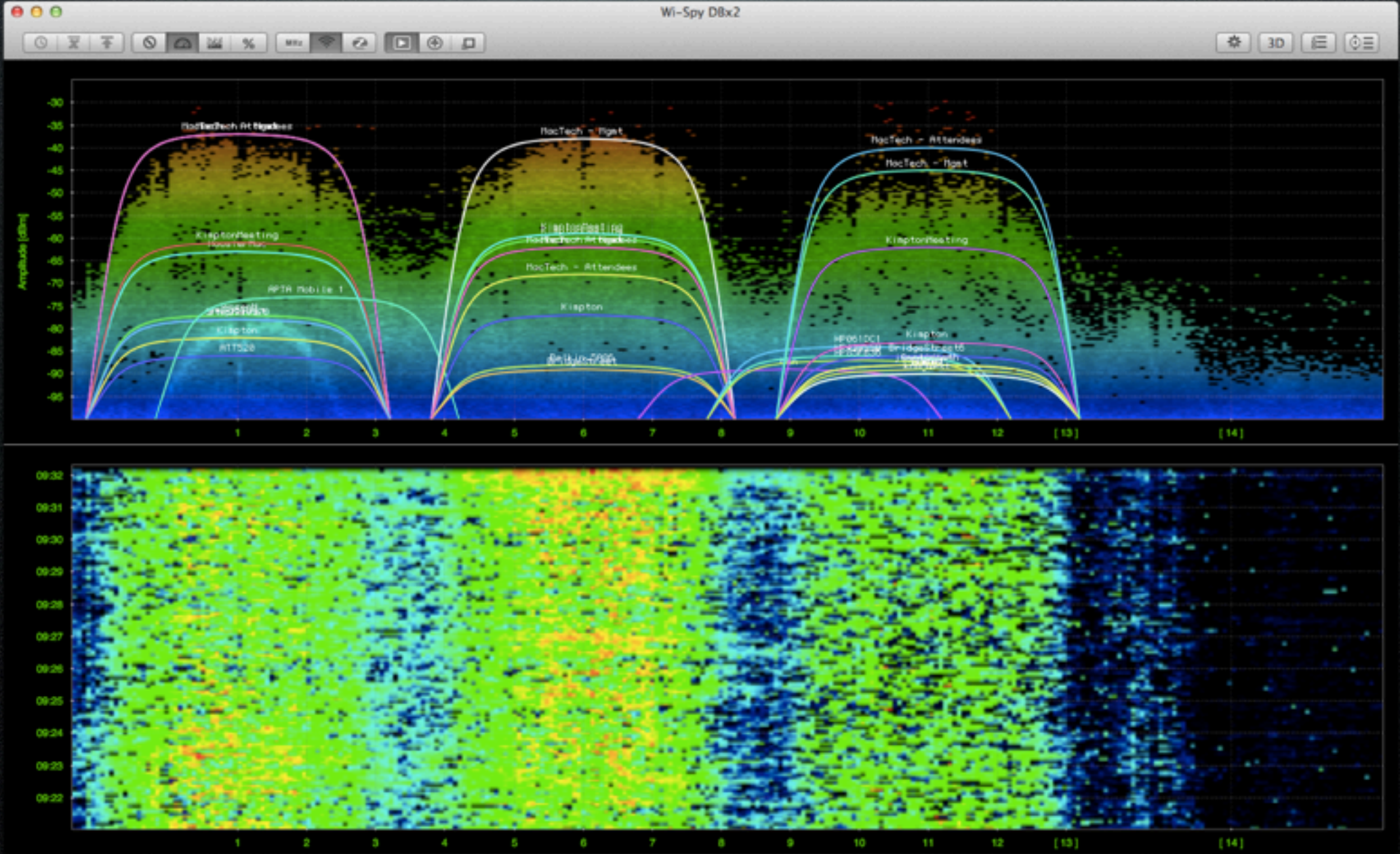
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WiSpy



