



**FCC 47 CFR PART 15 SUBPART E**

**CERTIFICATION TEST REPORT**

**FOR**

**TABLET DEVICE**

**MODEL NUMBER: A1673**

**FCC ID: BCGA1673**

**REPORT NUMBER: 15U22427-E4V2**

**ISSUE DATE: FEBRUARY 16, 2016**

*Prepared for*  
**APPLE, INC.**  
**1 INFINITE LOOP**  
**CUPERTINO, CA 95014, U.S.A.**

*Prepared by*  
**UL VERIFICATION SERVICES INC.**  
**47173 BENICIA STREET**  
**FREMONT, CA 94538, U.S.A.**  
**TEL: (510) 771-1000**  
**FAX: (510) 661-0888**



**NVLAP LAB CODE 200065-0**

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V1	02/11/2016	Initial Review	M. Mekuria
V2	02/16/2016	Revised report to address TCB's questions	T. Chu

## TABLE OF CONTENTS

<b>1. ATTESTATION OF TEST RESULTS .....</b>	<b>16</b>
<b>2. TEST METHODOLOGY .....</b>	<b>17</b>
<b>3. FACILITIES AND ACCREDITATION .....</b>	<b>17</b>
<b>4. CALIBRATION AND UNCERTAINTY .....</b>	<b>18</b>
4.1. MEASURING INSTRUMENT CALIBRATION.....	18
4.2. SAMPLE CALCULATION.....	18
4.3. MEASUREMENT UNCERTAINTY .....	18
<b>5. EQUIPMENT UNDER TEST.....</b>	<b>19</b>
5.1. DESCRIPTION OF EUT.....	19
5.2. MAXIMUM OUTPUT POWER.....	19
5.3. DESCRIPTION OF AVAILABLE ANTENNAS.....	22
5.4. SOFTWARE AND FIRMWARE .....	22
5.5. WORST-CASE CONFIGURATION AND MODE.....	23
5.6. DESCRIPTION OF TEST SETUP .....	24
<b>6. TEST AND MEASUREMENT EQUIPMENT.....</b>	<b>31</b>
<b>7. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS.....</b>	<b>32</b>
7.1. ON TIME AND DUTY CYCLE.....	32
7.2. MEASUREMENT METHODS.....	36
<b>8. ANTENNA PORT TEST RESULTS.....</b>	<b>37</b>
8.1. 802.11a ANTENNA - B MODE IN THE 5.2 GHz BAND .....	37
8.2. 802.11n HT20 ANTENNA - B MODE IN THE 5.2 GHz BAND .....	38
8.2.1. 26 dB BANDWIDTH .....	38
8.2.2. 99% BANDWIDTH.....	41
8.2.3. AVERAGE POWER.....	44
8.2.4. OUTPUT POWER AND PSD .....	45
8.3. 802.11a ANTENNA - A MODE IN THE 5.2 GHz BAND .....	49
8.4. 802.11n HT20 ANTENNA - A MODE IN THE 5.2 GHz BAND .....	50
8.4.1. 26 dB BANDWIDTH .....	50
8.4.2. 99% BANDWIDTH.....	53
8.4.3. AVERAGE POWER.....	56
8.4.4. OUTPUT POWER AND PSD .....	57
8.5. 802.11a ANTENNA - C MODE IN THE 5.2 GHz BAND .....	61
8.6. 802.11n HT20 ANTENNA - C MODE IN THE 5.2 GHz BAND .....	62
8.6.1. 26 dB BANDWIDTH .....	62
8.6.2. 99% BANDWIDTH.....	65
8.6.3. AVERAGE POWER.....	68

