

关于无线网络的 Data Rate

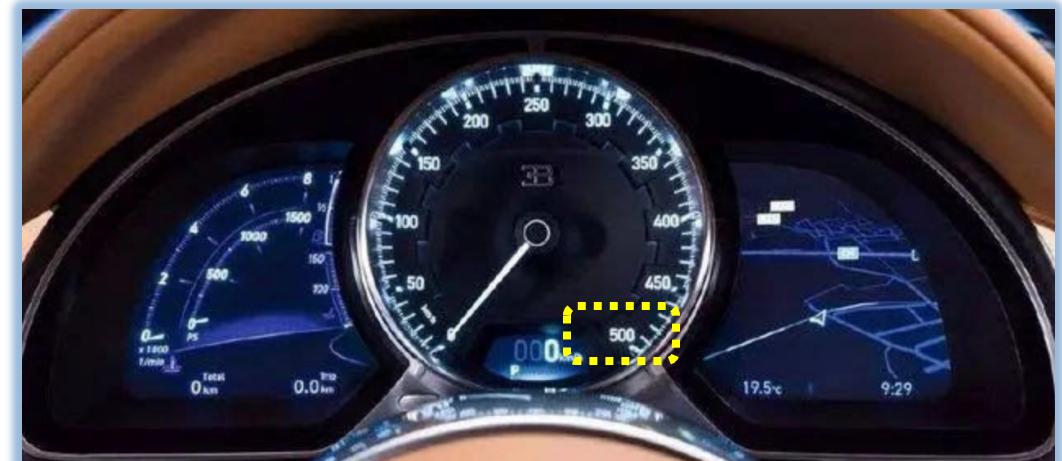
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什么是MCS？

- MCS --- Modulation and Coding Scheme (调制和编码方案)
- MCS 用作确定无线连接的数据速率。



AP 支持最大速率

	AP-50x (BRCM)	AP-51x (BRCM)	AP-53x (QCA)	AP-555 (QCA)
5GHz radio (HE80)	2x2	4x4	4x4	8x8 or dual 4x4 (tri-radio)
5GHz radio (HE160)	N/A	160	80 + 80	80 + 80
2.4GHz radio	2x2	2x2	4x4	4x4
Peak datarates 峰值速率 (2.4GHz, 5GHz)	574Mbps / 1.2Gbps	574Mbps / 4.8Gbps	1.15Gbps / 2.4Gbps	1.15Gbps / 4.8Gbps
Peak datarates 峰值速率 (HE20 2.4GHz, HE80 5GHz)	287Mbps / 1.2Gbps	287Mbps / 2.4Gbps	574Mbps / 2.4Gbps	574Mbps / 4.8Gbps

	AP-303 (QCA)	AP-305 (QCA)	AP-315 (QCA)	AP-325 (QCA)	AP-335 (QCA)	AP-345 (BRCM)
5GHz radio (VHT160)	No	No	2x2	No	2x2	2x2
5GHz radio (VHT80)	2x2	3x3	4x4	4x4	4x4	4x4
2.4GHz radio (HT40)	2x2	2x2	2x2	4x4	4x4	4x4
MU-MIMO	2SS	2SS	3SS	3SS	4SS	4SS
Peak datarates 峰值速率 (2.4GHz / 5GHz)	300 / 867 Mbps	300 / 1300 Mbps	300 / 1,733 Mbps	600 / 1,733 Mbps	600 / 1,733 Mbps	600 / 1,733 Mbps

终端协商速率

```
(Aruba7010) *[mynode] #show ap association ap-name AP-325 | include 5e:0b,5f:0b,2d:eb
AP-325 ac:a3:1e:57:94:d1 a4:83:e7:b2:5e:0b y y 1 10 mo 99 0x1000b a-VHT-80sgi-3ss 1d:5h:59m:47s 1 WAB 101/4
AP-325 ac:a3:1e:57:94:d0 e2:98:c1:e5:5f:0b y y 2 20 Momo 88 0x10009 a-VHT-80sgi-2ss 21m:14s 1 WVAB 121/78
AP-325 ac:a3:1e:57:94:d0 76:b0:42:2f:2d:eb y y 3 10 Momo 88 0x10009 a-VHT-80sgi-2ss 2h:45m:9s 1 WVMAB 10/7
a-VHT-80sgi-3ss
a-HE-80-2ss-V
a-HE-160-2ss-VM
```



```
(Aruba7010) *[mynode] #show ap debug client-table ap-name AP-325 | include e2:98:c1:e5:5f:0b
e2:98:c1:e5:5f:0b Momo ac:a3:1e:57:94:d0 Associated cAWvSsE 0x2 Power-save (0,0,0,0,N/A,0) (0,0) 851 1356 0 117 433 702 35 39 2[0x3] Sun Jul 4 17:09:14 2021
1 Sun Jul 4 17:09:14 2021 (0,0) 0 88/46
```

“Data Rate” vs “MCS Index”

* MCS table 请参考: <http://mcsindex.com/>

MCS Index			Spatial Stream	Modulation	Coding	OFDM (Prior 11ax)							
HT	VHT	HE				20MHz		40MHz		80MHz		160MHz	
						0.8μs GI	0.4μs GI	0.8μs GI	0.4μs GI	0.8μs GI	0.4μs GI	0.8μs GI	0.4μs GI
8	0	0	1	1024-QAM	5/6								
9	1	1	2	QPSK	1/2	13.00	14.40	27.00	30.00	58.50	65.00	117.00	130.00
10	2	2	2	QPSK	3/4	26.00	28.90	54.00	60.00	117.00	130.00	234.00	260.00
11	3	3	2	16-QAM	1/2	39.00	43.30	81.00	90.00	175.50	195.00	351.00	390.00
12	4	4	2	16-QAM	3/4	52.00	57.80	108.00	120.00	234.00	260.00	468.00	520.00
13	5	5	2	64-QAM	2/3	78.00	86.70	162.00	180.00	351.00	390.00	702.00	780.00
14	6	6	2	64-QAM	3/4	104.00	115.60	216.00	240.00	468.00	520.00	936.00	1040.00
15	7		2	64-QAM	5/6	117.00	130.00	243.00	270.00	526.50	585.00	1053.00	1170.00
	8	8	2	256-QAM	3/4	130.00	144.40	270.00	300.00	585.00	650.00	1170.00	1300.00
	9	9	2	256-QAM	5/6	156.00	173.30	324.00	360.00	702.00	780.00	1404.00	1560.00
	10		2	1024-QAM	3/4	N/A	N/A	360.00	400.00	780.00	866.70	1560.00	1733.30
	11		2	1024-QAM	5/6								
16	0	0	3	BPSK	1/2	19.50	21.70	40.50	45.00	87.80	97.50	175.50	195.00
17	1	1	3	QPSK	1/2	39.00	43.30	81.00	90.00	175.50	195.00	351.00	390.00
18	2	2	3	QPSK	3/4	58.50	65.00	121.50	135.00	263.30	292.50	526.50	585.00
19	3	3	3	16-QAM	1/2	78.00	86.70	162.00	180.00	351.00	390.00	702.00	780.00
20	4		3	16-QAM	3/4	117.00	130.00	243.00	270.00	526.50	585.00	1053.00	1170.00
21	5	5	3	64-QAM	2/3	156.00	173.30	324.00	360.00	702.00	780.00	1404.00	1560.00
22	6	6	3	64-QAM	3/4	175.50	195.00	364.50	405.00	N/A	N/A	1579.50	1755.00
23	7	7	3	64-QAM	5/6	195.00	216.70	405.00	450.00	877.50	975.00	1755.00	1950.00
	8	8	3	256-QAM	3/4	234.00	260.00	486.00	540.00	1053.00	1170.00	2106.00	2340.00
	9	9	3	256-QAM	5/6	260.00	288.90	540.00	600.00	1170.00	1300.00	N/A	N/A
	10		3	1024-QAM	3/4								
	11		3	1024-QAM	5/6								

终端	支持协议	天线	MCS rate	MCS Index	Modulation	Guard Interval
Macbook Pro	Wi-Fi5	3	780Mbps	5	64-QAM	0.4 μs GI
iPhone12 Pro Max	Wi-Fi6	2	702Mbps	8	256-QAM	0.8 μs GI
三星S21 Ultra	Wi-Fi6E	2	780Mbps	8	256-QAM	0.4 μs GI

Apple iPhone Maximum PHY data rate

Wi-Fi specifications for iPhone 11 and iPhone 12

The table below details the Wi-Fi specifications for the iPhone 11 and iPhone 12 models listed in the above table.