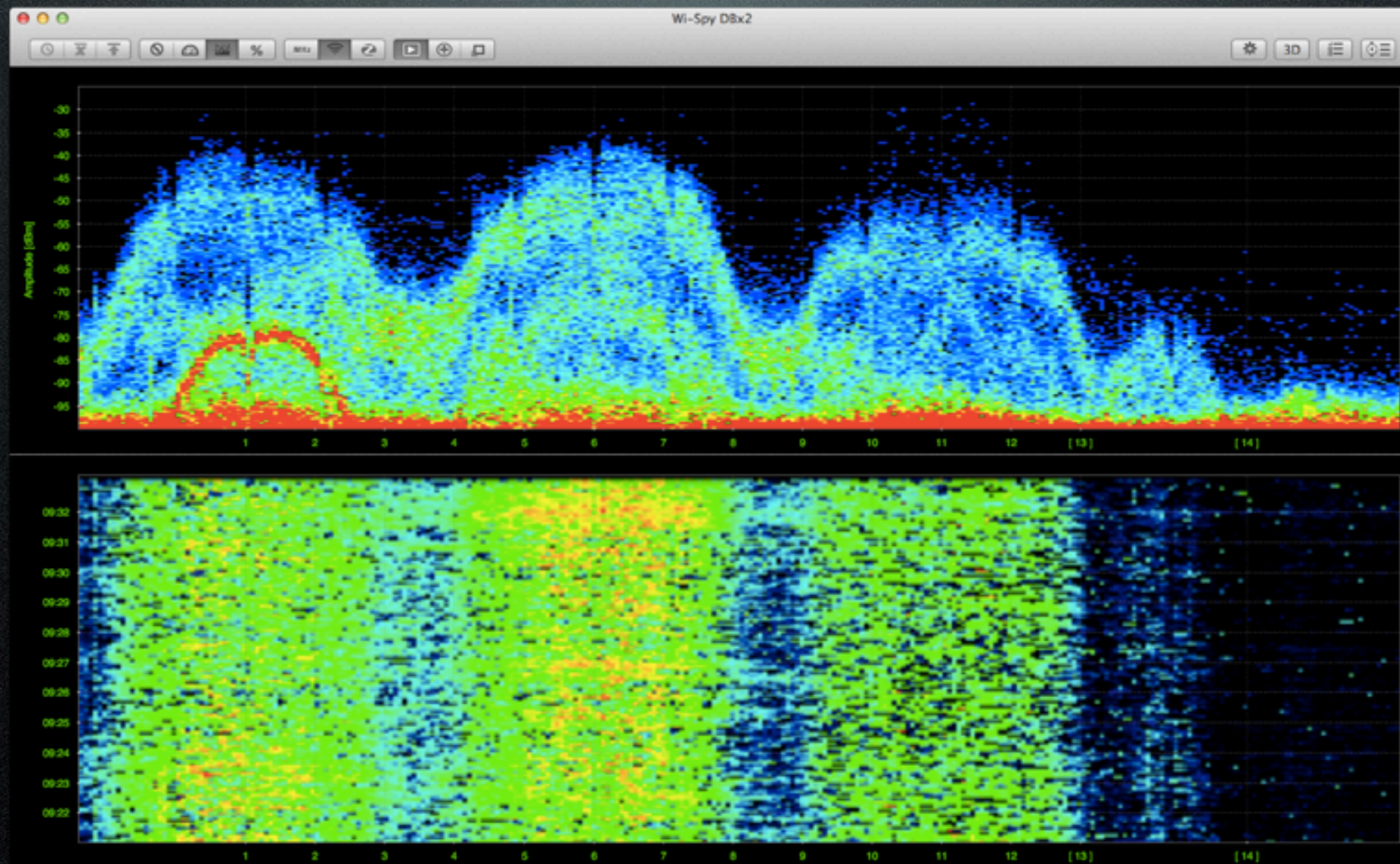
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Live Data - 2.4GHz



