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# How to Use Channel Utilization in Wi-Fi (tl;dr Ignore It)

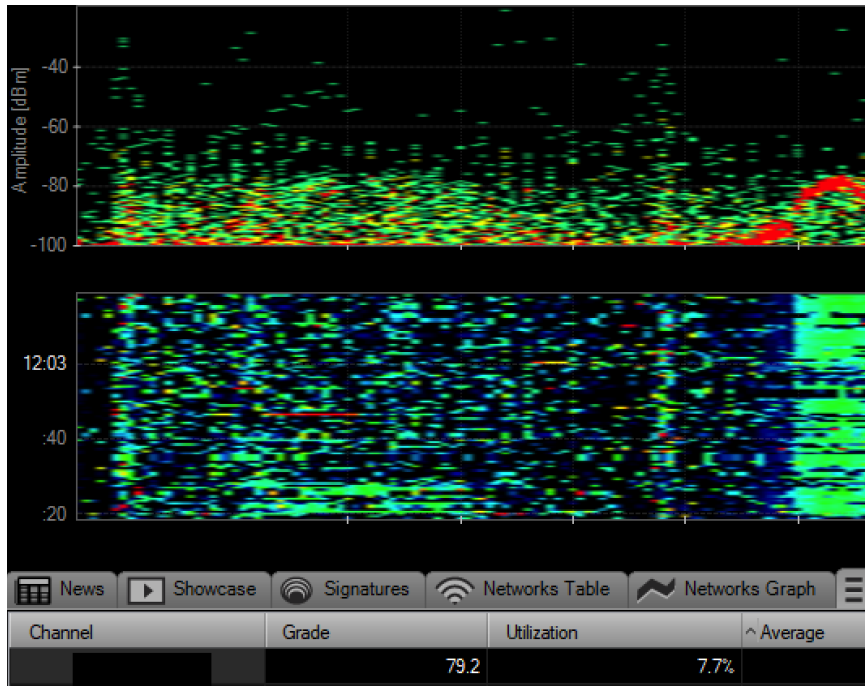
By Ben Miller, CWNE #12, @Ben\_SniffWiFi



# Which Channel Looks Better?

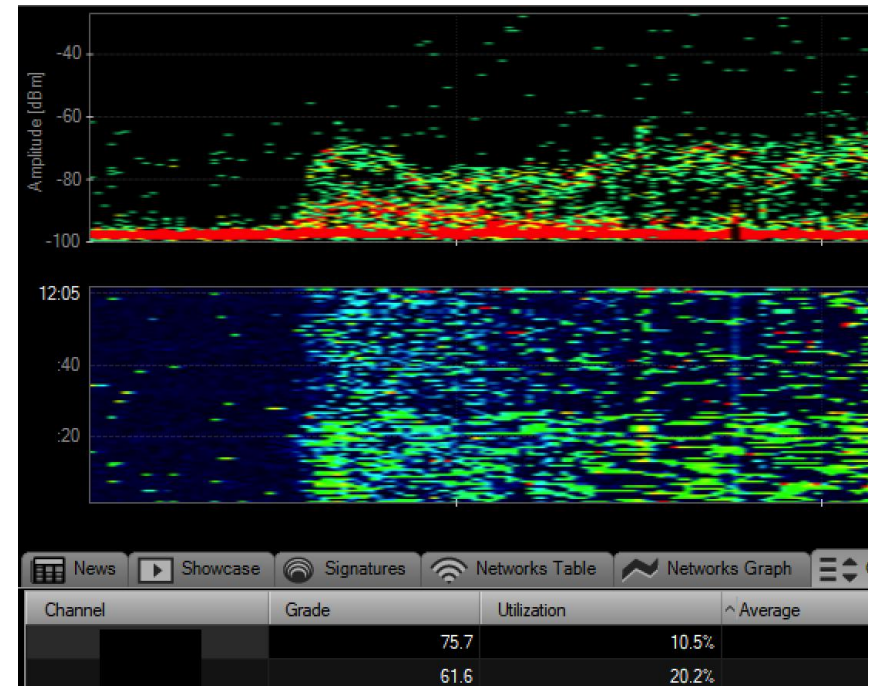
## Channel A:

- 7.7% Utilization
- Clean spectrogram



## Channel B:

- 20.2% Utilization
- Clean spectrogram





# Now Which Channel Looks Better?

## Channel A:

- 0.21 Mbps/1.3 Mbps speed test
- 54 seconds to load LATimes.com

Internet speed test

0.21

Mbps download

1.25

Mbps upload

Server: Los Angeles, CA

**Your Internet speed is very slow**

Your Internet download speed is very slow. Web browsing should work, but videos could load slowly.

[LEARN MORE](#) [TEST AGAIN](#)

## Channel B:

- 88 Mbps/96 Mbps speed test
- LATimes.com loads instantly

Internet speed test

87.8

Mbps download

95.5

Mbps upload

Latency: 12 ms

Server: Los Angeles, CA

**Your Internet speed is very fast**

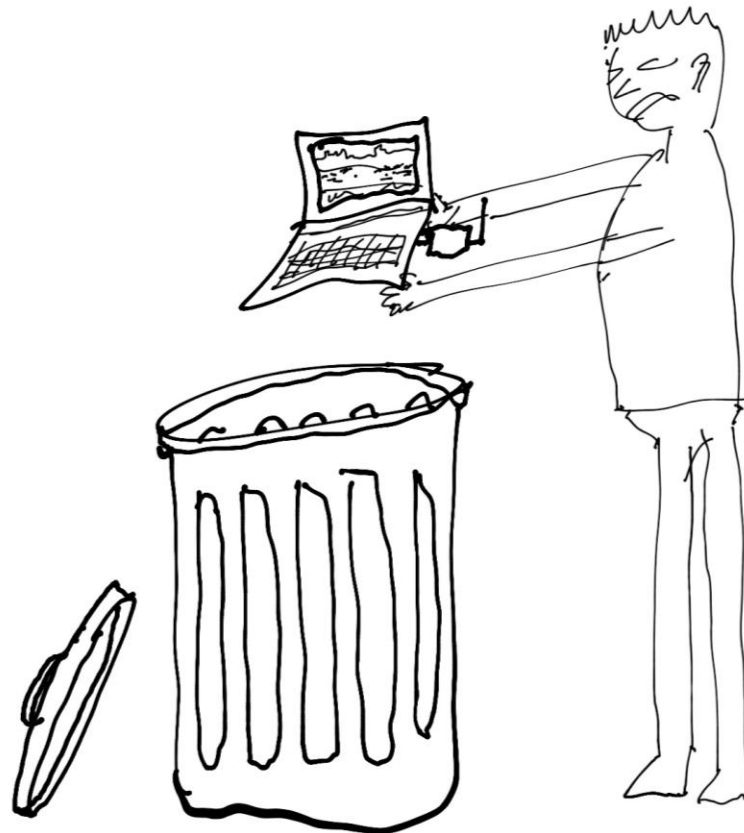
Your Internet connection should be able to handle multiple devices streaming HD videos, video conferencing, and gaming at the same time.

[LEARN MORE](#) [TEST AGAIN](#)



# Why Is This Happening to Me?

Because Channel Utilization  
should be ignored.





# The Case for Channel Utilization

Channel utilization is the percentage of time a channel is used\*.

In Wi-Fi, a channel is a collision domain. Therefore, when a channel is being used by one device, the channel cannot be used\*\* by any other devices.

Therefore therefore, a channel with lower utilization is a better channel, because more channel time is unused, and therefore available... or so the theory goes.

\*Usually a signal threshold (say, -95 dBm) is set to determine what qualifies as channel "use"

\*\*Wi-Fi devices may ATTEMPT to use a channel that's in use, but that usually causes collisions



# Except...

Some channel usage is good, and some usage is bad.