802.11 standard, name, frequency	Maximum PHY data rate	Maximum channel bandwidth	Maximum MCS index	Maximum spatial streams
ax@5 GHz	1200 Mbps	80 MHz	11 (HE)	2/MIMO
ac@5 GHz	866 Mbps	80 MHz	9 (VHT)	2/MIMO
a/n@5 GHz	300 Mbps	40 MHz	7 (HT)	2/MIMO
ax@2.4 GHz	195 Mbps	20 MHz	9 (HE)	2/MIMO
b/g/n@2.4 GHz	144 Mbps	20 MHz	7 (HT)	2/MIMO

Wi-Fi specifications for iPhone X

The table below details the Wi-Fi specifications for all iPhone X models: iPhone X, iPhone XR, iPhone XS, and iPhone XS Max.

802.11 standard, name, frequency	Maximum PHY data rate	Maximum channel bandwidth	Maximum MCS index	Maximum spatial streams
ac@5 GHz	866 Mbps	80 MHz	9 (VHT)	2/MIMO
a/n@5 GHz	300 Mbps	40 MHz	7 (HT)	2/MIMO
b/g/n@2.4 GHz	144 Mbps	20 MHz	7 (HT)	2/MIMO

MCS Index					Spatial Stream	Modulation	Coding	OFDM (Prior 11ax)								OFDM (802.11ax)											
HT	VHT	HE						20MHz	40MHz	80MHz	160MHz	20MHz	40MHz	80MHz	160MHz	20MHz	40MHz	80MHz	160MHz	20MHz	40MHz	80MHz	160MHz				
								0.8µs GI	0.4µs GI	0.8µs GI	0.4µs GI	0.8µs GI	0.4µs GI	0.8µs GI	1.6µs GI	3.2µs GI	0.8µs GI	1.6µs GI	3.2µs GI	0.8µs GI	1.6µs GI	3.2µs GI	0.8µs GI				
8	0	0	2	BPSK	1/2	13.00	14.40	27.00	30.00	58.50	65.00	117.00	130.00	17.20	16.30	14.60	34.40	32.50	29.30	72.10	68.10	61.30	144.10	136.10	122.50		
9	1	1	2	QPSK	1/2	26.00	28.90	54.00	60.00	117.00	130.00	234.00	260.00	34.40	32.50	29.30	68.80	65.00	58.50	144.10	136.10	122.50	288.20	272.20	245.00		
10	2	2	2	QPSK	3/4	39.00	43.30	81.00	90.00	175.50	195.00	351.00	390.00	51.60	48.80	43.90	103.20	97.50	87.80	216.20	204.20	183.80	432.40	408.30	367.50		
11	3	3	2	16-QAM	1/2	52.00	57.80	108.00	120.00	234.00	260.00	468.00	520.00	68.80	65.00	58.50	137.60	130.00	117.00	288.20	272.20	245.00	576.50	544.40	490.00		
12	4	4	2	16-QAM	3/4	78.00	86.70	162.00	180.00	351.00	390.00	702.00	780.00	103.20	97.50	87.80	206.50	195.00	175.50	432.40	408.30	367.50	864.70	816.70	735.00		
13	5	5	2	64-QAM	2/3	104.00	115.60	216.00	240.00	468.00	520.00	936.00	1040.00	137.60	130.00	117.00	275.30	260.00	234.00	576.50	544.40	490.00	1152.90	1088.90	980.00		
14	6	6	2	64-QAM	3/4	117.00	130.00	243.00	270.00	526.50	585.00	1053.00	1170.00	154.90	146.30	131.60	309.70	292.50	263.30	648.50	612.50	551.30	1297.10	1225.00	1102.50		
15	7	7	2	64-QAM	5/6	130.00	144.40	270.00	300.00	585.00	650.00	1170.00	1300.00	172.10	162.50	146.30	344.10	325.00	292.50	720.60	680.60	612.50	1441.20	1361.10	1225.00		
	8	8	2	256-QAM	3/4	156.00	173.30	324.00	360.00	702.00	780.00	1404.00	1560.00	206.50	195.00	175.50	412.90	390.00	351.00	864.70	816.70	735.00	1729.40	1633.30	1470.00		
	9	9	2	256-QAM	5/6	N/A	N/A	360.00	400.00	780.00	866.70	1560.00	1733.30	229.40	216.70	195.00	458.80	433.30	390.00	960.80	907.40	816.70	1921.60	1814.80	1633.30		
		10	2	1024-QAM	3/4											258.10	243.80	219.40	516.20	487.50	438.80	1080.90	1020.80	918.80	2161.80	2041.70	1837.50
		11	2	1024-QAM	5/6											286.80	270.80	243.80	573.50	541.70	487.50	1201.00	1134.30	1020.80	2402.00	2268.50	2041.70

Apple MacBook Pro Maximum PHY data rate

Wi-Fi specification details for Mac Book Pro computers with Apple silicon

- 13-inch, M1, 2020

802.11 standard, name, frequency	Maximum PHY data rate	Maximum channel bandwidth	Maximum MCS index	Maximum spatial streams
ax@5 GHz	1200 Mbps	80 MHz	11 (HE)	2/MIMO
ac@5 GHz	866 Mbps	80 MHz	9 (VHT)	2/MIMO
a/n@5 GHz	300 Mbps	40 MHz	15 (HT)	2/MIMO
ax@2.4 GHz	195 Mbps	20 MHz	9 (HE)	2/MIMO
b/g/n@2.4 GHz	144 Mbps	20 MHz	15 (HT)	2/MIMO

Wi-Fi specification details for Intel-based MacBook Pro computers (2020)

- 13-inch, 2020, Two Thunderbolt 3 ports
- 13-inch, 2020, Four Thunderbolt 3 ports

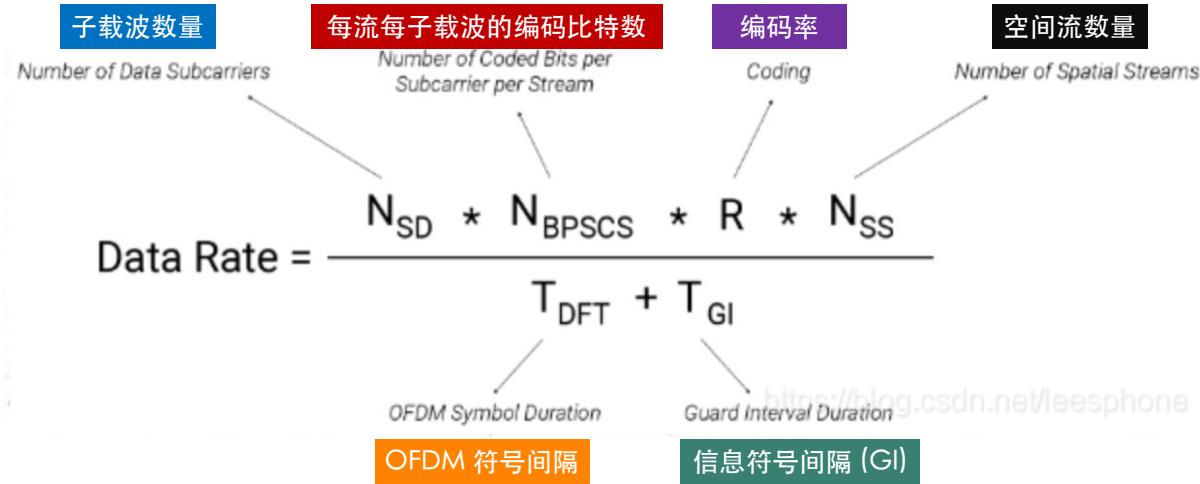
802.11 standard, name, frequency	Maximum PHY data rate	Maximum channel bandwidth	Maximum MCS index	Maximum spatial streams
ac@5 GHz	866 Mbps	80 MHz	9 (VHT)	2/MIMO
a/n@5 GHz	300 Mbps	40 MHz	15 (HT)	2/MIMO
b/g/n@2.4 GHz	144 Mbps	20 MHz	15 (HT)	2/MIMO