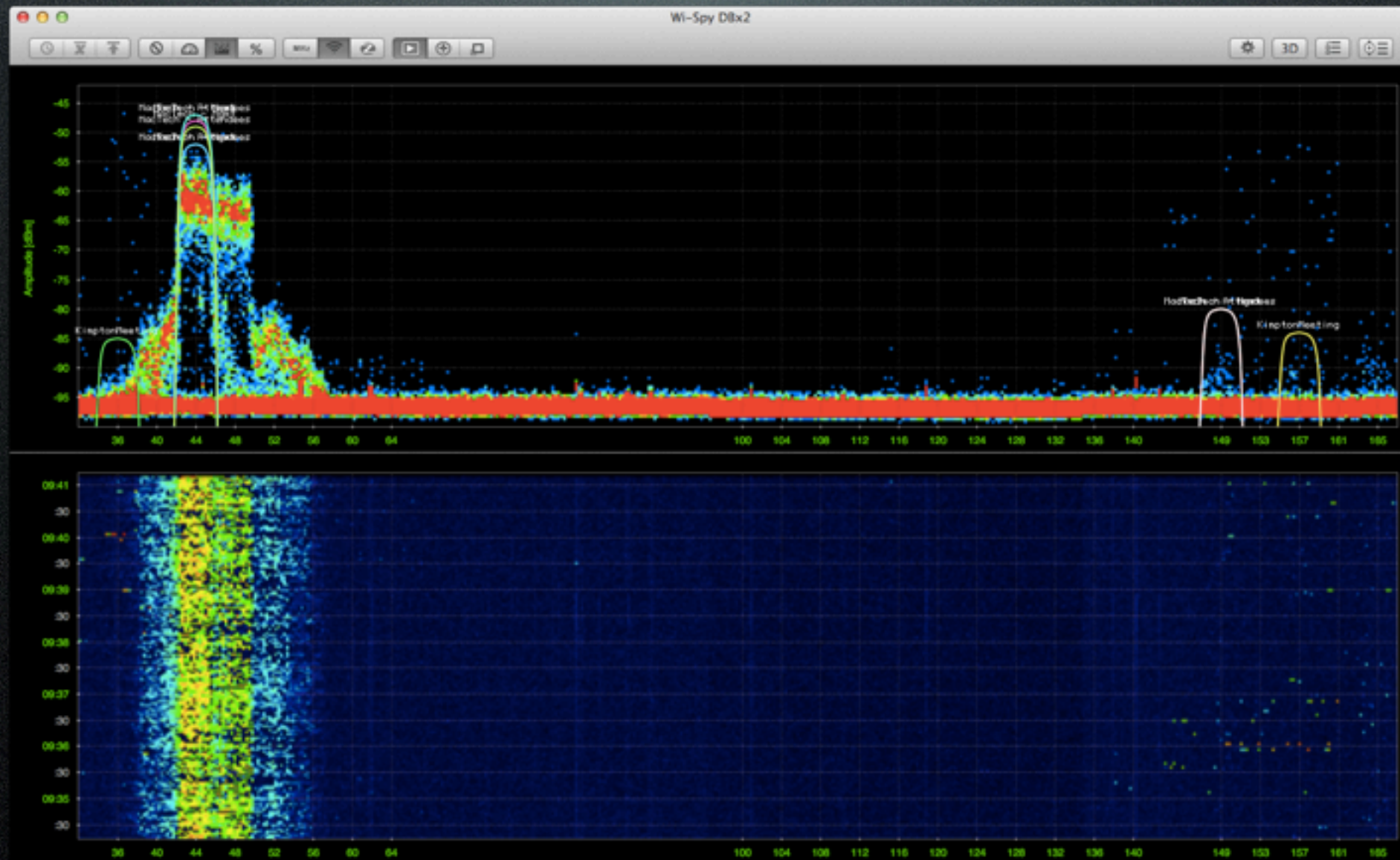
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Live Data - 2.4GHz



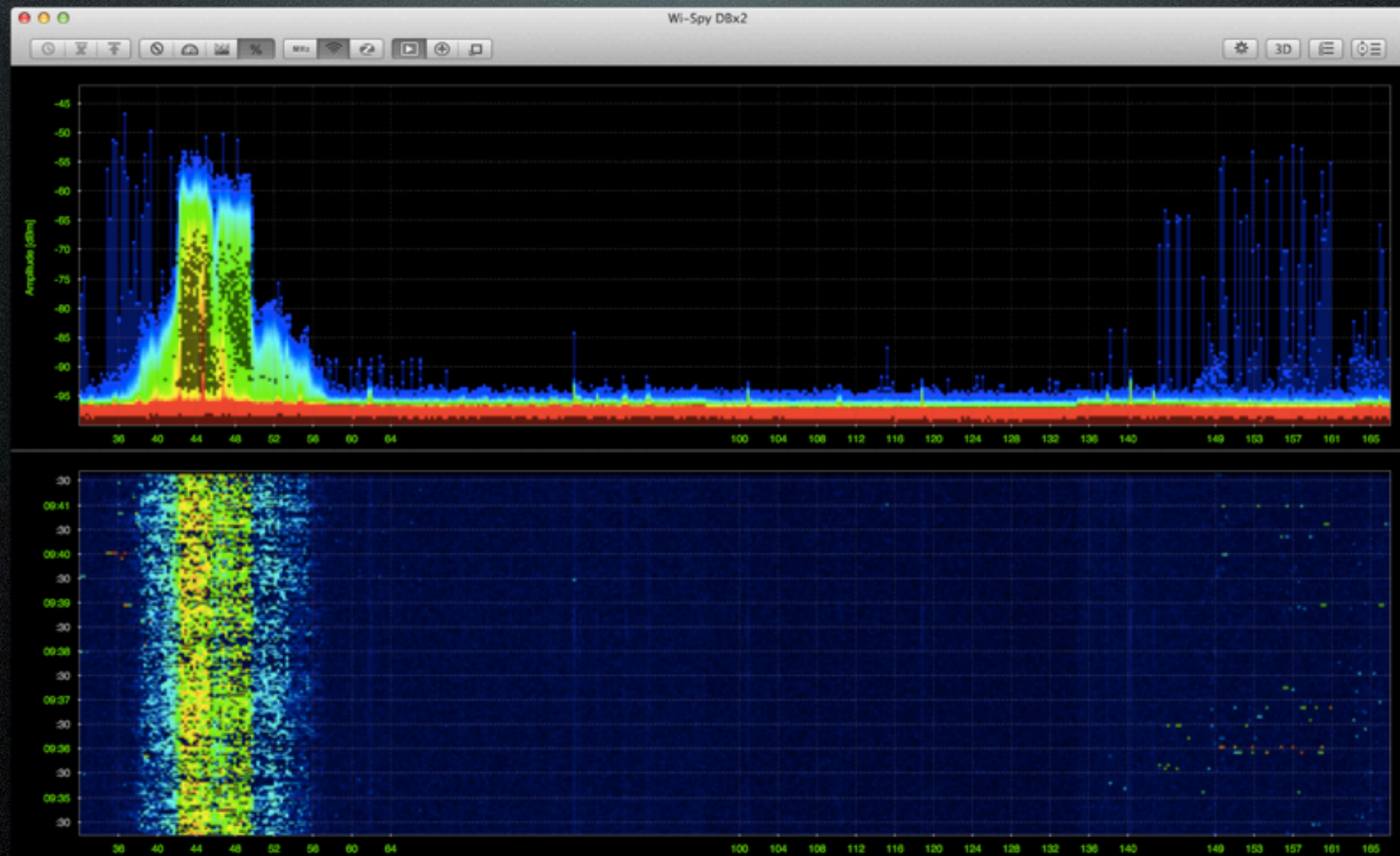
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Live Data - 5GHz



