

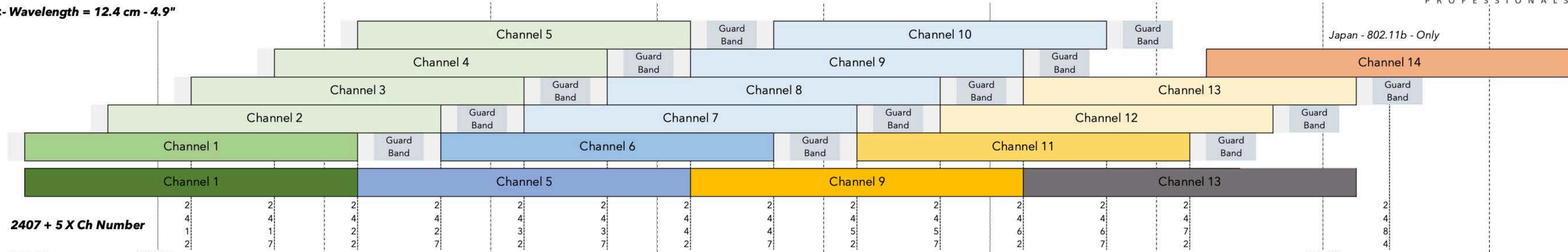
# 2.4GHz Unlicensed Spectrum

## Wi-Fi

802.11b - 22MHz
802.11g/n/ax - 20MHz
<b>3 20Mhz Channels</b>
4 Ch Plan - Non-US
Center Freq

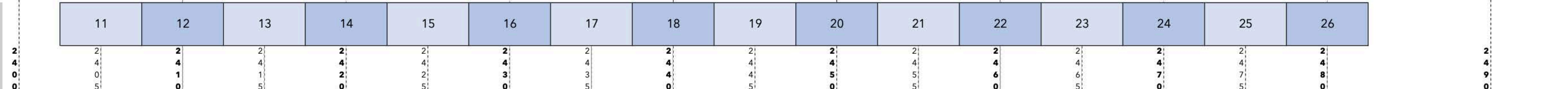
<- Wavelength = 12.4 cm - 4.9"