Wi-Fi specification details for Intel-based MacBook Pro models from 2017-2019

802.11 standard, name, frequency	Maximum PHY data rate	Maximum channel bandwidth	Maximum MCS index	Maximum spatial streams
ac@5 GHz	1300 Mbps	80 MHz	9 (VHT)	3/MIMO
a/n@5 GHz	450 Mbps	40 MHz	23 (HT)	3/MIMO
b/g/n@2.4 GHz	217 Mbps	20 MHz	23 (HT)	3/MIMO

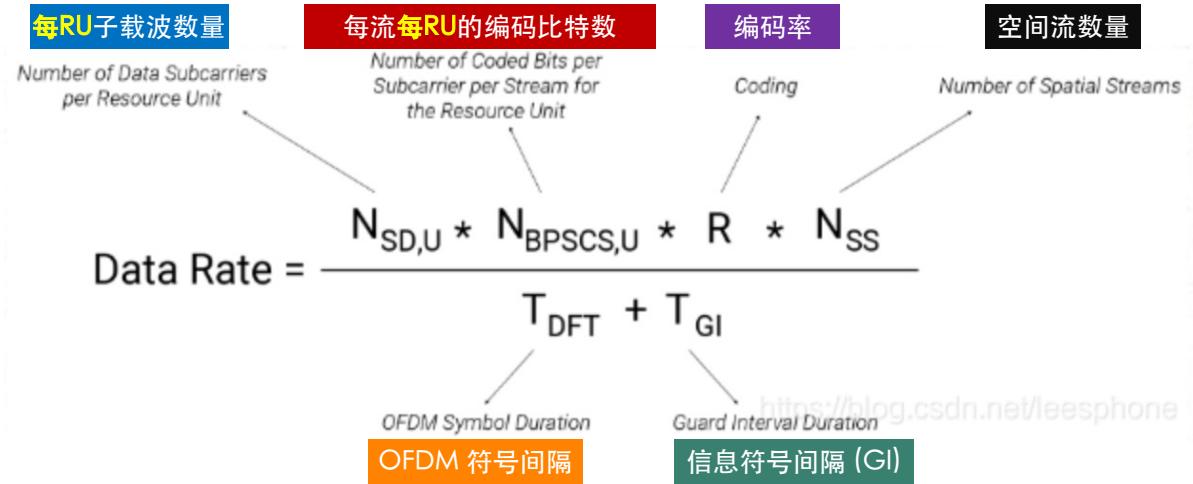
Data Rate 如何计算 (与什么有关系?)

802.11n, 802.11ac



PHY	Modulation		R	N _{ss}	N _{SD}				T _{DFT}	T _{GI}	
	Name	N _{BPSCS}			20MHz	40MHz	80MHz	160MHz		Long	Short
	802.11n (HT)	BPSK	1	1/2							
802.11ac (VHT)	QPSK	2	1/2 & 3/4	1 to 4							
	16-QAM	4	1/2 & 3/4								
	64-QAM	6	1/2 & 2/3 & 3/4								
	256-QAM	8	2/3 & 5/6								
HT and VHT OFDM Parameters											

802.11ax



PHY	Modulation		R	N _{ss}	N _{SD}				T _{DFT}	T _{GI}		
	Name	N _{BPSCS}			R		N _{ss}	N _{SD}				Long
	802.11ax (HE)	BPSK	1		1/2			20MHz	40MHz	80MHz	160MHz	12.8 μs
802.11ax (HE)	QPSK	2	1/2 & 3/4	1 to 8	1/2 & 3/4			234	468	980	1960	0.8 μs
	16-QAM	4	1/2 & 3/4		1/2 & 3/4							1.2 μs
	64-QAM	6	1/2 & 2/3 & 3/4		1/2 & 2/3 & 3/4							3.2 μs
	256-QAM	8	2/3 & 5/6		2/3 & 5/6							
	1024-QAM	10	3/4 & 5/6		3/4 & 5/6							

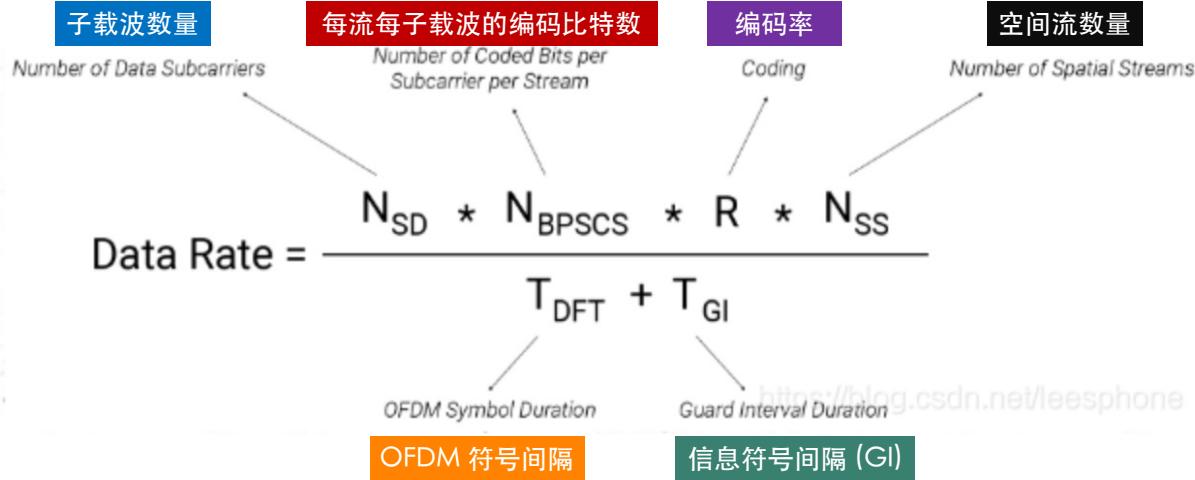
PHY	Modulation		R	N _{ss}	N _{SD}					T _{DFT}	T _{GI}			
	Name	N _{BPSCS}			R		N _{ss}	26-tone	52-tone	106-tone	242-tone	484-tone	996-tone	Long
	802.11ax (HE)	BPSK	1		1/2									12.8 μs
802.11ax (HE)	QPSK	2	1/2 & 3/4	1 to 8	1/2 & 3/4			24	48	102	234	468	980	0.8 μs
	16-QAM	4	1/2 & 3/4		1/2 & 3/4									1.2 μs
	64-QAM	6	1/2 & 2/3 & 3/4		1/2 & 2/3 & 3/4									3.2 μs
	256-QAM	8	2/3 & 5/6		2/3 & 5/6									
	1024-QAM	10	3/4 & 5/6		3/4 & 5/6									

HT and VHT OFDM Parameters

https://blog.csdn.net/leesphone

Data Rate 举例说明

802.11n, 802.11ac



PHY	Modulation		R	N _{ss}	N _{SD}				T _{DFT}	T _{GI}	
	Name	N _{BPSCS}			20MHz	40MHz	80MHz	160MHz		Long	Short
802.11n (HT)	BPSK	1	1/2	1 to 4					3.2 μs		
	QPSK	2	1/2 & 3/4							0.8 μs	
	16-QAM	4	1/2 & 3/4								0.4 μs
	64-QAM	6	1/2 & 2/3 & 3/4								
802.11ac (VHT)	BPSK	1	1/2	1 to 8	52	108	234	468	3.2 μs		
	QPSK	2	1/2 & 3/4							0.8 μs	
	16-QAM	4	1/2 & 3/4								0.4 μs
	64-QAM	6	1/2 & 2/3 & 3/4								
	256-QAM	8	2/3 & 5/6								