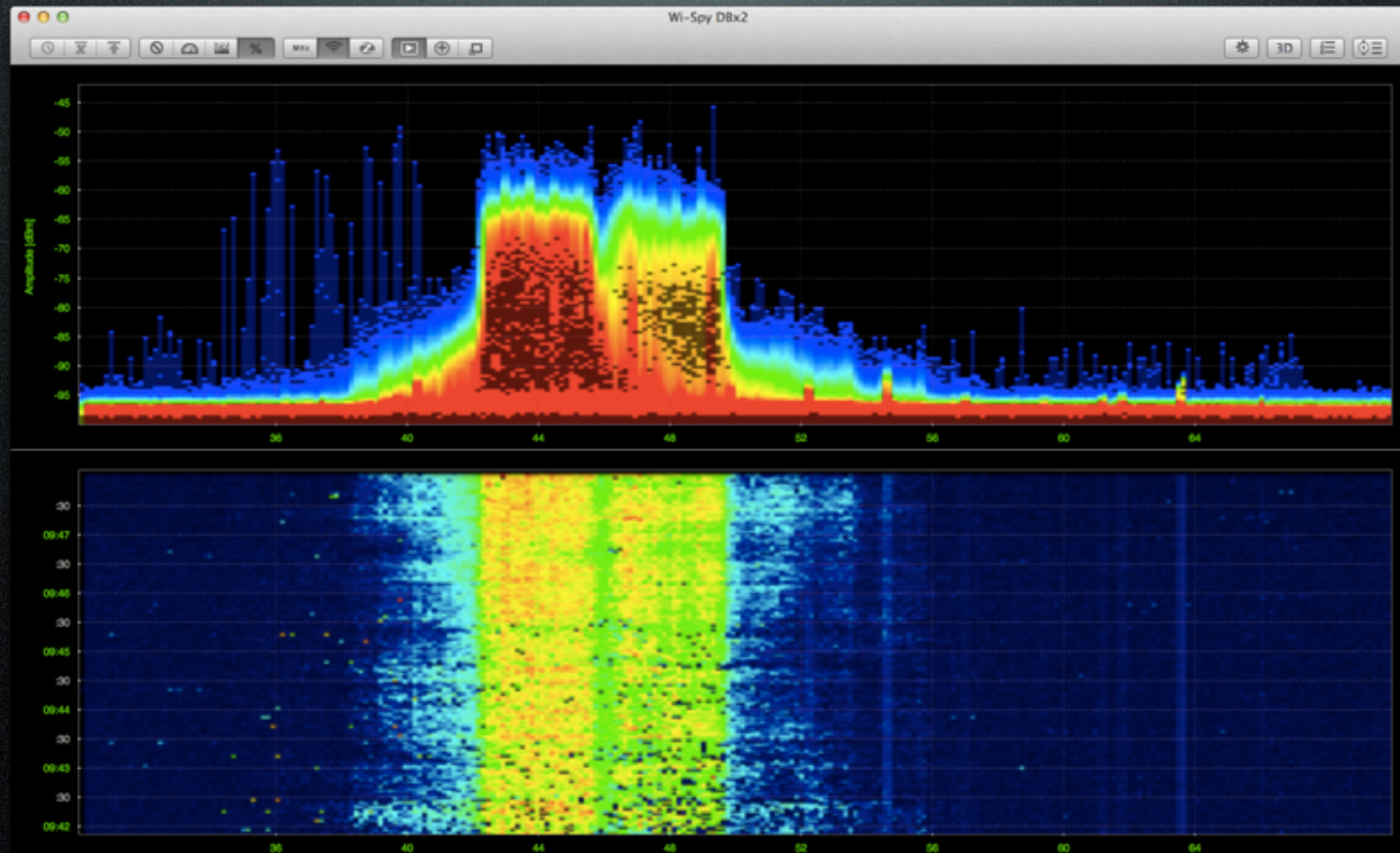
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Live Data - 5GHz