8.6.4. OUTPUT POWER AND PSD ..... 69

8.7. 802.11a ANTENNA B+A CDD MODE IN THE 5.2 GHz BAND ..... 73

8.8. 802.11n HT20 ANTENNA B+A CDD MODE IN THE 5.2 GHz BAND ..... 74

8.8.1. 26 dB BANDWIDTH ..... 74

8.8.2. 99% BANDWIDTH ..... 78

8.8.3. AVERAGE POWER ..... 82

8.8.4. OUTPUT POWER AND PSD ..... 83

8.9. 802.11a ANTENNA A+C CDD MODE IN THE 5.2 GHz BAND ..... 89

8.10. 802.11n HT20 ANTENNA A+C CDD MODE IN THE 5.2 GHz BAND ..... 90

8.10.1. 26 dB BANDWIDTH ..... 90

8.10.2. 99% BANDWIDTH ..... 94

8.10.3. AVERAGE POWER ..... 98

8.10.4. OUTPUT POWER AND PSD ..... 99

8.11. 802.11n HT20 ANTENNA B+A STBC MODE IN THE 5.2 GHz BAND ..... 105

8.11.1. 26 dB BANDWIDTH ..... 105

8.11.2. 99% BANDWIDTH ..... 109

8.11.3. AVERAGE POWER ..... 113

8.11.4. OUTPUT POWER AND PSD ..... 114

8.12. 802.11n HT20 ANTENNA A+C STBC MODE IN THE 5.2 GHz BAND ..... 120

8.12.1. 26 dB BANDWIDTH ..... 120

8.12.2. 99% BANDWIDTH ..... 124

8.12.3. AVERAGE POWER ..... 128

8.12.4. OUTPUT POWER AND PSD ..... 129

8.13. 802.11n HT20 ANTENNA B+A SDM MODE IN THE 5.2 GHz BAND ..... 135

8.14. 802.11n HT20 ANTENNA A+C SDM MODE IN THE 5.2 GHz BAND ..... 136

8.15. 802.11n HT40 ANTENNA - B MODE IN THE 5.2 GHz BAND ..... 137

8.15.1. 26 dB BANDWIDTH ..... 137

8.15.2. 99% BANDWIDTH ..... 139

8.15.3. AVERAGE POWER ..... 141

8.15.4. OUTPUT POWER AND PSD ..... 142

8.16. 802.11n HT40 ANTENNA - A MODE IN THE 5.2 GHz BAND ..... 145

8.16.1. 26 dB BANDWIDTH ..... 145

8.16.2. 99% BANDWIDTH ..... 147

8.16.3. AVERAGE POWER ..... 149

8.16.4. OUTPUT POWER AND PSD ..... 150

8.17. 802.11n HT40 ANTENNA - C MODE IN THE 5.2 GHz BAND ..... 153

8.17.1. 26 dB BANDWIDTH ..... 153

8.17.2. 99% BANDWIDTH ..... 155

8.17.3. AVERAGE POWER ..... 157

8.17.4. OUTPUT POWER AND PSD ..... 158

8.18. 802.11n HT40 ANTENNA B+A CDD MODE IN THE 5.2 GHz BAND ..... 161

8.18.1. 26 dB BANDWIDTH ..... 161

8.18.2. 99% BANDWIDTH ..... 164

8.18.3. AVERAGE POWER ..... 167

8.18.4. OUTPUT POWER AND PSD ..... 168

8.19. 802.11n HT40 ANTENNA A+C CDD MODE IN THE 5.2 GHz BAND ..... 173

8.19.1. 26 dB BANDWIDTH ..... 173

8.19.2.	99% BANDWIDTH .....	176
8.19.3.	AVERAGE POWER .....	179
8.19.4.	OUTPUT POWER AND PSD .....	180
8.20.	<i>802.11n HT40 ANTENNA B+A STBC MODE IN THE 5.2 GHz BAND .....</i>	<i>185</i>
8.20.1.	26 dB BANDWIDTH .....	185
8.20.2.	99% BANDWIDTH .....	188
8.20.3.	AVERAGE POWER .....	191
8.20.4.	OUTPUT POWER AND PSD .....	192
8.21.	<i>802.11n HT40 ANTENNA A+C STBC MODE IN THE 5.2 GHz BAND .....</i>	<i>197</i>
8.21.1.	26 dB BANDWIDTH .....	197
8.21.2.	99% BANDWIDTH .....	200
8.21.3.	AVERAGE POWER .....	203
8.21.4.	OUTPUT POWER AND PSD .....	204
8.22.	<i>802.11n HT40 ANTENNA B+A SDM MODE IN THE 5.2 GHz BAND .....</i>	<i>209</i>
8.23.	<i>802.11n HT40 ANTENNA A+C SDM MODE IN THE 5.2 GHz BAND .....</i>	<i>210</i>
8.24.	<i>802.11ac VHT80 ANTENNA - B MODE IN THE 5.2 GHz BAND .....</i>	<i>211</i>
8.24.1.	26 dB BANDWIDTH .....	211
8.24.2.	99% BANDWIDTH .....	212
8.24.3.	AVERAGE POWER .....	213
8.24.4.	OUTPUT POWER AND PSD .....	214
8.25.	<i>802.11ac VHT80 ANTENNA - A MODE IN THE 5.2 GHz BAND .....</i>	<i>217</i>
8.25.1.	26 dB BANDWIDTH .....	217
8.25.2.	99% BANDWIDTH .....	218
8.25.3.	AVERAGE POWER .....	219
8.25.4.	OUTPUT POWER AND PSD .....	220
8.26.	<i>802.11ac VHT80 ANTENNA - C MODE IN THE 5.2 GHz BAND .....</i>	<i>223</i>
8.26.1.	26 dB BANDWIDTH .....	223
8.26.2.	99% BANDWIDTH .....	224
8.26.3.	AVERAGE POWER .....	225
8.26.4.	OUTPUT POWER AND PSD .....	226
8.27.	<i>802.11ac VHT80 ANTENNA B+A CDD MODE IN THE 5.2 GHz BAND .....</i>	<i>229</i>
8.27.1.	26 dB BANDWIDTH .....	229
8.27.2.	99% BANDWIDTH .....	231
8.27.3.	AVERAGE POWER .....	233
8.27.4.	OUTPUT POWER AND PSD .....	234
8.28.	<i>802.11ac VHT80 ANTENNA A+C CDD MODE IN THE 5.2 GHz BAND .....</i>	<i>238</i>
8.28.1.	26 dB BANDWIDTH .....	238
8.28.2.	99% BANDWIDTH .....	240
8.28.3.	AVERAGE POWER .....	242
8.28.4.	OUTPUT POWER AND PSD .....	243
8.29.	<i>802.11ac VHT80 ANTENNA B+A STBC MODE IN THE 5.2 GHz BAND .....</i>	<i>247</i>
8.30.	<i>802.11ac VHT80 ANTENNA A+C STBC MODE IN THE 5.2 GHz BAND .....</i>	<i>248</i>
8.31.	<i>802.11ac VHT80 ANTENNA B+A SDM MODE IN THE 5.2 GHz BAND .....</i>	<i>249</i>
8.32.	<i>802.11ac VHT80 ANTENNA A+C SDM MODE IN THE 5.2 GHz BAND .....</i>	<i>250</i>
8.33.	<i>802.11a ANTENNA - B MODE IN THE 5.3 GHz BAND .....</i>	<i>251</i>
8.34.	<i>802.11n HT20 ANTENNA - B MODE IN THE 5.3 GHz BAND .....</i>	<i>252</i>

8.34.1.	26 dB BANDWIDTH.....	252
8.34.2.	99% BANDWIDTH.....	254
8.34.3.	AVERAGE POWER.....	256
8.34.4.	OUTPUT POWER AND PSD.....	257
8.35.	<i>802.11a ANTENNA - A MODE IN THE 5.3 GHz BAND.....</i>	<i>261</i>
8.36.	<i>802.11n HT20 ANTENNA - A MODE IN THE 5.3 GHz BAND.....</i>	<i>262</i>
8.36.1.	26 dB BANDWIDTH.....	262
8.36.2.	99% BANDWIDTH.....	264
8.36.3.	AVERAGE POWER.....	266
8.36.4.	OUTPUT POWER AND PSD.....	267
8.37.	<i>802.11a ANTENNA - C MODE IN THE 5.3 GHz BAND.....</i>	<i>271</i>
8.38.	<i>802.11n HT20 ANTENNA - C MODE IN THE 5.3 GHz BAND.....</i>	<i>272</i>
8.38.1.	26 dB BANDWIDTH.....	272
8.38.2.	99% BANDWIDTH.....	274
8.38.3.	AVERAGE POWER.....	276
8.38.4.	OUTPUT POWER AND PSD.....	277
8.39.	<i>802.11n HT20 ANTENNA B+A CDD MODE IN THE 5.3 GHz BAND.....</i>	<i>281</i>
8.39.1.	26 dB BANDWIDTH.....	281
8.39.2.	99% BANDWIDTH.....	285
8.39.3.	AVERAGE POWER.....	289
8.39.4.	OUTPUT POWER AND PSD.....	290
8.40.	<i>802.11n HT20 ANTENNA A+C CDD MODE IN THE 5.3 GHz BAND.....</i>	<i>295</i>
8.40.1.	26dB BANDWIDTH.....	295
8.40.2.	99% BANDWIDTH.....	299
8.40.3.	AVERAGE POWER.....	303
8.40.4.	OUTPUT POWER AND PSD.....	304
8.41.	<i>802.11n HT20 ANTENNA B+A STBC MODE IN THE 5.3 GHz BAND.....</i>	<i>309</i>
8.41.1.	26 dB BANDWIDTH.....	309
8.41.2.	99% BANDWIDTH.....	313
8.41.3.	AVERAGE POWER.....	317
8.41.4.	OUTPUT POWER AND PSD.....	318
8.42.	<i>802.11n HT20 ANTENNA A+C STBC MODE IN THE 5.3 GHz BAND.....</i>	<i>323</i>
8.42.1.	26 dB BANDWIDTH.....	323
8.42.2.	99% BANDWIDTH.....	327
8.42.3.	AVERAGE POWER.....	331
8.42.4.	OUTPUT POWER AND PSD.....	332
8.43.	<i>802.11n HT20 ANTENNA B+A SDM MODE IN THE 5.3 GHz BAND.....</i>	<i>337</i>
8.44.	<i>802.11n HT20 ANTENNA A+C SDM MODE IN THE 5.3 GHz BAND.....</i>	<i>338</i>
8.45.	<i>802.11n HT40 ANTENNA - B MODE IN THE 5.3 GHz BAND.....</i>	<i>339</i>
8.45.1.	26 dB BANDWIDTH.....	339
8.45.2.	99% BANDWIDTH.....	341
8.45.3.	AVERAGE POWER.....	343
8.45.4.	OUTPUT POWER AND PSD.....	344
8.46.	<i>802.11n HT40 ANTENNA - A MODE IN THE 5.3 GHz BAND.....</i>	<i>347</i>
8.46.1.	26 dB BANDWIDTH.....	347
8.46.2.	99% BANDWIDTH.....	349
8.46.3.	AVERAGE POWER.....	351