HT and VHT OFDM Parameters

Aruba AP-325



Samsung S21 Ultra



Wi-Fi6E, 2x2

$$\text{Data Rate} = \frac{234 \times 8(256\text{-QAM}) \times (3/4) \times 2}{3.2\mu\text{s} + 0.4\mu\text{s}} = 780 \text{ Mbps}$$

影响Data Rate的参数

➤ Symbol Duration 符号间隔

HT和VHT的符号间隔为 $3.2\mu s$ ，HE的符号间隔为 $12.8\mu s$ 。

➤ Spatial Streams 空间流

MIMO 允许相同的频率空间发送和接收多个数据流。

➤ 调制类型和编码率

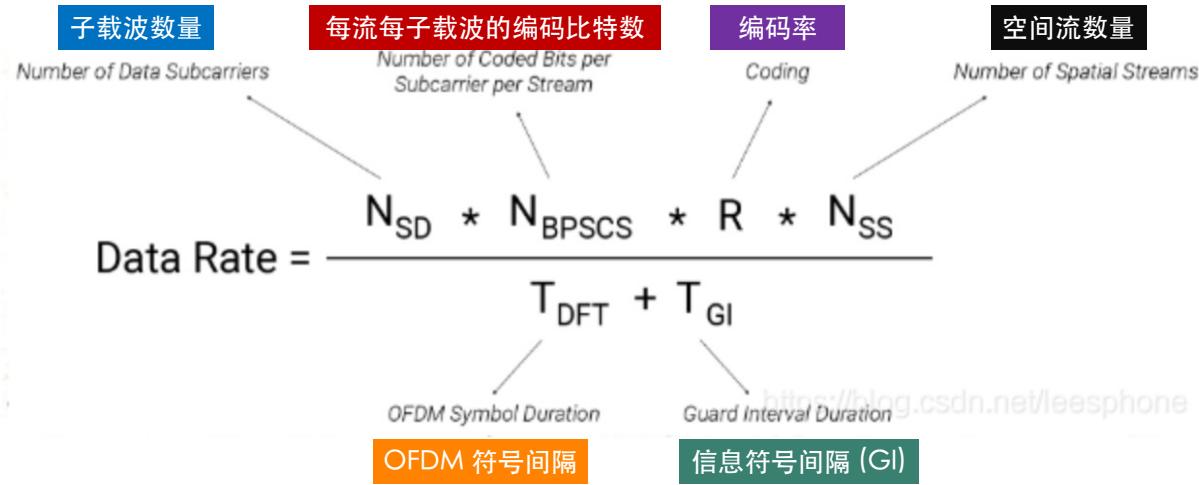
这决定了如何通过无线方式发送数据。更新和更复杂的调制方法可以维持高数据速率，但通常需要更少的干扰和良好的接入点视线 Line of Sight (LOS)。相比之下，BPSK 等旧方法可用于保持高错误率链路的连接性。编码率是用于传输可用网络数据的数据流百分比的指示。

➤ Guard Interval 保护间隔

保护间隔 (GI) 实际上是数据包传输之间的一个非常短的暂停，以允许忽略任何错误信息。更长的保护间隔使无线更可靠。该保护间隔对于抵消多径影响是必要的，否则会导致符号间干扰 (ISI)。保护间隔就像在对着扩音器说话的单词之间暂停以克服回声（声波反射）。传统 802.11a/g 设备使用 800 ns 保护间隔，但 802.11n 设备可以选择暂停 400 ns。较短的保护间隔会导致更多的干扰和提升吞吐量，而较长的保护间隔会导致无线环境中出现不必要的空闲时间。短保护间隔 (SGI) 将数据速率提高了 11% (HT/VHT)，同时保持了对大多数环境来说足够的符号分离。

➤ Channel Width 信道宽度

这是无线链路使用的信道宽度。通道越宽，数据速率就越高。虽然我们总是想拥有 40MHz 频道，但在使用 2.4GHz Wi-Fi 时无法部署的，因为只有 3 个非重叠的 20MHz 频道可用。此外，在 RF 干扰常见的挑战性环境中更难维持更宽的频道。

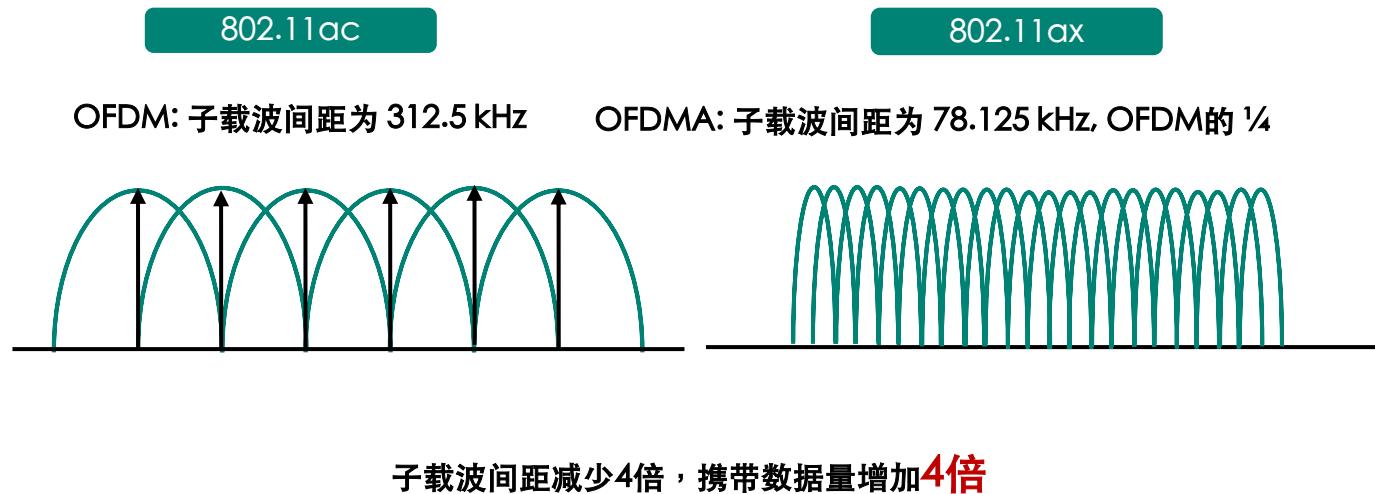
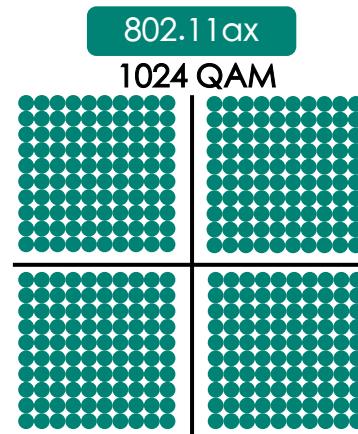
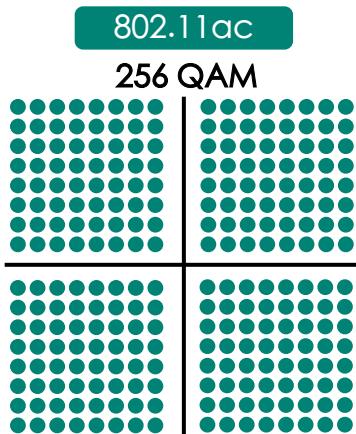


如何理解VHT到HE的“Modulation” 和 “Symbol Duration” 的变化？

1024 QAM supported, 10 bits per symbol, **25%** higher capacity

New MCS data rate:

- MCS 10 (1024QAM with 3/4 code rate)
- MCS 11 (1024QAM with 5/6 code rate)



如何判断终端可获取的无线速率范围？

- 通过无线控制器命令了解相关信息（show ap association）。

如何判断终端可获取的无线速率范围？

(3) 对照MCS table，了解终端在目前环境下可支持的速率范围

MCS Index			Spatial Stream	Modulation	Coding	OFDM (Prior 11ax)								OFDM (802.11ax)													
						20MHz		40MHz		80MHz		160MHz		20MHz		40MHz		80MHz		160MHz							
HT	VHT	HE				0.8μs GI	0.4μs GI	0.8μs GI	0.4μs GI	0.8μs GI	0.4μs GI	0.8μs GI	0.4μs GI	0.8μs GI	1.6μs GI	3.2μs GI	0.8μs GI	1.6μs GI	3.2μs GI	0.8μs GI	1.6μs GI	3.2μs GI	0.8μs GI	1.6μs GI	3.2μs GI		
0	0	0	1	BPSK	1/2	6.50	7.20	13.50	15.00	29.30	32.50	58.50	65.00	8.60	8.10	7.30	17.20	16.30	14.60	36.00	34.00	30.60	72.10	68.10	61.30		
1	1	1	1	QPSK	1/2	13.00	14.40	27.00	30.00	58.50	65.00	117.00	130.00	17.20	16.30	14.60	34.40	32.50	29.30	72.10	68.10	61.30	144.10	136.10	122.50		
2	2	2	1	QPSK	3/4	19.50	21.70	40.50	45.00	87.80	97.50	175.50	195.00	25.80	24.40	21.90	51.60	48.80	43.90	108.10	102.10	91.90	216.20	204.20	183.80		
3	3	3	1	16-QAM	1/2	26.00	28.90	54.00	60.00	117.00	130.00	234.00	260.00	34.40	32.50	29.30	68.80	65.00	58.50	144.10	136.10	122.50	288.20	272.20	245.00		
4	4	4	1	16-QAM	3/4	39.00	43.30	81.00	90.00	175.50	195.00	351.00	390.00	51.60	48.80	43.90	103.20	97.50	87.80	216.20	204.20	183.80	432.40	408.30	367.50		
5	5	5	1	64-QAM	2/3	52.00	57.80	108.00	120.00	234.00	260.00	468.00	520.00	68.80	65.00	58.50	137.60	130.00	117.00	288.20	272.20	245.00	576.50	544.40	490.00		
6	6	6	1	64-QAM	3/4	58.50	65.00	121.50	135.00	263.30	292.50	526.50	585.00	77.40	73.10	65.80	154.90	146.30	131.60	324.30	306.30	275.60	648.50	612.50	551.30		
7	7	7	1	64-QAM	5/6	65.00	72.20	135.00	150.00	292.50	325.00	585.00	650.00	86.00	81.30	73.10	172.10	162.50	146.30	360.30	306.30	272.60	680.60	612.50	551.30		
8	8	8	1	256-QAM	3/4	78.00	86.70	162.00	180.00	351.00	390.00	702.00	780.00	103.20	97.50	87.80	206.50	195.00	175.50	432.40	408.30	367.50	864.70	816.70	735.00		
9	9	9	1	256-QAM	5/6	N/A	N/A	180.00	200.00	390.00	433.30	780.00	866.70	114.70	108.30	97.50	229.40	216.70	195.00	480.40	453.70	408.30	960.80	907.40	816.70		
	10	1	1	1024-QAM	3/4											129.00	121.90	109.70	258.10	243.80	219.40	510.40	459.40	408.30	1020.80	918.80	918.80
	11	1	1	1024-QAM	5/6											143.40	135.40	121.90	286.80	270.80	243.80	600.50	567.10	510.40	1201.00	1134.30	1020.80
8	0	0	2	BPSK	1/2	13.00	14.40	27.00	30.00	58.50	65.00	117.00	130.00	17.20	16.30	14.60	34.40	32.50	29.30	72.10	68.10	61.30	144.10	136.10	122.50		
9	1	1	2	QPSK	1/2	26.00	28.90	54.00	60.00	117.00	130.00	234.00	260.00	34.40	32.50	29.30	68.80	65.00	58.50	144.10	136.10	122.50	288.20	272.20	245.00		
10	2	2	2	QPSK	3/4	39.00	43.30	81.00	90.00	175.50	195.00	351.00	390.00	51.60	48.80	43.90	103.20	97.50	87.80	216.20	204.20	183.80	432.40	408.30	367.50		
11	3	3	2	16-QAM	1/2	52.00	57.80	108.00	120.00	234.00	260.00	468.00	520.00	68.80	65.00	58.50	137.60	130.00	117.00	288.20	272.20	245.00	576.50	544.40	490.00		
12	4	4	2	16-QAM	3/4	78.00	86.70	162.00	180.00	351.00	390.00	702.00	780.00	103.20	97.50	87.80	206.50	195.00	175.50	432.40	408.30	367.50	864.70	816.70	735.00		
13	5	5	2	64-QAM	2/3	104.00	115.60	216.00	240.00	468.00	520.00	936.00	1040.00	137.60	130.00	117.00	275.30	260.00	234.00	576.50	544.40	490.00	1152.90	1088.90	980.00		
14	6	6	2	64-QAM	3/4	117.00	130.00	243.00	270.00	526.50	585.00	1053.00	1170.00	154.90	146.30	131.60	309.70	292.50	263.30	648.50	612.50	551.30	1297.10	1225.00	1102.50		
15	7	7	2	64-QAM	5/6	130.00	144.40	270.00	300.00	585.00	650.00	1170.00	1300.00	172.10	162.50	146.30	344.10	325.00	292.50	720.60	680.60	612.50	1441.20	1361.10	1225.00		
16	8	8	2	256-QAM	3/4	156.00	173.30	324.00	360.00	702.00	780.00	1404.00	1560.00	206.50	195.00	175.50	412.90	390.00	351.00	864.70	816.70	735.00	1729.40	1633.30	1470.00		
17	9	9	2	256-QAM	5/6	N/A	N/A	360.00	400.00	780.00	866.70	1560.00	1733.30	229.40	216.70	195.00	458.80	433.30	390.00	960.80	907.40	816.70	1921.60	1814.80	1633.30		
	10	2	1024-QAM	3/4											258.10	243.80	219.40	516.20	487.50	438.80	1080.90	1020.80	918.80	2041.70	1837.50		
	11	2	1024-QAM	5/6											286.80	270.80	243.80	573.50	541.70	487.50	1201.00	1134.30	1020.80	2402.00	2268.50	2041.70	
16	0	0	3	BPSK	1/2	19.50	21.70	40.50	45.00	87.80	97.50	175.50	195.00	25.80	24.40	21.90	51.60	48.80	43.90	108.10	102.10	91.90	216.20	204.20	183.80		
17	1	1	3	QPSK	1/2	39.00	43.30	81.00	90.00	175.50	195.00	351.00	390.00	51.60	48.80	43.90	103.20	97.50	87.80	216.20	204.20	183.80	432.40	408.30	367.50		
18	2	2	3	QPSK	3/4	58.50	65.00	121.50	135.00	263.30	292.50	526.50	585.00	77.40	73.10	65.80	154.90	146.30	131.60	324.30	306.30	275.60	648.50	612.50	551.30		
19	3	3	3	16-QAM	1/2	78.00	86.70	162.00	180.00	351.00	390.00	702.00	780.00	103.20	97.50	87.80	206.50	195.00	175.50	432.40	408.30	367.50	864.70	816.70	735.00		
20	4	4	3	16-QAM	3/4	117.00	130.00	243.00	270.00	526.50	585.00	1053.00	1170.00	154.90	146.30	131.60	309.70	292.50	263.30	648.50	612.50	551.30	1297.10	1225.00	1102.50		
21	5	5	3	64-QAM	2/3	156.00	173.30	324.00	360.00	702.00	780.00	1404.00	1560.00	206.50	195.00	175.50	412.90	390.00	351.00	864.70	816.70	735.00	1729.40	1633.30	1470.00		
22	6	6	3	64-QAM	3/4	175.50	195.00	364.50	405.00	N/A	N/A	157.50	175.50	232.30	219.40	197.40	464.60	438.80	394.90	972.80	918.80	826.90	1945.60	1837.50	1653.80		
23	7	7	3	64-QAM	5/6	195.00	216.70	405.00	450.00	877.50	975.00	1755.00	1950.00	258.10	243.80	219.40	516.20	487.50	438.80	1080.90	1020.80	918.80	2161.80	2041.70	1837.50		
8	8	3	256-QAM	3/4	234.00	260.00	486.00	540.00	1053.00	1170.00	2106.00	2340.00	309.70	292.50	263.30	619.40	585.00	526.50	1297.10	1225.00	1102.50	2594.10	2450.00	2205.00			
9	9	3	256-QAM	5/6	260.00	288.90	540.00	600.00	1170.00	1300.00	N/A	N/A	344.10	325.00	292.50	688.20	650.00	585.00	1441.20	1361.10	1225.00	2882.40	2722.20	2450.00			
	10	3	1024-QAM	3/4											387.10	365.60	329.10	774.30	731.30	658.10	1621.30	1531.30	1378.10	3242.60	3062.50	2756.30	
	11	3	1024-QAM	5/6											430.10	406.30	365.60	860.30	812.50	731.30	1801.50	1701.40	1531.30	3602.80	3402.80	3062.50	

