Wi-Fifor the Home Office It's not just for breakfast anymore.

Tom Bridge, 17 June 2020, Utah Mac Admins Group

Wi-Fi is a fight with physics.



The Inverse Square Law

Intensity of signal radiating from a point source is inversely proportional to the square of the distance from the source.



The playing field is different at home.

Logarithmic scales give us a mental "Easy Button" for a complex mathematical Concept

Rule of Threes and Tens

- -3 dBm of signal means half the raw signal power.
- -10 dBm of signal means one tenth the raw signal power.
- +3 dBm of signal means double the raw signal power.
- +10 dBm of signal means ten times the raw signal power.

Signal Absorption 2.4 GHz

Material **Concrete Wall Brick or Cinder Bloc** Lathe & Plaster Drywall or Glass Pan Wood Paneling

	Signal Absorption
	-15 dB
	-12dB
	-10 dB
e	
	-50B



Signal Absorption 5 GHz

Material **Concrete Wall Brick or Cinder Bloc** Lathe & Plaster Drywall or Glass Pan Wood Paneling



Signal Absorption
-25 dB
-18 dB
-15 dB
-50B



802.11ac Channel Allocation (N America)



*Channels 116 and 132 are Doppler Radar channels that may be used in some cases.



How you position your router matters.





Sharp Corners



-67 dBM V. -75 dBM WLAN Industry Versus macOS Roaming Trigger threshold

It's Caveats All The Way Down



-49 dBm





Distance	RSSI
1 m	-37 dBm
2 m	-43 dBm
4 m	-49 dBm
8 m	-55 dBm
16 m	-61 dBm
32 m	-67 dBm
64 m	-73 dBm
128 m	-79 dBm



5 GHz Cell Edge

-67 dBm

32 m





5 GHz Cell Edge

-67 dBm

32 m



RSSI to distance (5 GHz)











What Roaming Action does the Mac Take at -73 dBM?

-67 DBM VS. -75 DBM

I mean, it's right under the next AP, right?







-67 dBm







									\wedge		
			en0: \$	Scanning Assoc	ciated: attw	ifi, Ch 40, 40 MH:					
Secure 2.4	GHz Bad Channels	Cosmic Thing					94:84:0F:1F:46	50	5 GHZ 80	2.11ac 60	
ID	Signal	✓ Noise	Band	Amendme (Channel	Fast Transition	attwifi				
F:46:50	-74	-98	5 GH	z d/e/h/v	40		Aruba Network	<u>s Inc.</u>			
							Poor Signal Quality 192.168.21 IP Address	.147 hannel(s): 44, 4	40 (40) Channel -74 Signal	405 Mbps -98 Noise	7 ACS Index 24 SNR (dB)
				Network Details	Signal	Strength Spec	ctrum Advanced D	Details			

Strength	Spectrum	Advanced Details	

Best Practices for Home Office Wi-Fi

- RSSI of -65 or better
- Plan for MCS Index of 5 (802.11ac PHY) or 12 (802.11n PHY)
- WPA2 Personal Encryption (AES *only*)
- 5 GHz is better than 2.4 GHz
- Try to avoid wireless extenders
- Don't overpower your radios

Hardware Placement Guidelines Where You Put Your Router Absolutely Matters

- Don't hide your access point in a cabinet
- Don't shove it in a corner
- Prefer mesh-designed systems to extenders
- Powerline Ethernet if possible
- Be wary of your neighbors

There are good (cheap) tools!