8.46.4.	OUTPUT POWER AND PSD .....	352
8.47.	<i>802.11n HT40 ANTENNA - C MODE IN THE 5.3 GHz BAND</i> .....	355
8.47.1.	26 dB BANDWIDTH.....	355
8.47.2.	99% BANDWIDTH.....	357
8.47.3.	AVERAGE POWER.....	359
8.47.4.	OUTPUT POWER AND PSD.....	360
8.48.	<i>802.11n HT40 ANTENNA B+A CDD MODE IN THE 5.3 GHz BAND</i> .....	363
8.48.1.	26 dB BANDWIDTH.....	363
8.48.2.	99% BANDWIDTH.....	366
8.48.3.	AVERAGE POWER.....	369
8.48.4.	OUTPUT POWER AND PSD.....	370
8.49.	<i>802.11n HT40 ANTENNA A+C CDD MODE IN THE 5.3 GHz BAND</i> .....	374
8.49.1.	26 dB BANDWIDTH.....	374
8.49.2.	99% BANDWIDTH.....	377
8.49.3.	AVERAGE POWER.....	380
8.49.4.	OUTPUT POWER AND PSD.....	381
8.50.	<i>802.11n HT40 ANTENNA B+A STBC MODE IN THE 5.3 GHz BAND</i> .....	385
8.50.1.	26 dB BANDWIDTH.....	385
8.50.2.	99% BANDWIDTH.....	388
8.50.3.	AVERAGE POWER.....	391
8.50.4.	OUTPUT POWER AND PSD.....	392
8.51.	<i>802.11n HT40 ANTENNA A+C STBC MODE IN THE 5.3 GHz BAND</i> .....	396
8.51.1.	26 dB BANDWIDTH.....	396
8.51.2.	99% BANDWIDTH.....	399
8.51.3.	AVERAGE POWER.....	402
8.51.4.	OUTPUT POWER AND PSD.....	403
8.52.	<i>802.11n HT40 ANTENNA B+A SDM MODE IN THE 5.3 GHz BAND</i> .....	407
8.53.	<i>802.11n HT40 ANTENNA A+C SDM MODE IN THE 5.3 GHz BAND</i> .....	408
8.54.	<i>802.11ac VHT80 ANTENNA - B MODE IN THE 5.3 GHz BAND</i> .....	409
8.54.1.	26 dB BANDWIDTH.....	409
8.54.2.	99% BANDWIDTH.....	410
8.54.3.	AVERAGE POWER.....	411
8.54.4.	OUTPUT POWER AND PSD.....	412
8.55.	<i>802.11ac VHT80 ANTENNA - A MODE IN THE 5.3 GHz BAND</i> .....	415
8.55.1.	26 dB BANDWIDTH.....	415
8.55.2.	99% BANDWIDTH.....	416
8.55.3.	AVERAGE POWER.....	417
8.55.4.	OUTPUT POWER AND PSD.....	418
8.56.	<i>802.11ac VHT80 ANTENNA - C MODE IN THE 5.3 GHz BAND</i> .....	421
8.56.1.	26 dB BANDWIDTH.....	421
8.56.2.	99% BANDWIDTH.....	422
8.56.3.	AVERAGE POWER.....	423
8.56.4.	OUTPUT POWER AND PSD.....	424
8.57.	<i>802.11ac VHT80 ANTENNA B+A CDD MODE IN THE 5.3 GHz BAND</i> .....	427
8.57.1.	26 dB BANDWIDTH.....	427
8.57.2.	99% BANDWIDTH.....	429
8.57.3.	AVERAGE POWER.....	431
8.57.4.	OUTPUT POWER AND PSD.....	432

8.58. 802.11ac VHT80 ANTENNA A+C CDD MODE IN THE 5.3 GHz BAND..... 435  
8.58.1. 26 dB BANDWIDTH..... 435  
8.58.2. 99% BANDWIDTH..... 437  
8.58.3. AVERAGE POWER..... 439  
8.58.4. OUTPUT POWER AND PSD..... 440  
8.59. 802.11ac VHT80 ANTENNA B+A STBC MODE IN THE 5.3 GHz BAND ..... 443  
8.60. 802.11ac VHT80 ANTENNA A+C STBC MODE IN THE 5.3 GHz BAND..... 444  
8.61. 802.11ac VHT80 ANTENNA B+A SDM MODE IN THE 5.3 GHz BAND..... 445  
8.62. 802.11ac VHT80 ANTENNA A+C SDM MODE IN THE 5.3 GHz BAND..... 446  
8.63. 802.11a ANTENNA - B MODE IN THE 5.6 GHz BAND..... 447  
8.64. 802.11n HT20 ANTENNA - B MODE IN THE 5.6 GHz BAND..... 448  
8.64.1. 26 dB BANDWIDTH..... 448  
8.64.2. 99% BANDWIDTH..... 451  
8.64.3. AVERAGE POWER..... 454  
8.64.4. OUTPUT POWER AND PSD..... 455  
8.65. 802.11ac VHT20 ANTENNA - B STRADDLE CHANNEL 144 RESULTS..... 459  
8.65.1. 6 dB BANDWIDTH..... 463  
8.66. 802.11a ANTENNA - A MODE IN THE 5.6 GHz BAND..... 464  
8.67. 802.11n HT20 ANTENNA - A MODE IN THE 5.6 GHz BAND..... 465  
8.67.1. 26 dB BANDWIDTH..... 465  
8.67.2. 99% BANDWIDTH..... 468  
8.67.3. AVERAGE POWER..... 471  
8.67.4. OUTPUT POWER AND PSD..... 472  
8.68. 802.11ac VHT20 ANTENNA - A STRADDLE CHANNEL 144 RESULTS..... 476  
8.68.1. 6 dB BANDWIDTH..... 480  
8.69. 802.11a ANTENNA C MODE IN THE 5.6 GHz BAND..... 481  
8.70. 802.11n HT20 ANTENNA - C MODE IN THE 5.6 GHz BAND..... 482  
8.70.1. 26 dB BANDWIDTH..... 482  
8.70.2. 99% BANDWIDTH..... 485  
8.70.3. AVERAGE POWER..... 488  
8.70.4. OUTPUT POWER AND PSD..... 489  
8.71. 802.11ac VHT20 ANTENNA - C STRADDLE CHANNEL 144 RESULTS..... 493  
8.71.1. 6 dB BANDWIDTH..... 497  
8.72. 802.11n HT20 ANTENNA B+A CDD MODE IN THE 5.6 GHz BAND ..... 498  
8.72.1. 26 dB BANDWIDTH..... 498  
8.72.2. 99% BANDWIDTH..... 503  
8.72.3. AVERAGE POWER..... 508  
8.72.4. OUTPUT POWER AND PSD..... 509  
8.73. 802.11ac VHT20 ANTENNA B+A CDD STRADDLE CHANNEL 144 RESULTS ..... 514  
8.73.1. 6 dB BANDWIDTH..... 520  
8.74. 802.11n HT20 ANTENNA A+C CDD MODE IN THE 5.6 GHz BAND..... 522  
8.74.1. 26 dB BANDWIDTH..... 522  
8.74.2. 99% BANDWIDTH..... 527  
8.74.3. AVERAGE POWER..... 532  
8.74.4. OUTPUT POWER AND PSD..... 533



8.75. 802.11ac VHT20 ANTENNA A+C CDD STRADDLE CHANNEL 144 RESULTS ..... 538  
8.75.1. 6 dB BANDWIDTH..... 544

8.76. 802.11n HT20 ANTENNA B+A STBC MODE IN THE 5.6 GHz BAND ..... 546  
8.76.1. 26 dB BANDWIDTH..... 546  
8.76.2. 99% BANDWIDTH..... 551  
8.76.3. AVERAGE POWER..... 556  
8.76.4. OUTPUT POWER AND PSD..... 557

8.77. 802.11ac VHT20 ANTENNA B+A STBC STRADDLE CHANNEL 144 RESULTS ..... 562  
8.77.1. 6 dB BANDWIDTH..... 568

8.78. 802.11n HT20 ANTENNA A+C STBC MODE IN THE 5.6 GHz BAND ..... 570  
8.78.1. 26 dB BANDWIDTH..... 570  
8.78.2. 99% BANDWIDTH..... 575  
8.78.3. AVERAGE POWER..... 580  
8.78.4. OUTPUT POWER AND PSD..... 581