示例：

❖ AP : Aruba AP-325 (支持11ac，支持4空间流；支持并配置80MHz，配置VHT，)

❖ 终端 : Samsung S21 Ultra (支持11ax，支持80MHz，支持2空间流)

MCS Index			Spatial Stream	Modulation	Coding	OFDM (Prior 11ax)						OFDM (802.11ax)									OFDM (802.11ax)							
HT	VHT	HE				20MHz		40MHz		80MHz		160MHz		20MHz		40MHz		80MHz		160MHz		OFDM (802.11ax)						
						0.8μs GI	0.4μs GI	0.8μs GI	0.4μs GI	0.8μs GI	0.4μs GI	0.8μs GI	1.6μs GI	3.2μs GI	0.8μs GI	1.6μs GI	3.2μs GI	0.8μs GI	1.6μs GI	3.2μs GI	0.8μs GI	1.6μs GI	3.2μs GI	0.8μs GI	1.6μs GI	3.2μs GI		
0	0	0	1	BPSK	1/2	6.50	7.20	13.50	15.00	29.30	32.50	58.50	65.00	8.60	8.10	7.30	17.20	16.30	14.60	36.00	34.00	30.60	72.10	68.10	61.30			
1	1	1	1	QPSK	1/2	13.00	14.40	27.00	30.00	58.50	65.00	117.00	130.00	17.20	16.30	14.60	34.40	32.50	29.30	72.10	68.10	61.30	144.10	136.10	122.50			
2	2	2	1	QPSK	3/4	19.50	21.70	40.50	45.00	87.80	97.50	175.50	195.00	25.80	24.40	21.90	51.60	48.80	43.90	108.10	102.10	91.90	216.20	204.20	183.80			
3	3	3	1	16-QAM	1/2	26.00	28.90	54.00	60.00	117.00	130.00	234.00	260.00	34.40	32.50	29.30	68.80	65.00	58.50	144.10	136.10	122.50	288.20	272.20	245.00			
4	4	4	1	16-QAM	3/4	39.00	43.30	81.00	90.00	175.50	195.00	351.00	390.00	51.60	48.80	43.90	103.20	97.50	87.80	216.20	204.20	183.80	432.40	408.30	367.50			
5	5	5	1	64-QAM	2/3	52.00	57.80	108.00	120.00	234.00	260.00	468.00	520.00	68.80	65.00	58.50	137.60	130.00	117.00	288.20	272.20	245.00	576.50	544.40	490.00			
6	6	6	1	64-QAM	3/4	58.50	65.00	121.50	135.00	263.30	292.50	526.50	585.00	77.40	73.10	65.80	154.90	146.30	131.60	324.30	306.30	275.60	648.50	612.50	551.30			
7	7	7	1	64-QAM	5/6	65.00	72.20	135.00	150.00	292.50	325.00	585.00	650.00	86.00	81.30	73.10	172.10	162.50	146.30	360.30	340.30	306.30	720.60	680.60	612.50			
8	8	8	1	256-QAM	3/4	78.00	86.70	162.00	180.00	351.00	390.00	702.00	780.00	103.20	97.50	87.80	206.50	195.00	175.50	432.40	408.30	367.50	864.70	816.70	735.00			
9	9	9	1	256-QAM	5/6	N/A	N/A	180.00	200.00	390.00	433.30	780.00	866.70	114.70	108.30	97.50	229.40	216.70	195.00	480.40	453.70	408.30	960.80	907.40	816.70			
10	10	10	1	1024-QAM	3/4												129.00	121.90	109.70	258.10	243.80	219.40	540.40	510.40	459.40	1080.90	1020.80	918.80
11	11	11	1	1024-QAM	5/6												143.40	135.40	121.90	286.80	270.80	243.80	600.50	567.10	510.40	1201.00	1134.30	1020.80
12	8	0	2	BPSK	1/2	13.00	14.40	27.00	30.00	58.50	65.00	117.00	130.00	17.20	16.30	14.60	34.40	32.50	29.30	72.10	68.10	61.30	144.10	136.10	122.50			
13	9	1	2	QPSK	1/2	26.00	28.90	54.00	60.00	117.00	130.00	234.00	260.00	34.40	32.50	29.30	68.80	65.00	58.50	144.10	136.10	122.50	288.20	272.20	245.00			
14	10	2	2	QPSK	3/4	39.00	43.30	81.00	90.00	175.50	195.00	351.00	390.00	51.60	48.80	43.90	103.20	97.50	87.80	216.20	204.20	183.80	432.40	408.30	367.50			
15	11	3	2	16-QAM	1/2	52.00	57.80	108.00	120.00	234.00	260.00	468.00	520.00	68.80	65.00	58.50	137.60	130.00	117.00	288.20	272.20	245.00	576.50	544.40	490.00			
16	12	4	2	16-QAM	3/4	78.00	86.70	162.00	180.00	351.00	390.00	702.00	780.00	103.20	97.50	87.80	206.50	195.00	175.50	432.40	408.30	367.50	864.70	816.70	735.00			
17	13	5	2	64-QAM	2/3	104.00	115.60	216.00	240.00	351.00	390.00	702.00	780.00	103.20	97.50	87.80	216.20	204.20	183.80	432.40	408.30	367.50	972.80	918.80	826.90			
18	14	6	3	64-QAM	3/4	117.00	130.00	243.00	270.00	526.50	585.00	1053.00	1170.00	154.90	146.30	131.60	324.30	306.30	275.60	648.50	612.50	551.30	1441.20	1361.10	1225.00			
19	15	7	3	64-QAM	5/6	130.00	144.40	270.00	300.00	585.00	650.00	1170.00	1300.00	172.10	162.50	146.30	344.10	325.00	292.50	720.60	680.60	612.50	1441.20	1361.10	1225.00			
20	16	8	2	256-QAM	3/4	156.00	173.30	324.00	360.00	702.00	780.00	1404.00	1560.00	206.50	195.00	175.50	412.90	390.00	351.00	864.70	816.70	735.00	1729.40	1633.30	1470.00			
21	17	9	3	256-QAM	5/6	173.30	195.00	324.00	360.00	702.00	780.00	1404.00	1560.00	206.50	195.00	175.50	412.90	390.00	351.00	864.70	816.70	735.00	1729.40	1633.30	1470.00			
22	18	10	3	1024-QAM	3/4											157.90	175.50	232.30	219.40	197.40	464.60	438.80	394.90	972.80	918.80	826.90		
23	19	11	3	1024-QAM	5/6											175.50	195.00	258.10	243.80	219.40	516.20	487.50	438.80	1080.90	1020.80	918.80		
24	20	12	4	BPSK	1/2	26.00	28.90	54.00	60.00	117.00	130.00	234.00	260.00	34.40	32.50	29.30	68.80	65.00	58.50	144.10	136.10	122.50	288.20	272.20	245.00			
25	21	13	4	QPSK	1/2	52.00	57.80	108.00	120.00	234.00	260.00	468.00	520.00	68.80	65.00	58.50	137.60	130.00	117.00	288.20	272.20	245.00	576.50	544.40	490.00			
26	22	14	4	QPSK	3/4	78.00	86.70	162.00	180.00	351.00	390.00	702.00	780.00	103.20	97.50	87.80	206.50	195.00	175.50	432.40	408.30	367.50	864.70	816.70	735.00			
27	23	15	4	16-QAM	1/2	104.00	115.60	216.00	240.00	468.00	520.00	936.00	1040.00	137.60	130.00	117.00	275.30	260.00	234.00	576.50	544.40	490.00	1152.90	1088.90	980.00			
28	24	16	4	16-QAM	3/4	156.00	173.30	324.00	360.00	702.00	780.00	1404.00	1560.00	206.50	195.00	175.50	412.90	390.00	351.00	864.70	816.70	735.00	1729.40	1633.30	1470.00			
29	25	17	4	64-QAM	2/3	208.00	231.10	432.00	480.00	936.00	1040.00	1872.00	2080.00	275.30	260.00	234.00	550.60	520.00	468.00	1152.90	1088.90	980.00	2305.90	2177.80	1960.00			
30	26	18	4	64-QAM	3/4	234.00	260.00	486.00	540.00	1053.00	1170.00	2106.00	2340.00	309.70	292.50	619.40	585.00	526.50	1297.10	1225.00	1102.50	2594.10	2450.00	2205.00				
31	27	19	4	64-QAM	5/6	260.00	288.90	540.00	600.00	1170.00	130.00	2340.00	2600.00	344.10	325.00	292.50	688.20	650.00	585.00	1441.20	1361.10	1225.00	2882.40	2722.20	2450.00			