# Good Utilization vs. Bad Utilization

Good Utilization	Bad Utilization
<b>High rate frames</b> -Less channel time used for data	<b>Low rate frames</b> -More channel time used for data
<b>Successful frames</b> -The channel is used for data	<b>Unsuccessful frames</b> -Channel time is wasted

**Channel Utilization readings can not tell the difference.**



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# Other Problems With Channel Utilization

Channel Utilization does NOT show channel availability

- 802.11 CSMA/CA makes it so new devices/data can always use the channel

Channel Utilization is especially deceptive when width is 40/80/160 MHz

- 802.11 management & control traffic uses the primary channel, only



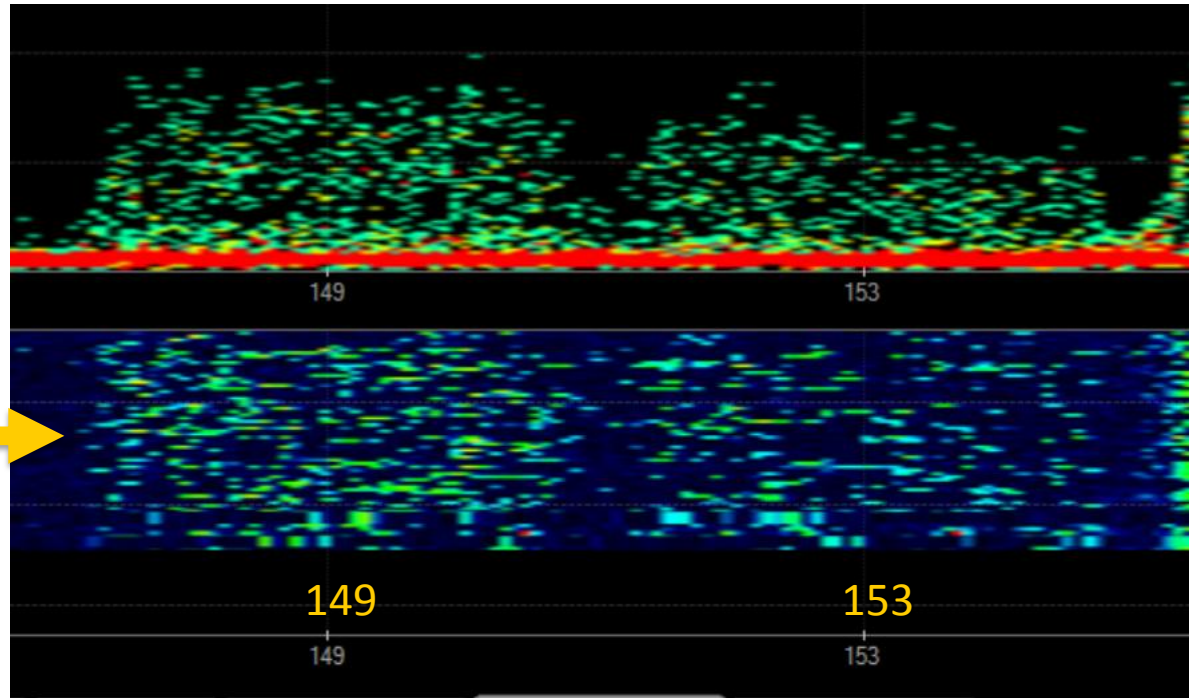
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## Primary vs. Secondary Channel(s)

Channel 153 must be QUIET while Mgmt or Ctrl frames are on Channel 149

Channel 149 has  
"more utilization"