8.79. 802.11ac VHT20 ANTENNA A+C STBC STRADDLE CHANNEL 144 RESULTS ..... 586  
8.79.1. 6 dB BANDWIDTH..... 592

8.80. 802.11n HT20 ANTENNA B+A SDM MODE IN THE 5.6 GHz BAND ..... 594

8.81. 802.11n HT20 ANTENNA A+C SDM MODE IN THE 5.6 GHz BAND..... 595

8.82. 802.11n HT40 ANTENNA - B MODE IN THE 5.6 GHz BAND ..... 596  
8.82.1. 26 dB BANDWIDTH..... 596  
8.82.2. 99% BANDWIDTH..... 599  
8.82.3. AVERAGE POWER..... 602  
8.82.4. OUTPUT POWER AND PSD..... 603

8.83. 802.11ac VHT40 ANTENNA - B STRADDLE CH 142 RESULTS..... 607  
8.83.1. 6 dB BANDWIDTH..... 611

8.84. 802.11n HT40 ANTENNA - A MODE IN THE 5.6 GHz BAND ..... 612  
8.84.1. 26 dB BANDWIDTH..... 612  
8.84.2. 99% BANDWIDTH..... 615  
8.84.3. AVERAGE POWER..... 618  
8.84.4. OUTPUT POWER AND PSD..... 619

8.85. 802.11ac VHT40 ANTENNA - A STRADDLE CH 142 RESULTS..... 623  
8.85.1. 6 dB BANDWIDTH..... 627

8.86. 802.11n HT40 ANTENNA - C MODE IN THE 5.6 GHz BAND..... 628  
8.86.1. 26 dB BANDWIDTH..... 628  
8.86.2. 99% BANDWIDTH..... 631  
8.86.3. AVERAGE POWER..... 634  
8.86.4. OUTPUT POWER AND PSD..... 635

8.87. 802.11ac VHT40 ANTENNA - C STRADDLE CH 142 RESULTS ..... 639  
8.87.1. 6 dB BANDWIDTH..... 643

8.88. 802.11n HT40 ANTENNA B+A CDD MODE IN THE 5.6 GHz BAND ..... 644  
8.88.1. 26 dB BANDWIDTH..... 644  
8.88.2. 99% BANDWIDTH..... 649  
8.88.3. AVERAGE POWER..... 654  
8.88.4. OUTPUT POWER AND PSD..... 655

8.89. 802.11ac VHT40 ANTENNA B+A CDD STRADDLE CHANNEL 142 RESULTS ..... 660  
8.89.1. 6 dB BANDWIDTH..... 666

8.90. 802.11n HT40 ANTENNA A + C CDD MODE IN THE 5.6 GHz BAND ..... 668  
8.90.1. 26 dB BANDWIDTH..... 668  
8.90.2. 99% BANDWIDTH..... 673  
8.90.3. AVERAGE POWER..... 678  
8.90.4. OUTPUT POWER AND PSD..... 679  
8.91. 802.11ac VHT40 ANTENNA A+C CDD STRADDLE CHANNEL 142 RESULTS..... 684  
8.91.1. 6 dB BANDWIDTH..... 690  
8.92. 802.11n HT40 ANTENNA B+A STBC MODE IN THE 5.6 GHz BAND ..... 692  
8.92.1. 26 dB BANDWIDTH..... 692  
8.92.2. 99% BANDWIDTH..... 697  
8.92.3. AVERAGE POWER..... 702  
8.92.4. OUTPUT POWER AND PSD..... 703  
8.93. 802.11ac VHT40 ANTENNA B+A STBC STRADDLE CHANNEL 142 RESULTS ..... 708  
8.93.1. 6 dB BANDWIDTH..... 714  
8.94. 802.11n HT40 ANTENNA A+C STBC MODE IN THE 5.6 GHz BAND ..... 716  
8.94.1. 26 dB BANDWIDTH..... 716  
8.94.2. 99% BANDWIDTH..... 721  
8.94.3. AVERAGE POWER..... 726  
8.94.4. OUTPUT POWER AND PSD..... 727  
8.95. 802.11ac VHT40 ANTENNA A+C STBC STRADDLE CHANNEL 142 RESULTS ..... 732  
8.95.1. 6 dB BANDWIDTH..... 738  
8.96. 802.11n HT40 ANTENNA B+A SDM MODE IN THE 5.6 GHz BAND..... 740  
8.97. 802.11n HT40 ANTENNA A+C SDM MODE IN THE 5.6 GHz BAND..... 741  
8.98. 802.11ac VHT80 ANTENNA - B MODE IN THE 5.6 GHz BAND..... 742  
8.98.1. 26 dB BANDWIDTH..... 742  
8.98.2. 99% BANDWIDTH..... 744  
8.98.3. AVERAGE POWER..... 746  
8.98.4. OUTPUT POWER AND PSD..... 747  
8.98.5. STRADDLE CHANNEL 138 RESULTS..... 750  
8.98.6. 6 dB BANDWIDTH..... 754  
8.99. 802.11ac VHT80 ANTENNA - A MODE IN THE 5.6 GHz BAND..... 755  
8.99.1. 26 dB BANDWIDTH..... 755  
8.99.2. 99% BANDWIDTH..... 757  
8.99.3. AVERAGE POWER..... 759  
8.99.4. OUTPUT POWER AND PSD..... 760  
8.99.5. STRADDLE CHANNEL 138 RESULTS..... 763  
8.99.6. 6 dB BANDWIDTH..... 767  
8.100. 802.11ac VHT80 ANTENNA - C MODE IN THE 5.6 GHz BAND..... 768  
8.100.1. 26 dB BANDWIDTH..... 768  
8.100.2. 99% BANDWIDTH..... 770  
8.100.3. AVERAGE POWER..... 772  
8.100.4. OUTPUT POWER AND PSD..... 773  
8.100.5. STRADDLE CHANNEL 138 RESULTS..... 776  
8.100.6. 6 dB BANDWIDTH..... 780  
8.101. 802.11ac VHT80 ANTENNA B+A CDD MODE IN THE 5.6 GHz BAND..... 781  
8.101.1.1. 26 dB BANDWIDTH..... 781  
8.101.2. 99% BANDWIDTH..... 785  
8.101.3. AVERAGE POWER..... 789