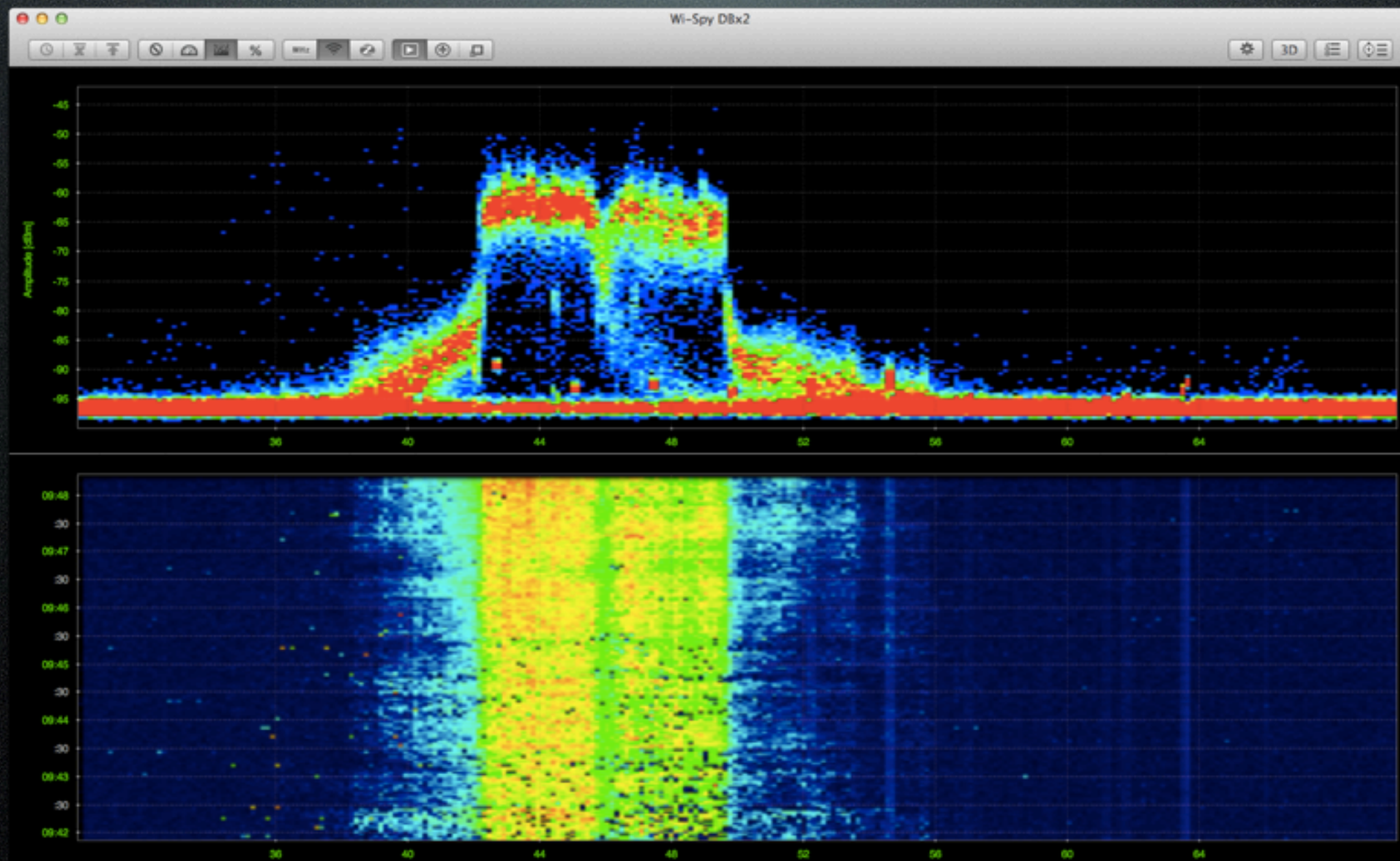
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Live Data - 5GHz