Wi-Fi Explorer Lite Free, <u>Mac App Store</u> Upgraded version in <u>Setapp</u>



What's It Good For? **Wi-Fi Explorer Lite**

- Seeing what your Mac sees
- Spotting interfering radios
- Spotting weirdness in the configuration of your Wi-Fi

All 2.4 GHz 5	GHz Open Secu	ıre						Q~ Filter		
BSSID	Network Name		Vendor	Signal	Channel		Channel Width	Band	Mode	Gen
E2:63:DA:2A:2A:EB	Bridge Secure	£	Ubiquiti Networks Inc.	-80 dBm		153	40 MHz	5 GHz	a/n/ac	Wi-F
76:83:C2:93:4B:F4	Bridge Guest		Ubiquiti Networks Inc.	-53 dBm		11	20 MHz	2.4 GHz	b/g/n	Wi-F
B8:F8:53:17:8A:04	D Router	£		-64 dBm		44	80 MHz	5 GHz	a/n/ac/ax	Wi-F
E0:63:DA:5A:2A:EB	Bridge	A	Ubiquiti Networks Inc.	-80 dBm		153	40 MHz	5 GHz	a/n/ac	Wi-F
76:83:C2:93:4B:F5	Bridge Guest		Ubiquiti Networks Inc.	-38 dBm		161	40 MHz	5 GHz	a/n/ac	Wi-F
E2:63:DA:2A:2A:EA	Bridge Secure	£	Ubiquiti Networks Inc.	-74 dBm		6	20 MHz	2.4 GHz	b/g/n	Wi-F
B6:FB:E4:CE:1F:79	Bridge Guest		Ubiquiti Networks Inc.	-72 dBm		44	40 MHz	5 GHz	a/n/ac	Wi-F
B4:FB:E4:CE:1F:79	Bridge	A	Ubiquiti Networks Inc.	-72 dBm		44	40 MHz	5 GHz	a/n/ac	Wi-F
E0:63:DA:5A:2A:EA	Bridge	£	Ubiquiti Networks Inc.	-74 dBm		6	20 MHz	2.4 GHz	b/g/n	Wi-F
C6:FB:E4:CE:1F:79	Bridge Secure	£	Ubiquiti Networks Inc.	-71 dBm		44	40 MHz	5 GHz	a/n/ac	Wi-
74:83:C2:D3:4B:F5	Bridge	£	Ubiquiti Networks Inc.	-38 dBm		161	40 MHz	5 GHz	a/n/ac	Wi-F
76:83:C2:A3:4B:F5	Bridge Secure	A	Ubiquiti Networks Inc.	-38 dBm		161	40 MHz	5 GHz	a/n/ac	Wi-F
E2:63:DA:1A:2A:EB	Bridge Guest		Ubiquiti Networks Inc.	-79 dBm		153	40 MHz	5 GHz	a/n/ac	Wi-F
E2:63:DA:1A:2A:EA	Bridge Guest		Ubiquiti Networks Inc.	-74 dBm		6	20 MHz	2.4 GHz	b/g/n	Wi-F
BC:A5:11:56:FD:90	Bois guest	A	Netgear Inc.	-72 dBm		11	20 MHz	2.4 GHz	b/g/n	Wi-F
B8:F8:53:17:8A:02	D Router	A		-58 dBm		1	20 MHz	2.4 GHz	b/g/n	Wi-F
B6:FB:E4:CE:1F:7A	Bridge Guest		Ubiquiti Networks Inc.	-63 dBm		1	20 MHz	2.4 GHz	b/g/n	Wi-F
	ISM			UNII-1 U	NII-2		UNII-2	2 Ext	UNII-3	



Networks Found: 51, Displayed: 51 (100%)

Wi-Fi Signal \$4.99, <u>Mac App Store</u>



What's It Good For? Wi-Fi Signal

- Situational Awareness for Wi-Fi signal level
- Helpful for spotting where you're roaming or not
- At a glance signal measurement for attenuation

are	Window		Bridge	Secure	3 17	🐳 🗗	%			
	C6:FB:E4:CE:1	F:79		5 GHz 802.11ac 450 Mbps						
	Bridge Secure									
	Ubiquiti Netwo	orks Inc.								
	Poor		4	4 (40)	120) (3			
	Signal Quality		(Channel	Mbps	s MCS	Index			
				-77	-94	1	7			
				<u>Signal</u>	Noise	SNR	(dB)			
							**			