示例：

- ❖ AP : Aruba AP-535 (支持11ax，支持4空间流；支持并配置160MHz，配置HE，)
- ❖ 终端 : Apple iPhone 12 Pro Max (支持11ax，支持160MHz，支持2空间流)

MCS Index			Spatial Stream	Modulation	Coding	OFDM (Prior 11ax)								OFDM (802.11ax)								160MHz						
HT	VHT	HE				20MHz		40MHz		80MHz		160MHz		20MHz		40MHz		80MHz		160MHz		160MHz						
						0.8μs GI	0.4μs GI	0.8μs GI	0.4μs GI	0.8μs GI	0.4μs GI	0.8μs GI	1.6μs GI	3.2μs GI	0.8μs GI	1.6μs GI	3.2μs GI	0.8μs GI	1.6μs GI	3.2μs GI	0.8μs GI	1.6μs GI	3.2μs GI					
0	0	0	1	BPSK	1/2	6.50	7.20	13.50	15.00	29.30	32.50	58.50	65.00	8.60	8.10	7.30	17.20	16.30	14.60	36.00	34.00	30.60	72.10	68.10	61.30			
1	1	1	1	QPSK	1/2	13.00	14.40	27.00	30.00	58.50	65.00	117.00	130.00	17.20	16.30	14.60	34.40	32.50	29.30	72.10	68.10	61.30	144.10	136.10	122.50			
2	2	2	1	QPSK	3/4	19.50	21.70	40.50	45.00	87.80	97.50	175.50	195.00	25.80	24.40	21.90	51.60	48.80	43.90	108.10	102.10	91.90	216.20	204.20	183.80			
3	3	3	1	16-QAM	1/2	26.00	28.90	54.00	60.00	117.00	130.00	234.00	260.00	34.40	32.50	29.30	68.80	65.00	58.50	144.10	136.10	122.50	288.20	272.20	245.00			
4	4	4	1	16-QAM	3/4	39.00	43.30	81.00	90.00	175.50	195.00	351.00	390.00	51.60	48.80	43.90	103.20	97.50	87.80	216.20	204.20	183.80	432.40	408.30	367.50			
5	5	5	1	64-QAM	2/3	52.00	57.80	108.00	120.00	234.00	260.00	468.00	520.00	68.80	65.00	58.50	137.60	130.00	117.00	288.20	272.20	245.00	576.50	544.40	490.00			
6	6	6	1	64-QAM	3/4	58.50	65.00	121.50	135.00	263.30	292.50	526.50	585.00	77.40	73.10	65.80	154.90	146.30	131.60	324.30	306.30	275.60	648.50	612.50	551.30			
7	7	7	1	64-QAM	5/6	65.00	72.20	135.00	150.00	292.50	325.00	585.00	650.00	86.00	81.30	73.10	172.10	162.50	146.30	360.30	340.30	306.30	720.60	680.60	612.50			
8	8	8	1	256-QAM	3/4	78.00	86.70	162.00	180.00	351.00	390.00	702.00	780.00	103.20	97.50	87.80	206.50	195.00	175.50	432.40	408.30	367.50	864.70	816.70	735.00			
9	9	9	1	256-QAM	5/6	N/A	N/A	180.00	200.00	390.00	433.30	780.00	866.70	114.70	108.30	97.50	229.40	216.70	195.00	480.40	453.70	408.30	960.80	907.40	816.70			
10	10	10	1	1024-QAM	3/4												129.00	121.90	109.70	258.10	243.80	219.40	540.40	510.40	459.40	1080.90	1020.80	918.80
11	11	11	1	1024-QAM	5/6												143.40	135.40	121.90	286.80	270.80	243.80	600.50	567.10	510.40	1201.00	1134.30	1020.80
12	0	0	2	BPSK	1/2	13.00	14.40	27.00	30.00	58.50	65.00	117.00	130.00	17.20	16.30	14.60	34.40	32.50	29.30	72.10	68.10	61.30	144.10	136.10	122.50			
13	1	1	2	QPSK	1/2	26.00	28.90	54.00	60.00	117.00	130.00	234.00	260.00	34.40	32.50	29.30	68.80	65.00	58.50	144.10	136.10	122.50	288.20	272.20	245.00			
14	2	2	2	QPSK	3/4	39.00	43.30	81.00	90.00	175.50	195.00	351.00	390.00	51.60	48.80	43.90	103.20	97.50	87.80	216.20	204.20	183.80	432.40	408.30	367.50			
15	3	3	2	16-QAM	1/2	52.00	57.80	108.00	120.00	234.00	260.00	468.00	520.00	68.80	65.00	58.50	137.60	130.00	117.00	288.20	272.20	245.00	576.50	544.40	490.00			
16	4	4	2	16-QAM	3/4	78.00	86.70	162.00	180.00	351.00	390.00	702.00	780.00	103.20	97.50	87.80	206.50	195.00	175.50	432.40	408.30	367.50	864.70	816.70	735.00			
17	5	5	3	64-QAM	2/3	104.00	115.60	216.00	240.00	468.00	520.00	936.00	1040.00	137.60	130.00	127.10	206.50	195.00	175.50	412.90	390.00	351.00	864.70	816.70	735.00			
18	6	6	3	64-QAM	3/4	121.50	135.00	263.30	292.50	526.50	585.00	77.40	73.10	65.80	154.90	146.30	131.60	324.30	306.30	275.60	648.50	612.50	551.30					
19	7	7	3	64-QAM	5/6	144.40	150.00	270.00	300.00	585.00	650.00	1170.00	1300.00	172.10	162.50	146.30	344.10	325.00	292.50	720.60	680.60	612.50	1441.20	1361.10	1225.00			
20	8	8	2	256-QAM	3/4	156.00	173.30	324.00	360.00	585.00	650.00	1170.00	1300.00	172.10	162.50	146.30	344.10	325.00	292.50	720.60	680.60	612.50	1729.40	1633.30	1470.00			
21	9	9	2	256-QAM	5/6	173.30	190.00	360.00	400.00	780.00	866.70	1560.00	1733.30	216.70	195.00	175.50	458.80	433.30	390.00	960.80	907.40	816.70	1921.60	1814.80	1633.30			
22	10	10	3	1024-QAM	3/4											258.10	243.80	219.40	487.50	438.80	408.00	1020.80	918.80	2161.80	2041.70	1837.50		
23	11	11	3	1024-QAM	5/6											286.80	270.80	243.80	573.50	541.70	487.50	1201.00	1134.30	1020.80	2402.00	2268.50	2041.70	
24	0	0	4	BPSK	1/2	26.00	28.90	54.00	60.00	117.00	130.00	234.00	260.00	34.40	32.50	29.30	68.80	65.00	58.50	144.10	136.10	122.50	288.20	272.20	245.00			
25	1	1	4	QPSK	1/2	52.00	57.80	108.00	120.00	234.00	260.00	468.00	520.00	68.80	65.00	58.50	137.60	130.00	117.00	288.20	272.20	245.00	576.50	544.40	490.00			
26	2	2	4	QPSK	3/4	78.00	86.70	162.00	180.00	351.00	390.00	702.00	780.00	103.20	97.50	87.80	206.50	195.00	175.50	432.40	408.30	367.50	864.70	816.70	735.00			
27	3	3	4	16-QAM	1/2	104.00	115.60	216.00	240.00	468.00	520.00	936.00	1040.00	137.60	130.00	117.00	275.30	260.00	234.00	576.50	544.40	490.00	1152.90	1088.90	980.00			
28	4	4	4	16-QAM	3/4	156.00	173.30	324.00	360.00	702.00	780.00	1404.00	1560.00	206.50	195.00	175.50	412.90	390.00	351.00	864.70	816.70	735.00	1633.30	1470.00	1960.00			
29	5	5	4	64-QAM	2/3	208.00	231.10	432.00	480.00	936.00	1040.00	1872.00	2080.00	275.30	260.00	234.00	550.60	520.00	468.00	1152.90	1088.90	980.00	2305.90	2177.80	2045.00			
30	6	6	4	64-QAM	3/4	234.00	260.00	486.00	540.00	1053.00	1170.00	2106.00	2340.00	309.70	292.50	263.30	619.40	585.00	526.50	1297.10	1225.00	1102.50	2594.10	2450.00	2205.00			
31	7	7	4	64-QAM	5/6	260.00	288.90	540.00	600.00	1170.00	1300.00	2340.00	2600.00	344.10	325.00	292.50	688.20	650.00	585.00	1441.20	1361.10	1225.00	2882.40	2722.20	2450.00			