8.101.4.	OUTPUT POWER AND PSD .....	790
8.101.5.	STRADDLE CHANNEL 138 RESULTS.....	795
8.101.6.	6 dB BANDWIDTH.....	801
8.102.	<i>802.11ac VHT80 ANTENNA A+C CDD MODE IN THE 5.6 GHz BAND.....</i>	<i>803</i>
8.102.1.1.	26 dB BANDWIDTH .....	803
8.102.2.	99% BANDWIDTH.....	807
8.102.3.	AVERAGE POWER.....	811
8.102.4.	OUTPUT POWER AND PSD .....	812
8.102.5.	STRADDLE CHANNEL 138 RESULTS.....	817
8.102.6.	6 dB BANDWIDTH.....	823
8.103.	<i>802.11ac VHT80 ANTENNA B+A STBC MODE IN THE 5.6 GHz BAND .....</i>	<i>825</i>
8.104.	<i>802.11ac VHT80 ANTENNA A+C STBC MODE IN THE 5.6 GHz BAND .....</i>	<i>826</i>
8.105.	<i>802.11ac VHT80 ANTENNA B+A SDM MODE IN THE 5.6 GHz BAND.....</i>	<i>827</i>
8.106.	<i>802.11ac VHT80 ANTENNA A+C SDM MODE IN THE 5.6 GHz BAND.....</i>	<i>828</i>
8.107.	<i>802.11a ANTENNA - B MODE IN THE 5.8 GHz BAND.....</i>	<i>829</i>
8.108.	<i>802.11n HT20 ANTENNA - B MODE IN THE 5.8 GHz BAND.....</i>	<i>830</i>
8.108.1.	6 dB BANDWIDTH.....	830
8.108.2.	26 dB BANDWIDTH.....	832
8.108.3.	99% BANDWIDTH.....	834
8.108.4.	AVERAGE POWER.....	836
8.108.5.	OUTPUT POWER.....	837
8.108.6.	PSD .....	839
8.109.	<i>802.11a ANTENNA - A MODE IN THE 5.8 GHz BAND.....</i>	<i>842</i>
8.110.	<i>802.11n HT20 ANTENNA - A MODE IN THE 5.8 GHz BAND.....</i>	<i>843</i>
8.110.1.	6 dB BANDWIDTH.....	843
8.110.2.	26 dB BANDWIDTH.....	845
8.110.3.	99% BANDWIDTH.....	847
8.110.4.	AVERAGE POWER.....	849
8.110.5.	OUTPUT POWER.....	850
8.110.6.	PSD .....	852
8.111.	<i>802.11a ANTENNA - C MODE IN THE 5.8 GHz BAND .....</i>	<i>855</i>
8.112.	<i>802.11n HT20 ANTENNA - C MODE IN THE 5.8 GHz BAND.....</i>	<i>856</i>
8.112.1.	6 dB BANDWIDTH.....	856
8.112.2.	26 dB BANDWIDTH.....	858
8.112.3.	99% BANDWIDTH.....	860
8.112.4.	AVERAGE POWER.....	862
8.112.5.	OUTPUT POWER.....	863
8.112.6.	PSD .....	865
8.113.	<i>802.11n HT20 ANTENNA B + A CDD MODE IN THE 5.8 GHz BAND .....</i>	<i>868</i>
8.113.1.	6 dB BANDWIDTH.....	868
8.113.2.	26 dB BANDWIDTH.....	872
8.113.3.	99% BANDWIDTH.....	876
8.113.4.	AVERAGE POWER.....	880
8.113.5.	OUTPUT POWER.....	881
8.113.6.	PSD .....	883
8.114.	<i>802.11n HT20 ANTENNA A+C CDD MODE IN THE 5.8 GHz BAND.....</i>	<i>888</i>
8.114.1.	6 dB BANDWIDTH.....	888

8.114.2.	26 dB BANDWIDTH.....	892
8.114.3.	99% BANDWIDTH.....	896
8.114.4.	AVERAGE POWER.....	900
8.114.5.	OUTPUT POWER.....	901
8.114.6.	PSD.....	903
8.115.	<i>802.11n HT20 ANTENNA B+A STBC MODE IN THE 5.8 GHz BAND.....</i>	<i>908</i>
8.116.	<i>802.11n HT20 ANTENNA A+C STBC MODE IN THE 5.8 GHz BAND.....</i>	<i>909</i>
8.117.	<i>802.11n HT20 ANTENNA B+A SDM MODE IN THE 5.8 GHz BAND.....</i>	<i>910</i>
8.118.	<i>802.11n HT20 ANTENNA A+C SDM MODE IN THE 5.8 GHz BAND.....</i>	<i>911</i>
8.119.	<i>802.11n HT40 ANTENNA - B MODE IN THE 5.8 GHz BAND.....</i>	<i>912</i>
8.119.1.	6 dB BANDWIDTH.....	912
8.119.2.	26 dB BANDWIDTH.....	914
8.119.3.	99% BANDWIDTH.....	916
8.119.4.	AVERAGE POWER.....	918
8.119.5.	OUTPUT POWER.....	919
8.119.6.	PSD.....	921
8.120.	<i>802.11n HT40 ANTENNA - A MODE IN THE 5.8 GHz BAND.....</i>	<i>924</i>
8.120.1.	6 dB BANDWIDTH.....	924
8.120.2.	26 dB BANDWIDTH.....	926
8.120.3.	99% BANDWIDTH.....	928
8.120.4.	AVERAGE POWER.....	930
8.120.5.	OUTPUT POWER.....	931
8.120.6.	PSD.....	933
8.121.	<i>802.11n HT40 ANTENNA - C MODE IN THE 5.8 GHz BAND.....</i>	<i>936</i>
8.121.1.	6 dB BANDWIDTH.....	936
8.121.2.	26 dB BANDWIDTH.....	938
8.121.3.	99% BANDWIDTH.....	940
8.121.4.	AVERAGE POWER.....	942
8.121.5.	OUTPUT POWER.....	943
8.121.6.	PSD.....	945
8.122.	<i>802.11n HT40 ANTENNA B+A CDD MODE IN THE 5.8 GHz BAND.....</i>	<i>948</i>
8.122.1.	6 dB BANDWIDTH.....	948
8.122.2.	26 dB BANDWIDTH.....	951
8.122.3.	99% BANDWIDTH.....	954
8.122.4.	AVERAGE POWER.....	957
8.122.5.	OUTPUT POWER.....	958
8.122.6.	PSD.....	960
8.123.	<i>802.11n HT40 ANTENNA A+C CDD MODE IN THE 5.8 GHz BAND.....</i>	<i>964</i>
8.123.1.	6 dB BANDWIDTH.....	964
8.123.2.	26 dB BANDWIDTH.....	967
8.123.3.	99% BANDWIDTH.....	970
8.123.4.	AVERAGE POWER.....	973
8.123.5.	OUTPUT POWER.....	974
8.123.6.	PSD.....	976
8.124.	<i>802.11n HT40 ANTENNA B+A STBC MODE IN THE 5.8 GHz BAND.....</i>	<i>980</i>
8.125.	<i>802.11n HT40 ANTENNA A+C STBC MODE IN THE 5.8 GHz BAND.....</i>	<i>981</i>
8.126.	<i>802.11n HT40 ANTENNA B+A SDM MODE IN THE 5.8 GHz BAND.....</i>	<i>982</i>