Japan - 802.11b - Only



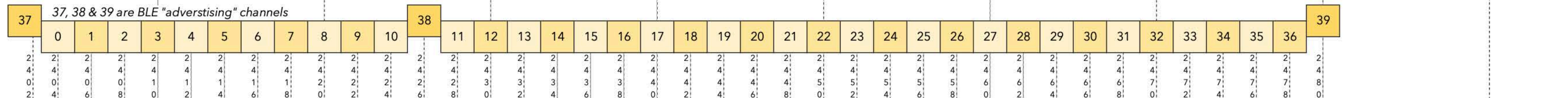
## 802.15.4/Zigbee

<b>16 5Mhz Channels</b>
Center Freq



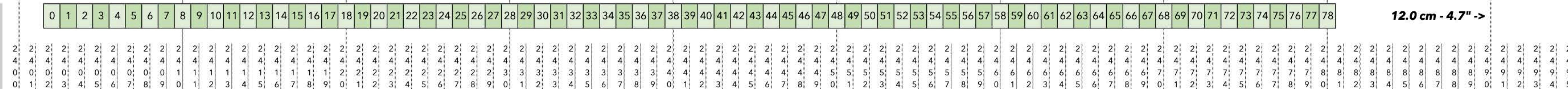
## BLE

<b>40 2Mhz Channels</b>
Center Freq



## BlueTooth

<b>79 1Mhz Channels</b>
Center Freq



12.0 cm - 4.7" ->



5 GHz Channel Allocations

500 MHz



Frequency		5000 + 5 X Ch. Number				DFS Channels				DFS Channels																Proposed Channels																			
Qty	Radio Band	U-NII-1				U-NII-2a				Past Proposal UNII-2b								U-NII-2c (Extended)								U-NII-3					UNII-4			25 12 6 2											
	Center Freq	5.180	5.200	5.220	5.240	5.260	5.280	5.300	5.320	5.340	5.360	5.380	5.400	5.420	5.440	5.460	5.480	5.500	5.520	5.540	5.560	5.580	5.600	5.620	5.640	5.660	5.680	5.700	5.720	5.745	5.765	5.785	5.805		5.825	5.845	5.865	5.885							
	20 MHz	36	40	44	48	52	56	60	64	68	72	76	80	84	88	92	96	100	104	108	112	116	120	124	128	132	136	140	144	149	153	157	161		165	169	173	177							
	40 MHz	38		46		54		62		70		78		86		94		102		110		118		126		134		142		151		159			167		175								
	80 MHz	42				58				74				90				106				122		138				155				171													
	160 MHz	50								82								114								165 was ISM, now U-NII-3					Proposed														
FCC - US		1,000 mW Tx Power Indoor & Outdoor No DFS needed				250 mw w/6dBi Indoor & Outdoor DFS Required				Not Currently Available for Unlicensed								250 mw w/6dBi Indoor & Outdoor DFS Required								120, 124, 128 US - Allowed  Now Allowed								1,000 mW Tx Power Indoor & Outdoor No DFS needed					Not Currently Available For Unlicensed						
ISED - Canada		FCC - Except Outdoor License Req. >200 mW				Same as FCC												Same as FCC				TDWR Not Allowed		Same as FCC				Canada PtP allows Higher EIRP																	
ACMA - Australia		200 mW EIRP Indoor				200 mW EIRP - DFS & TPC 100 mW EIRP - DFS-Only Indoor												1,000 mW - DFS & TPC 500 mW - DFS-Only - No TPC Indoor/Outdoor				TDWR Not Allowed		1,000 mW - DFS & TPC 500 mW - DFS-Only Indoor/Outdoor				4,000 mW Tx Power Indoor & Outdoor No DFS needed																	
ETSI - EU		100 mW No DFS/TPC Indoor				200 mW EIRP DFS/TPC Indoor												1,000 mW EIRP DFS/TPC Indoor/Outdoor										UK No 144		4,000 mW EIRP DFS/TPC - Outdoor Fixed Wireless Access															
		200 mW EIRP DFS/TPC - Indoor																				10-min TWDR Scan Time						25mW SRD		25mW - SRD - No DFS															
20 MHz		36	40	44	48	52	56	60	64	68	72	76	80	84	88	92	96	100	104	108	112	116	120	124	128	132	136	140	144	149	153	157	161	165	169	173	177								
Center Freq		5.180	5.200	5.220	5.240	5.260	5.280	5.300	5.320	5.340	5.360	5.380	5.400	5.420	5.440	5.460	5.480	5.500	5.520	5.540	5.560	5.580	5.600	5.620	5.640	5.660	5.680	5.700	5.720	5.745	5.765	5.785	5.805	5.825	5.845	5.865	5.885								
<- Wavelength 5.8cm - 2.3"																																		Wavelength 5.1cm - 2.0" ->											
Free Space Path Loss 1m		-45.74	-45.77	-45.80	-45.84	-45.87	-45.90	-45.94	-45.97	-46.00	-46.03	-46.07	-46.10	-46.13	-46.16	-46.19	-46.23	-46.26	-46.29	-46.32	-46.35	-46.38	-46.41	-46.44	-46.48	-46.51	-46.54	-46.57	-46.60	-46.64	-46.67	-46.70	-46.73	-46.76	-46.79	-46.82	-46.84								



6 GHz Channel Allocations

1,200 MHz



FCC - USA

5950 + 5 X Ch. Number

Low Power Indoor		5dBm/MHz - Net EIRP 18dBm												1.2 Gigahertz Proposed											
Radio Band		UNII-5																							
Center Freq		5.955	5.975	5.995	6.015	6.035	6.055	6.075	6.095	6.115	6.135	6.155	6.175	6.195	6.215	6.235	6.255	6.275	6.295	6.315	6.335	6.355	6.375	6.395	6.415
20 MHz		1	5	9	13	17	21	25	29	33	37	41	45	49	53	57	61	65	69	73	77	81	85	89	93
40 MHz		3		11		19		27		35		43		51		59		67		75		83		91	
80 MHz		7				23				39				55				71				87			
160 MHz		15								47								79							

Standard Power AP		36dBm with Automated Frequency Coordination (AFC)																							
Radio Band		UNII-5																							
Center Freq		5.955	5.975	5.995	6.015	6.035	6.055	6.075	6.095	6.115	6.135	6.155	6.175	6.195	6.215	6.235	6.255	6.275	6.295	6.315	6.335	6.355	6.375	6.395	6.415
Qty	20 MHz	1	5	9	13	17	21	25	29	33	37	41	45	49	53	57	61	65	69	73	77	81	85	89	93
24	40 MHz	3		11		19		27		35		43		51		59		67		75		83		91	
12	80 MHz	7				23				39				55				71				87			
6	160 MHz	15								47								79							
3																									