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Live Data - 5GHz



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Network Tools

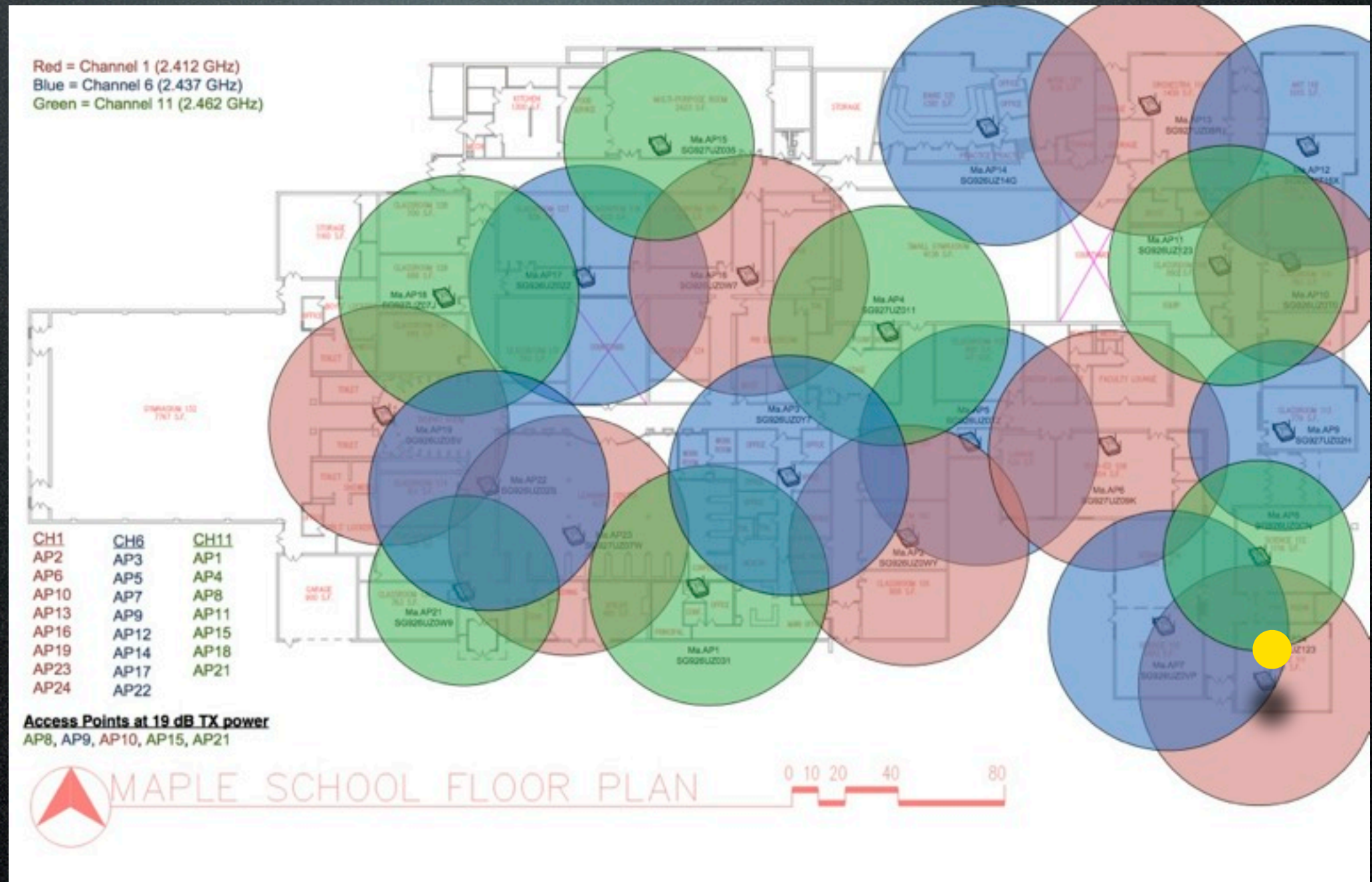
- Monitor networks and strength
 - Kismet
 - Macstumbler
 - AirRadar
 - iStumbler