8.127. 802.11n HT40 ANTENNA A+C SDM MODE IN THE 5.8 GHz BAND..... 983

8.128. 802.11ac VHT80 ANTENNA - B MODE IN THE 5.8 GHz BAND..... 984

8.128.1. 6 dB BANDWIDTH..... 984

8.128.2. 26 dB BANDWIDTH..... 985

8.128.3. 99% BANDWIDTH..... 986

8.128.4. AVERAGE POWER..... 987

8.128.5. OUTPUT POWER..... 988

8.128.6. PSD..... 990

8.129. 802.11ac VHT80 ANTENNA - A MODE IN THE 5.8 GHz BAND..... 992

8.129.1. 6 dB BANDWIDTH..... 992

8.129.2. 26 dB BANDWIDTH..... 993

8.129.3. 99% BANDWIDTH..... 994

8.129.4. AVERAGE POWER..... 995

8.129.5. OUTPUT POWER..... 996

8.129.6. PSD..... 998

8.130. 802.11ac VHT80 ANTENNA - C MODE IN THE 5.8 GHz BAND..... 1000

8.130.1. 6 dB BANDWIDTH..... 1000

8.130.2. 26 dB BANDWIDTH..... 1001

8.130.3. 99% BANDWIDTH..... 1002

8.130.4. AVERAGE POWER..... 1003

8.130.5. OUTPUT POWER..... 1004

8.130.6. PSD..... 1006

8.131. 802.11ac VHT80 ANTENNA B + A CDD MODE IN THE 5.8 GHz BAND..... 1008

8.131.1. 6 dB BANDWIDTH..... 1008

8.131.2. 26 dB BANDWIDTH..... 1010

8.131.3. 99% BANDWIDTH..... 1012

8.131.4. AVERAGE POWER..... 1014

8.131.5. OUTPUT POWER..... 1015

8.131.6. PSD..... 1017

8.132. 802.11ac VHT80 ANTENNA A + C CDD MODE IN THE 5.8 GHz BAND..... 1020

8.132.1. 6 dB BANDWIDTH..... 1020

8.132.2. 26 dB BANDWIDTH..... 1022

8.132.3. 99% BANDWIDTH..... 1024

8.132.4. AVERAGE POWER..... 1026

8.132.5. OUTPUT POWER..... 1027

8.132.6. PSD..... 1029

8.133. 802.11ac VHT80 ANTENNA B+A STBC MODE IN THE 5.8 GHz BAND..... 1032

8.134. 802.11ac VHT80 ANTENNA A+C STBC MODE IN THE 5.8 GHz BAND..... 1033

8.135. 802.11ac VHT80 ANTENNA B+A SDM MODE IN THE 5.8 GHz BAND..... 1034

8.136. 802.11ac VHT80 ANTENNA A+C SDM MODE IN THE 5.8 GHz BAND..... 1035

**9. RADIATED TEST RESULTS ..... 1036**

9.1. LIMITS AND PROCEDURE..... 1036

9.2. 802.11n HT20 1Tx MODE IN THE 5.2 GHz BAND..... 1037

9.3. 802.11n HT20 2Tx CDD MODE IN THE 5.2 GHz BAND..... 1061

9.4. 802.11n HT40 1Tx MODE IN THE 5.2 GHz BAND..... 1077

9.5.	802.11n HT40 2Tx CDD MODE IN THE 5.2 GHz BAND .....	1095
9.6.	802.11ac VHT80 1Tx MODE IN THE 5.2 GHz BAND.....	1107
9.7.	802.11ac VHT80 2Tx CDD MODE IN THE 5.2 GHz BAND .....	1119
9.8.	802.11n HT20 1Tx MODE IN THE 5.3 GHz BAND.....	1127
9.9.	802.11n HT20 2Tx CDD MODE IN THE 5.3 GHz BAND .....	1151
9.10.	802.11n HT40 1Tx MODE IN THE 5.3 GHz BAND .....	1167
9.11.	802.11n HT40 2Tx CDD MODE IN THE 5.3 GHz BAND.....	1185
9.12.	802.11ac VHT80 1Tx MODE IN THE 5.3 GHz BAND .....	1197
9.13.	802.11ac VHT80 2Tx CDD MODE IN THE 5.3 GHz BAND.....	1209
9.14.	802.11n HT20 1Tx MODE IN THE 5.6 GHz BAND .....	1217
9.15.	802.11n HT20 2Tx CDD MODE IN THE 5.6 GHz BAND.....	1253
9.16.	802.11n HT40 1Tx MODE IN THE 5.6 GHz BAND .....	1277
9.17.	802.11n HT40 2Tx CDD MODE IN THE 5.6 GHz BAND.....	1313
9.18.	802.11ac VHT80 1Tx MODE IN THE 5.6 GHz BAND .....	1337
9.19.	802.11ac VHT80 2Tx CDD MODE IN THE 5.6 GHz BAND.....	1361
9.20.	802.11n HT20 1Tx MODE IN THE 5.8 GHz BAND .....	1377
9.21.	802.11n HT20 2Tx CDD MODE IN THE 5.8 GHz BAND.....	1407
9.22.	802.11n HT40 1Tx MODE IN THE 5.8 GHz BAND .....	1427
9.23.	802.11n HT40 2Tx CDD MODE IN THE 5.8 GHz BAND.....	1451
9.24.	802.11ac VHT80 1Tx MODE IN THE 5.8 GHz BAND .....	1467
9.25.	802.11ac VHT80 2Tx CDD MODE IN THE 5.8 GHz BAND.....	1485
9.26.	WORST-CASE BELOW 1 GHz.....	1497
9.27.	WORST-CASE ABOVE 18 GHz .....	1499
<b>10.</b>	<b>AC POWER LINE CONDUCTED EMISSIONS .....</b>	<b>1503</b>
10.1.	EUT POWERED BY AC ADAPTER.....	1504
10.2.	EUT POWERED BY HOST PC VIA USB CABLE .....	1506
<b>11.</b>	<b>DYNAMIC FREQUENCY SELECTION.....</b>	<b>1508</b>
11.1.	OVERVIEW .....	1508
11.1.1.	LIMITS.....	1508
11.1.2.	TEST AND MEASUREMENT SYSTEM .....	1512
11.1.3.	SETUP OF EUT (CLIENT MODE) .....	1515
11.1.4.	SETUP OF EUT (CLIENT-TO-CLIENT COMMUNICATIONS MODE).....	1516
11.1.5.	DESCRIPTION OF EUT .....	1517
11.2.	CLIENT MODE RESULTS FOR 20 MHz BANDWIDTH .....	1519
11.2.1.	TEST CHANNEL.....	1519
11.2.2.	RADAR WAVEFORM AND TRAFFIC .....	1519
11.2.3.	OVERLAPPING CHANNEL TESTS .....	1522
11.2.4.	MOVE AND CLOSING TIME .....	1522

---

11.3.	<i>CLIENT MODE RESULTS FOR 40 MHz BANDWIDTH</i>	1526
11.3.1.	TEST CHANNEL	1526
11.3.2.	RADAR WAVEFORM AND TRAFFIC	1526
11.3.3.	OVERLAPPING CHANNEL TESTS	1529
11.3.4.	MOVE AND CLOSING TIME	1529
11.3.5.	10-MINUTE CLIENT Tx MONITORING PERIOD	1533
11.4.	<i>CLIENT-TO-CLIENT COMMUNICATIONS MODE RESULTS FOR 20 MHz BANDWIDTH</i>	1534
11.4.1.	TEST CHANNEL	1534
11.4.2.	RADAR WAVEFORM AND TRAFFIC	1534
11.4.3.	OVERLAPPING CHANNEL TESTS	1537
11.4.4.	MOVE AND CLOSING TIME	1537
11.5.	<i>CLIENT-TO-CLIENT COMMUNICATIONS MODE RESULTS FOR 40 MHz BANDWIDTH</i>	1541
11.5.1.	TEST CHANNEL	1541
11.5.2.	RADAR WAVEFORM AND TRAFFIC	1541
11.5.3.	OVERLAPPING CHANNEL TESTS	1544
11.5.4.	MOVE AND CLOSING TIME	1544
11.5.5.	10-MINUTE CLIENT Tx MONITORING PERIOD	1548
<b>12.</b>	<b>SETUP PHOTOS</b>	<b>1549</b>

# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** APPLE, INC.  
1 INFINITE LOOP  
CUPERTINO, CA 95014, U.S.A.

**EUT DESCRIPTION:** TABLET DEVICE

**MODEL:** A1673

**SERIAL NUMBER:** RADIATED (DLXQV00RH36D) & CONDUCTED (DLXQT001H35T)  
DFS (DLXQT005H35Y)

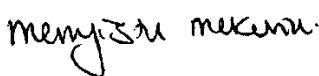
**DATE TESTED:** NOVEMBER 4, 2015 – FEBRUARY 11, 2016

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart E	Pass

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For  
UL Verification Services Inc. By:



MENGISTU MEKURIA  
SENIOR ENGINEER  
UL VERIFICATION SERVICES INC.

Tested By:



ERIC YU  
EMC ENGINEER  
UL VERIFICATION SERVICES INC.