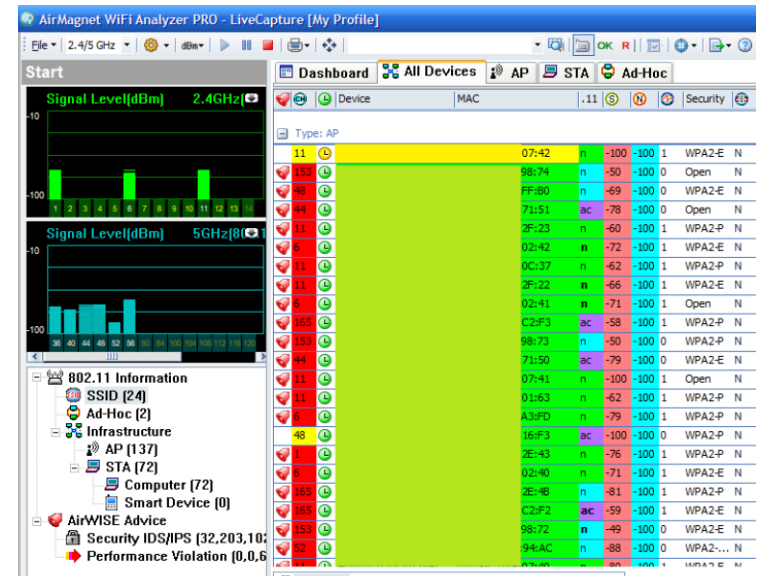


# So, What Should I Use Instead?

## Protocol Analyzers!

No.	Time	Source	Destination	Protocol	Length	Info
14	0.342837	a9:71	Broadcast	802.11	207	Beacon frame, SN=1962, FN=0, Flags=....., BI=100, SSID=
15	0.342847	a9:72	Broadcast	802.11	230	Beacon frame, SN=1961, FN=0, Flags=....., BI=100, SSID=
16	0.342856	1b:86		a9:72 802.11	26	QoS Null function (No data), SN=0, FN=0, Flags=.....T
17	0.342864			1b:86 (... 802.11	10	Acknowledgement, Flags=.....
18	0.344334	a9:72		1b:86 (... 802.11	19	VHT NDP Announcement, Flags=.....
19	0.344353	1b:86		a9:72 802.11	225	Action No Ack, SN=3836, FN=0, Flags=.....
20	0.345348	78:c4		1b:86 802.11	111	QoS Data, SN=423, FN=0, Flags=.p..R.F.
21	0.345368	1b:86		a9:72 (... 802.11	28	802.11 Block Ack, Flags=.....
22	0.394288	1b:86		ee:ff 802.11	90	QoS Data, SN=509, FN=0, Flags=.p.....T
23	0.394319			1b:86 (... 802.11	10	Acknowledgement, Flags=.....
24	0.445191	a9:70	Broadcast	802.11	218	Beacon frame, SN=1964, FN=0, Flags=....., BI=100, SSID=
25	0.445228	a9:71	Broadcast	802.11	207	Beacon frame, SN=1963, FN=0, Flags=....., BI=100, SSID=
26	0.445238	a9:72	Broadcast	802.11	230	Beacon frame, SN=1962, FN=0, Flags=....., BI=100, SSID=
27	0.494062	1b:86		a9:72 802.11	26	QoS Null function (No data), SN=0, FN=0, Flags=...P...T
28	0.494089			1b:86 (... 802.11	10	Acknowledgement, Flags=.....
29	0.548035	a9:70	Broadcast	802.11	218	Beacon frame, SN=1965, FN=0, Flags=....., BI=100, SSID=
30	0.548073	a9:71	Broadcast	802.11	207	Beacon frame, SN=1964, FN=0, Flags=....., BI=100, SSID=
31	0.548082	a9:72	Broadcast	802.11	230	Beacon frame, SN=1963, FN=0, Flags=....., BI=100, SSID=

> Frame 1: 28 bytes on wire (224 bits), 28 bytes captured (224 bits)  
> 802.11 radio information  
> IEEE 802.11 802.11 Block Ack, Flags: .....





# Channel Quality Metrics

## **Amount of Frames/Bytes**

### **Number of associated clients**

- More clients = more potential contention for channel access

### **Retransmissions (retries)**

- Low Retry% means less wasted channel time

### **Data rates**

- High rates means less channel time used, per byte of data

### **Management frames (especially Beacons & Probes)**

- Beacon & Probe activity can be reduced via configuration & design

NOTE: If 6 Mbps is not the minimum basic rate, then you can't analyze anything, due to GHOST FRAMES



# And, Are Spectrum Analyzers Good For Anything?

Yes! Two things:

- 1) Identifying interference sources, either by spectral mask or proximity.
- 2) Locating interference sources, by watching the "Max" level rise.



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**Thank you!**