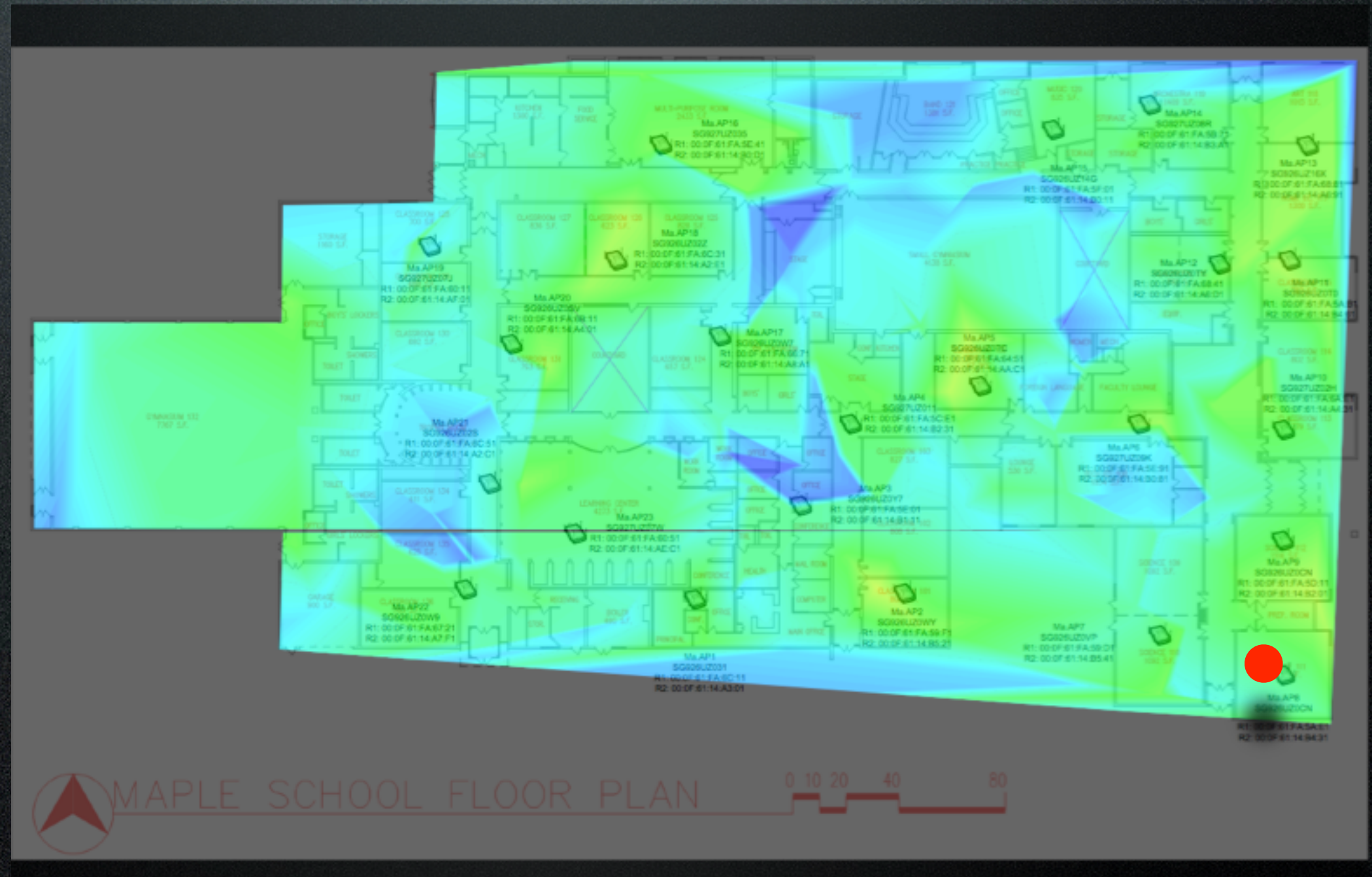
Interference detection

- Best tool - network users
- Sneakernet
- What is running, where (HVAC)

Troubleshooting



Troubleshooting



← worse 0dB 43dB 86dB better →

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Troubleshooting

AP: Ma.AP23 | Wireless clients

?

Number of associated client stations: 60

AP name	Radio	MAC address	IP address	User name	SSID	Security	Duration	Signal	Noise	SNR	Action
Ma.AP23	1	28:CF:DA:0E:A6:19	10.15.13.28	N/A	District ...	Authorized	12d 02:47:35	-53	-95	42	Disassociate
Ma.AP23	1	28:6A:BA:83:F6:B3	10.15.12.92	N/A	District ...	Authorized	2d 01:15:42	-50	-95	45	Disassociate
Ma.AP23	1	28:6A:BA:84:08:8C	10.15.12.47	N/A	District ...	Authorized	2d 01:15:41	-58	-98	40	Disassociate
Ma.AP23	1	28:6A:BA:83:FD:37	10.15.12.39	N/A	District ...	Authorized	2d 01:15:40	-52	-95	43	Disassociate
Ma.AP23	1	28:6A:BA:83:F0:3B	10.15.13.245	N/A	District ...	Authorized	2d 01:15:40	-53	-98	45	Disassociate
Ma.AP23	1	28:6A:BA:83:F0:77	10.15.11.239	N/A	District ...	Authorized	2d 01:15:40	-57	-95	38	Disassociate
Ma.AP23	1	28:6A:BA:7D:20:99	10.15.12.46	N/A	District ...	Authorized	2d 01:15:39	-58	-95	37	Disassociate
Ma.AP23	1	28:6A:BA:7D:16:EE	10.15.12.162	N/A	District ...	Authorized	2d 01:15:34	-57	-95	38	Disassociate
Ma.AP23	1	28:6A:BA:7D:18:38	10.15.11.120	N/A	District ...	Authorized	2d 01:15:34	-51	-95	44	Disassociate
Ma.AP23	1	28:6A:BA:7D:22:2B	10.15.12.18	N/A	District ...	Authorized	2d 01:15:33	-54	-95	41	Disassociate



Troubleshooting

AP: Ma.AP23 | Wireless rates

?