## 2. TEST METHODOLOGY

FCC: The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 14-30, FCC KDB 662911 D01 v02r01, FCC KDB 905462 D02 v01r02/D03 v01r01/D06 v01, FCC KDB 789033 D02 v01r01, FCC KDB 644545 D03 v01, ANSI C63.10-2013.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
<input type="checkbox"/> Chamber A	<input checked="" type="checkbox"/> Chamber D
<input type="checkbox"/> Chamber B	<input checked="" type="checkbox"/> Chamber E
<input type="checkbox"/> Chamber C	<input type="checkbox"/> Chamber F
	<input checked="" type="checkbox"/> Chamber G
	<input type="checkbox"/> Chamber H

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers A through H are covered under Industry Canada company address code 2324B with site numbers 2324B -1 through 2324B-8, respectively.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2000650.htm>.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable} \\ &\text{Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

### 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	± 3.52 dB
Radiated Disturbance, 30 to 1000 MHz	± 4.94 dB
Radiated Disturbance, 1 to 6 GHz	± 3.86 dB
Radiated Disturbance, 6 to 18 GHz	± 4.23 dB
Radiated Disturbance, 18 to 26 GHz	± 5.30 dB
Radiated Disturbance, 26 to 40 GHz	± 5.23 dB

Uncertainty figures are valid to a confidence level of 95%.

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is a tablet with multimedia functions (music, application support, and video), IEEE 802.11a/b/g/n/ac radio, and Bluetooth radio. The rechargeable battery is not user accessible.

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

NOTE: Covered modes are test reduction modes. The output powers on the “covered modes are equal to or less than the mode referenced and use the same modulation.

#### 5.2GHz Band

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5180 - 5240	802.11a	Covered by 802.11n HT20 SISO	
	802.11n HT20 SISO	16.98	49.89
	802.11a 2TX CDD	Covered by 802.11n HT20 2TX CDD	
	802.11n HT20 2TX CDD	18.99	79.25
	802.11n HT20 2TX STBC	19.97	99.31
	802.11n HT20 2TX SDM	Covered by 802.11n HT20 2TX STBC	
5190 - 5230	802.11n HT40 SISO	16.97	49.77
	802.11n HT40 2TX CDD	18.92	77.98
	802.11n HT40 2TX STBC	19.92	98.17
	802.11n HT40 2TX SDM	Covered by 802.11n HT40 2TX STBC	
5210	802.11ac VHT80 SISO	13.50	22.39
	802.11ac VHT80 2TX CDD	14.94	31.19
	802.11ac VHT80 2TX STBC	Covered by 802.11ac VHT80 2TX CDD	
	802.11ac VHT80 2TX SDM	Covered by 802.11ac VHT80 2TX CDD	

#### 5.3GHz Band

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5260 - 5320	802.11a	Covered by 802.11n HT20 SISO	
	802.11n HT20 SISO	17.46	55.72
	802.11n HT20 2TX CDD	18.97	78.89
	802.11n HT20 2TX STBC	19.97	99.31
	802.11n HT20 2TX SDM	Covered by 802.11n HT20 2TX STBC	
5270 - 5310	802.11n HT40 SISO	17.31	53.83
	802.11n HT40 2TX CDD	18.98	79.07
	802.11n HT40 2TX STBC	20.00	100.00
	802.11n HT40 2TX SDM	Covered by 802.11n HT40 2TX STBC	
5290	802.11ac VHT80 SISO	13.50	22.39
	802.11ac VHT80 2TX CDD	15.00	31.62
	802.11ac VHT80 2TX STBC	Covered by 802.11ac VHT80 2TX CDD	
	802.11ac VHT80 2TX SDM	Covered by 802.11ac VHT80 2TX CDD	

**5.6GHz Band**

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5500 - 5700	802.11a	Covered by 802.11n HT20 SISO	
5720	802.11a (based on UNII-2C band output power)	Covered by 802.11n HT20 SISO	
5500 - 5700	802.11n HT20 SISO	16.45	44.16
5720	802.11ac VHT20 SISO (based on UNII-2C band output power)	15.36	34.36
5500 - 5700	802.11a 2TX CDD	Covered by 802.11n HT20 2TX CDD	
5500 - 5700	802.11n HT20 2TX CDD	18.01	63.24
5720	802.11ac VHT20 2TX CDD (based on UNII-2C band output power)	16.87	48.64
5500 - 5700	802.11n HT20 2TX STBC	19.25	84.14
5720	802.11ac VHT20 2TX STBC (based on UNII-2C band output power)	18.02	63.39
5500 - 5700	802.11n HT20 2TX SDM	Covered by 802.11n HT20 2TX STBC	
5720	802.11ac VHT20 2TX SDM (based on UNII-2C band output power)	Covered by 802.11ac VHT20 2TX STBC	
5510 - 5670	802.11n HT40 SISO	16.47	44.36
5710	802.11ac VHT40 (based on UNII-2C band output power)	15.93	39.17
5510 - 5670	802.11n HT40 2TX CDD	17.99	62.95
5710	802.11ac VHT40 2TX CDD (based on UNII-2C band output power)	17.43	55.34
5510 - 5670	802.11n HT40 2TX STBC	19.19	82.99
5710	802.11ac VHT40 2TX STBC (based on UNII-2C band output power)	18.55	71.61
5510 - 5670	802.11n HT40 2TX SDM	Covered by 802.11n HT40 2TX STBC	
5710	802.11ac VHT40 2TX SDM (based on UNII-2C band output power)	Covered by 802.11ac VHT40 2TX STBC	
5530-5610	802.11ac VHT80 SISO	16.42	43.85
5690	802.11ac VHT80 SISO (based on UNII-2C band output power)	16.19	41.59
5530-5610	802.11ac VHT80 2TX CDD	19.23	83.75
5690	802.11ac VHT80 2TX CDD (based on UNII-2C band output power)	19.17	82.60
5530-5610	802.11ac VHT80 2TX STBC	Covered by 802.11ac VHT80 CDD 2TX	
5690	802.11ac VHT80 2TX STBC (based on UNII-2C band output power)	Covered by 802.11ac VHT80 CDD 2TX	
5530-5610	802.11ac VHT80 2TX SDM	Covered by 802.11ac VHT80 CDD 2TX	
5690	802.11ac VHT80 2TX SDM (based on UNII-2C band output power)	Covered by 802.11ac VHT80 CDD 2TX	

**5.8GHz Band**

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5745 - 5825	802.11a	Covered by 802.11n HT20 SISO	
5745 - 5825	802.11n HT20 SISO	17.39	54.83
5745 - 5825	802.11a 2TX CDD	Covered by 802.11n HT20 2TX CDD	
5745 - 5825	802.11n HT20 2TX CDD	19.97	99.31
5745 - 5825	802.11n HT20 2TX STBC	Covered by 802.11n HT20 2TX CDD	
5745 - 5825	802.11n HT20 2TX SDM	Covered by 802.11n HT20 2TX CDD	
5755 - 5795	802.11n HT40 SISO	16.43	43.95
5755 - 5795	802.11n HT40 2TX CDD	18.42	69.50
5755 - 5795	802.11n HT40 2TX STBC	Covered by 802.11n HT40 2TX CDD	
5755 - 5795	802.11n HT40 2TX SDM	Covered by 802.11n HT40 2TX CDD	
5775	802.11ac VHT80 SISO	13.49	22.34
5775	802.11ac VHT80 2TX CDD	15.96	39.45
5775	802.11ac VHT80 2TX STBC	Covered by 802.11ac VHT80 2TX CDD	
5775	802.11ac VHT80 2TX SDM	Covered by 802.11ac VHT80 2TX CDD	

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Band (GHz)	Antenna Gain(dBi)		
	Antenna B	Antenna C	Antenna A
5.2	3.04	1.36	2.30
5.3	3.02	2.12	2.23
5.5	2.83	4.16	4.03
5.8	2.42	3.92	4.16

### 5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 13E31820k.

### 5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

For SISO modes, there are three transmission antennas. The antenna used in any given time can be either Antenna B, Antenna C or Antenna A. on the other hand, for MIMO modes, either Antenna B and Antenna A or Antenna C and Antenna A can be used at the same time.