Low Power Indoor		UNII-6																				UNII-7																				UNII-8															
Radio Band																																																									
Center Freq		6.435	6.455	6.475	6.495	6.515	6.535	6.555	6.575	6.595	6.615	6.635	6.655	6.675	6.695	6.715	6.735	6.755	6.775	6.795	6.815	6.835	6.855	6.875	6.895	6.915	6.935	6.955	6.975	6.995	7.015	7.035	7.055	7.075	7.095	7.115																					
Qty	20 MHz	97	101	105	109	113	117	121	125	129	133	137	141	145	149	153	157	161	165	169	173	177	181	185	189	193	197	201	205	209	213	217	221	225	229	233																					
	40 MHz	99		107		115		123		131		139		147		155		163		171		179		187	195		203		211		219		227																								
	80 MHz	103				119				135				151				167				183					199				215																										
	160 MHz	111						143						175							207																																				

Standard Power AP		UNII-6																				UNII-7										UNII-8									
Radio Band																																									
Center Freq		6.435	6.455	6.475	6.495	6.515	6.535	6.555	6.575	6.595	6.615	6.635	6.655	6.675	6.695	6.715	6.735	6.755	6.775	6.795	6.815	6.835	6.855	6.875	6.895	6.915	6.935	6.955	6.975	6.995	7.015	7.035	7.055	7.075	7.095	7.115					
Qty	20 MHz						117	121	125	129	133	137	141	145	149	153	157	161	165	169	173	177	181																		
	40 MHz							123		131		139		147		155		163		171		179																			
	80 MHz									135				151				167																							
	160 MHz									143																															



## ETSI - EU

Radio Band	5925 - 6425 - Proposed 500 Megahertz																								Qty
	UNII-5																								
	5.945	5.965	5.985	6.005	6.025	6.045	6.065	6.085	6.105	6.125	6.145	6.165	6.185	6.205	6.225	6.245	6.265	6.285	6.305	6.325	6.345	6.365	6.385	6.405	
20 MHz	1	5	9	13	17	21	25	29	33	37	41	45	49	53	57	61	65	69	73	77	81	85	89	93	24
40 MHz	3		11		19		27		35		43		51		59		67		75		83		91		12
80 MHz	7				23				39				55				71				87				6
160 MHz	15								47								79								3



6 GHz Channel Allocations

1,200 MHz



FCC - USA

5950 + 5 X Ch. Number

Low Power Indoor		5925	5dBm/MHz - Net EIRP 18dBm										1.2 Gigahertz Proposed										6425		
Radio Band		UNII-5																							
Center Freq		5.955	5.975	5.995	6.015	6.035	6.055	6.075	6.095	6.115	6.135	6.155	6.175	6.195	6.215	6.235	6.255	6.275	6.295	6.315	6.335	6.355	6.375	6.395	6.415
20 MHz		1	5	9	13	17	21	25	29	33	37	41	45	49	53	57	61	65	69	73	77	81	85	89	93
40 MHz		3		11		19		27		35		43		51		59		67		75		83		91	
80 MHz		7				23				39				55				71				87			
160 MHz		15								47								79							

Standard Power AP

5925	36dBm with Automated Frequency Coordination (AFC)																								6425
	UNII-5																								
	5.955	5.975	5.995	6.015	6.035	6.055	6.075	6.095	6.115	6.135	6.155	6.175	6.195	6.215	6.235	6.255	6.275	6.295	6.315	6.335	6.355	6.375	6.395	6.415	
	1	5	9	13	17	21	25	29	33	37	41	45	49	53	57	61	65	69	73	77	81	85	89	93	
	3		11		19		27		35		43		51		59		67		75		83		91		
	7				23				39				55				71				87				
	15								47								79								