Legacy rate traffic																											
			Receive												Transmit												
AP	Radio	Client MAC	1	2	5.5	11	6	9	12	18	24	36	48	54	1	2	5.5	11	6	9	12	18	24	36	48	54	
Ma.AP23	1	28:CF:DA:0E:A6:19																									
Ma.AP23	1	28:6A:BA:83:F6:B3																									
Ma.AP23	1	28:6A:BA:84:08:8C																									
Ma.AP23	1	28:6A:BA:83:FD:37																									
Ma.AP23	1	28:6A:BA:83:F0:3B																									
Ma.AP23	1	28:6A:BA:83:F0:77																									
Ma.AP23	1	28:6A:BA:7D:20:99																									
Ma.AP23	1	28:6A:BA:7D:16:EE																									



Troubleshooting

Base Group: All | System log

Controlled AP log

Switch Log Direction

Clear Log

Save Log...

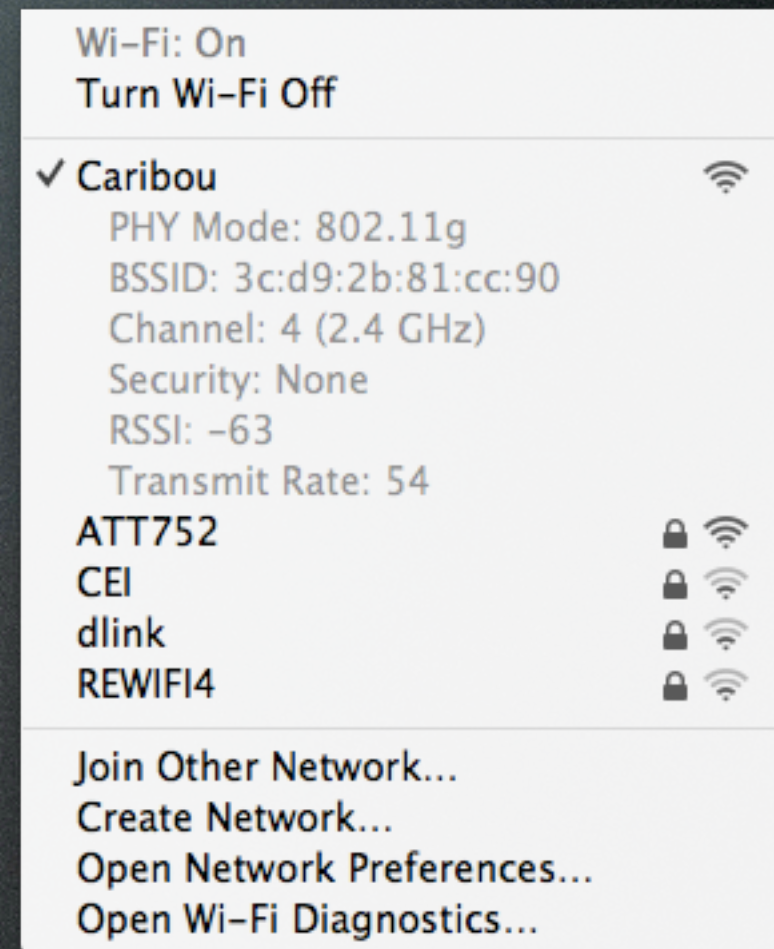
☐ Auto-refresh

Current direction: Latest events at top

LEVEL	PROCESS	MESSAGE
ug	kernel	SG926UZ0W7 wlan0: power already at maximum, cannot increase
ug	kernel	SG926UZ0W7
ning	kernel	SG926UZ0W7 Channel 161:
ning	kernel	SG926UZ0W7 Channel 157: *****
ning	kernel	SG926UZ0W7 Channel 153:
ning	kernel	SG926UZ0W7 Channel 149:
ning	kernel	SG926UZ0W7 Channel 48:
ning	kernel	SG926UZ0W7 Channel 44:
ning	kernel	SG926UZ0W7 Channel 40: *****
ning	kernel	SG926UZ0W7 Channel 36:
ug	kernel	SG926UZ0W7 DisplayChannelCost: === CHANNEL COST FUNCTION ===, RAD
ug	kernel	SG926UZ0W7 AcstimerHandler: ifname=wlan0
ug	kernel	SG926UZ0CN wlan0: power already at minimum, cannot decrease
ug	kernel	SG926UZ0CN
ning	kernel	SG926UZ0CN Channel 161:
ning	kernel	SG926UZ0CN Channel 157:
ning	kernel	SG926UZ0CN Channel 153:
ning	kernel	SG926UZ0CN Channel 149: *****
ning	kernel	SG926UZ0CN Channel 48:

Troubleshooting

- ping
- logs (AP)
- Tests from controller
-> Client
- scope?



Tracking down issues



Slow Data Rates



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Intermittent Connections

- Reliable Ethernet base
- Devices in the area
- NIC
- PC wireless switch

Dealing with Trouble Sources

- Remove trouble device if possible
- Add capacity if possible
- Doesn't HAVE to be wireless
- Repeaters / Mesh networks



Q&A