Aruba 802.11ax 无线网络部署建议

Aruba Recommendations for AP Placements

AP placement recommendations for an enterprise network, which needs to support high-performing 802.11ax network along with real-time voice and video applications, are as follows:

- Distance between two APs should be approximately 40 to 60 feet. AP 间隔12米-18米
- Minimum RSSI should be -55 dBm throughout the coverage area. 覆盖区域保证最少-55 dBm RSSI

The reason behind choosing RSSI to be -55 is that it could reliably provide MCS11 on 40 MHz for most high density deployments. The minimum receive sensitivity for HE MCS11 rates are:

- a. HE20: -60 dBm
- b. HE40: -57 dBm
- c. HE80: -54 dBm
- d. HE160: -51 dBm

获得HE MCS11对应各种频宽设置下的RSSI要求

- SNR should be at least 35dB to achieve the highest 1024-QAM rates (MCS10 – 11). SNR 最少35dB以获得1024-QAM

查看各无线传输速率的比例情况

第一步，先清除计数器

```
(Aruba7010) *[mynode] #clear ap debug radio-stats ap-name AP-325 radio 0
```

```
(Aruba7010) *[mynode] #clear ap debug client-stats client-mac a4:83:e7:b2:5e:0b
```

第二步，检查ap和client的无线传输速率使用情况

```
(Aruba7010) *[mynode] #show ap debug radio-stats ap-name AP-325 radio 0
```

Tx Data Priority [BK]	8
Tx Data Priority [BE]	746
Tx Data Priority [VI]	1014
Tx Data Priority [VO]	1416
Tx Data Frames 12 Mbps (Mon)	1682
Tx Data Frames 24 Mbps (Mon)	291
Tx Data Frames 36 Mbps (Mon)	0
Tx Data Frames 54 Mbps (Mon)	0
Tx Data Frames 72 Mbps (Mon)	0
Tx Data Frames 108 Mbps (Mon)	0
Tx Data Frames 300 Mbps (Mon)	12
Tx Data Frames 450 Mbps (Mon)	8
Tx Data Frames 1300 Mbps (Mon)	2054
Tx Data Frames 1300 Mbps+ (Mon)	0
Tx Data Bytes 12 Mbps (Mon)	172203
Tx Data Bytes 24 Mbps (Mon)	81758
Tx Data Bytes 36 Mbps (Mon)	0
Tx Data Bytes 54 Mbps (Mon)	0
Tx Data Bytes 72 Mbps (Mon)	0
Tx Data Bytes 108 Mbps (Mon)	0
Tx Data Bytes 300 Mbps (Mon)	1260
Tx Data Bytes 450 Mbps (Mon)	2110
Tx Data Bytes 1300 Mbps (Mon)	2703783
Tx Data Bytes 1300 Mbps+ (Mon)	0
Tx HT 6.5 Mbps	1682
Tx HT 162 Mbps	10
Tx HT 216 Mbps	2
Tx VHT 433.3 Mbps	8
Tx VHT 468 Mbps	470
Tx VHT 526.5 Mbps	939
Tx VHT 585 Mbps	13
Tx VHT 650 Mbps	9
Tx VHT 702 Mbps	592
Tx VHT 877.5 Mbps	30
Tx VHT 975 Mbps	1

```
(Aruba7010) *[mynode] #show ap debug client-stats client-mac a4:83:e7:b2:5e:0b
```

Tx Data Priority [BE]	165
Tx Data Priority [VI]	813
Tx Data Priority [VO]	1
Tx Data Frames 12 Mbps (Mon)	0
Tx Data Frames 24 Mbps (Mon)	0
Tx Data Frames 36 Mbps (Mon)	0
Tx Data Frames 54 Mbps (Mon)	0
Tx Data Frames 72 Mbps (Mon)	0
Tx Data Frames 108 Mbps (Mon)	0
Tx Data Frames 300 Mbps (Mon)	0
Tx Data Frames 450 Mbps (Mon)	0
Tx Data Frames 1300 Mbps (Mon)	1709
Tx Data Frames 1300 Mbps+ (Mon)	0
Tx Data Bytes 12 Mbps (Mon)	0
Tx Data Bytes 24 Mbps (Mon)	0
Tx Data Bytes 36 Mbps (Mon)	0
Tx Data Bytes 54 Mbps (Mon)	0
Tx Data Bytes 72 Mbps (Mon)	0
Tx Data Bytes 108 Mbps (Mon)	0
Tx Data Bytes 300 Mbps (Mon)	0
Tx Data Bytes 450 Mbps (Mon)	0
Tx Data Bytes 1300 Mbps (Mon)	2525735
Tx Data Bytes 1300 Mbps+ (Mon)	0
Tx VHT 468 Mbps	399
Tx VHT 526.5 Mbps	883
Tx VHT 585 Mbps	13
Tx VHT 650 Mbps	9
Tx VHT 702 Mbps	381
Tx VHT 877.5 Mbps	23
Tx VHT 975 Mbps	1

Thank you