Low Power Indoor	
Radio Band	
Center Freq	
20 MHz	
40 MHz	
80 MHz	
160 MHz	

UNII-6					UNII-7																UNII-8													
6.435	6.455	6.475	6.495	6.515	6.535	6.555	6.575	6.595	6.615	6.635	6.655	6.675	6.695	6.715	6.735	6.755	6.775	6.795	6.815	6.835	6.855	6.875	6.895	6.915	6.935	6.955	6.975	6.995	7.015	7.035	7.055	7.075	7.095	7.115
97	101	105	109	113	117	121	125	129	133	137	141	145	149	153	157	161	165	169	173	177	181	185	189	193	197	201	205	209	213	217	221	225	229	233
99		107		115		123		131		139		147		155		163		171		179		187	195		203		211		219		227			
103				119				135				151				167				183			199				215							
111					143					175					207																			

Standard Power AP	
Radio Band	
Center Freq	
20 MHz	
40 MHz	
80 MHz	
160 MHz	

UNII-6					UNII-7																UNII-8														
6.435	6.455	6.475	6.495	6.515	6.535	6.555	6.575	6.595	6.615	6.635	6.655	6.675	6.695	6.715	6.735	6.755	6.775	6.795	6.815	6.835	6.855		6.875	6.895	6.915	6.935	6.955	6.975	6.995	7.015	7.035	7.055	7.075	7.095	7.115
					117	121	125	129	133	137	141	145	149	153	157	161	165	169	173	177	181														
					123		131		139		147		155		163		171		179																
								135				151				167																			
								143																											

Client Devices

6dB Below AP max Net EIRP of 18dBm - Anticipating 12dBm



# Unlicensed Spectrum and Channel Allocations



## 2.4 GHz Channels

80 MHz

ISM Band	2407 + 5 X Ch. Number			Wavelength	12.5cm - 4.9" to 12.0cm - 4.7"		
Channel	1	6	11				
Center Freq	2.412	2.437	2.462				

## 5 GHz Channels

500 MHz

Frequency	5000 + 5 X Ch. Number			Wavelength	5.8cm - 2.3" to 5.1cm - 2.0"		
-----------	-----------------------	--	--	------------	------------------------------	--	--

Radio Band Center Freq	DFS Channels				DFS Channels																				
	U-NII-1				U-NII-2a				U-NII-2c (Extended)										U-NII-3						
	5.180	5.200	5.220	5.240	5.260	5.280	5.300	5.320	5.500	5.520	5.540	5.560	5.580	5.600	5.620	5.640	5.660	5.680	5.700	5.720	5.745	5.765	5.785	5.805	5.825
	36	40	44	48	52	56	60	64	100	104	108	112	116	120	124	128	132	136	140	144	149	153	157	161	165
	38	46		54		62		102		110		118		126		134		142		151		159			
20 MHz	42				58				106				122		138				155						
40 MHz	50								114												165 was ISM, now U-NII-3				
80 MHz																									
160 MHz																									

## 6 GHz Channels

1,200 MHz

FCC - USA	5950 + 5 X Ch. Number			Wavelength	5.1cm - 2.0" to 4.2cm - 1.6"		
-----------	-----------------------	--	--	------------	------------------------------	--	--

Radio Band Center Freq	5dBm/MHz - Net EIRP 18dBm																																																																									
	UNII-5																								UNII-6					UNII-7															UNII-8																													
	5.955	5.975	5.995	6.015	6.035	6.055	6.075	6.095	6.115	6.135	6.155	6.175	6.195	6.215	6.235	6.255	6.275	6.295	6.315	6.335	6.355	6.375	6.395	6.415	6.435	6.455	6.475	6.495	6.515	6.535	6.555	6.575	6.595	6.615	6.635	6.655	6.675	6.695	6.715	6.735	6.755	6.775	6.795	6.815	6.835	6.855	6.875	6.895	6.915	6.935	6.955	6.975	6.995	7.015	7.035	7.055	7.075	7.095	7.115															
	1	5	9	13	17	21	25	29	33	37	41	45	49	53	57	61	65	69	73	77	81	85	89	93	97	101	105	109	113	117	121	125	129	133	137	141	145	149	153	157	161	165	169	173	177	181	185	189	193	197	201	205	209	213	217	221	225	229	233															
	3	11		19		27		35		43		51		59		67		75		83		91		99		107		115		123		131		139		147		155		163		171		179		187		195		203		211		219		227																		
7	23				39				55				71				87				103					119					135					151					167					183										199					215													
15	47								79								111					143										175															207																											