The fundamental of the EUT was investigated in three orthogonal orientations X (Flatbed), Y (Landscape), and Z (Portrait), that was determined was worst-case orientations (see table below). Therefore, all final radiated testing was performed with the EUT in those (see table below) orientation.

Frequency Band (GHz)	Mode	Antenna Port	Worst-case Orientation
5.2-5.8	1TX SISO	Antenna B	Y-Landscape
		Antenna C	Y-Landscape
		Antenna A	Y-Landscape
	2TX MIMO	Antenna B + Antenna A	Z-Portrait
		Antenna A + Antenna C	Z-Portrait

Worst-case data rates as provided by the client were:

- 802.11a mode: 6 Mbps
- 802.11n HT20 mode: MCS0
- 802.11n HT40 mode: MCS0
- 802.11ac VHT20 mode: MCS0
- 802.11ac VHT40 mode: MCS0
- 802.11ac VHT80 mode: MCS0

802.11ac VHT20 and VHT40 mode are different from 802.11nHT20 and HT40 only in control messages and have the same power settings.

There are two vendors of the WiFi/Bluetooth radio modules: variant 1 and variant 2. The Wi-Fi/Bluetooth radio modules have the same mechanical outline (e.g., the same package dimension and pin-out layout), use the same on-board antenna matching circuit, have an identical antenna structure, and are built and tested to conform to the same specifications and to operate within the same tolerances.

Baseline testing was performed on the two variants to determine the worst case on all conducted power and radiated emissions.

For simultaneous transmission of multiple channels from the same antenna in the 2.4GHz and 5GHz bands, tests were conducted for various configurations having the highest power. No noticeable new emission was found.

The following configurations were investigated on AC line conducted test.

Configuration	Descriptions
1	EUT powered by AC/DC adapter via USB cable
2	EUT powered by host PC via USB cable

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Apple	MacBook Pro	73043BDQAGU	N/A
Laptop AC/DC adapter	Apple	A1172	MV7211FJAX4XA	N/A
Earphone	Apple	NA	NA	N/A
EUT AC/DC adapter	Apple	A1357	W010A051	N/A

### I/O CABLES (CONDUCTED TEST)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Antenna	1	SMA	Un-Shielded	0.2	To spectrum Analyzer
2	USB	1	USB	Shielded	1	N/A
3	AC	1	AC	Un-shielded	3	N/A

### I/O CABLES (RADIATED ABOVE 1 GHZ)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
None Used						

### I/O CABLES (RADIATED BELOW 1 GHZ)

I/O Cable List						
Cable No	Port	# of identical	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Headphones Jack	1	3.5mm Audio	Shielded	0.9	N/A
2	AC	1	AC	Un-shielded	3	N/A

### I/O CABLES (AC LINE CONDUCTED: AC/DC ADAPTER)

I/O Cable List						
Cable No	Port	# of identical	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Headphones Jack	1	3.5mm Audio	Shielded	0.9	N/A
2	AC	1	AC	Un-shielded	3	N/A



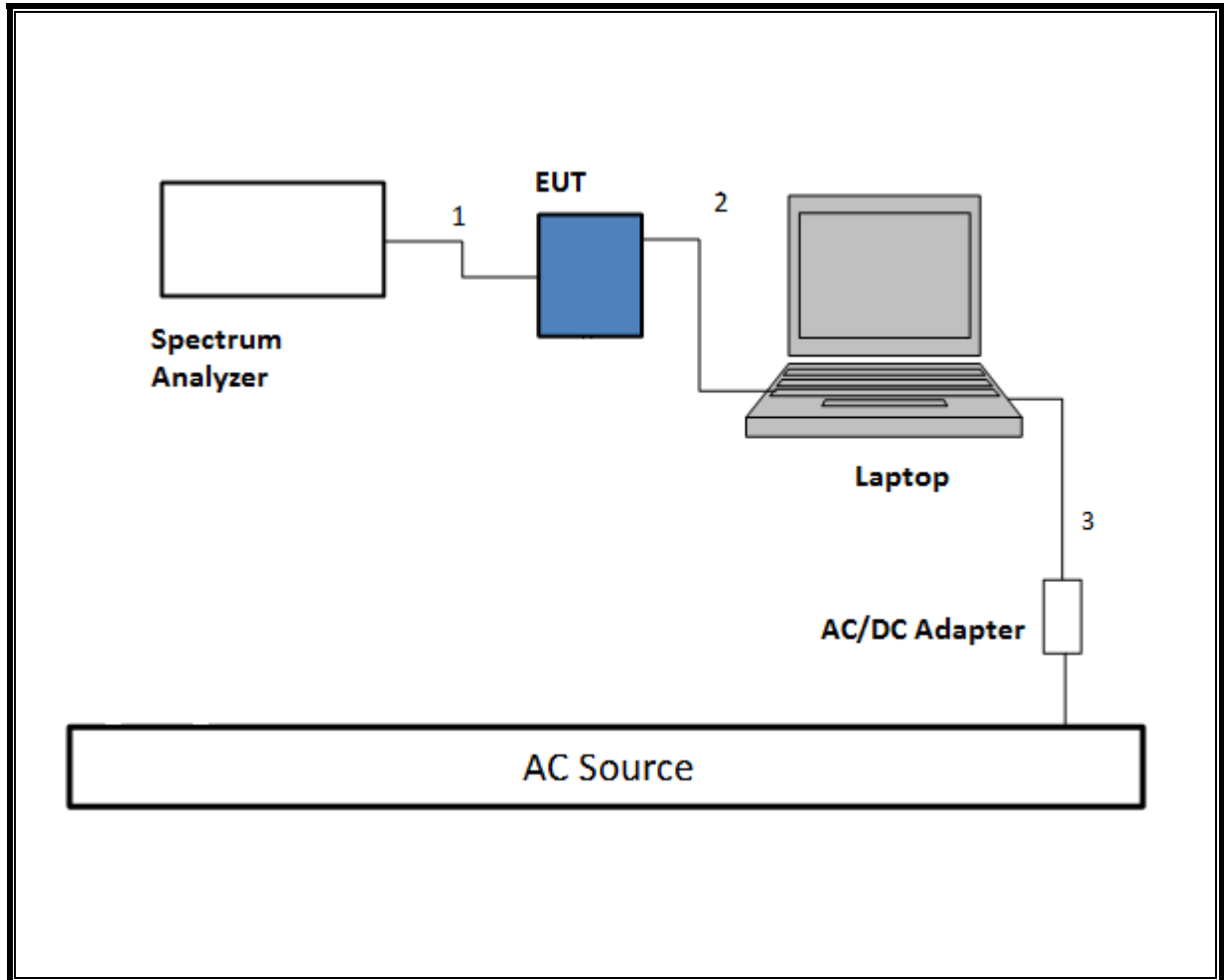
**I/O CABLES (AC LINE CONDUCTED: LAPTOP CONFIGUARTION)**

<b>I/O Cable List</b>						
<b>Cable No</b>	<b>Port</b>	<b># of identical</b>	<b>Connector Type</b>	<b>Cable Type</b>	<b>Cable Length (m)</b>	<b>Remarks</b>
1	Headphones Jack	1	3.5mm Audio	Shielded	0.9	N/A
2	USB	1	USB	Shielded	1	N/A
3	AC	1	AC	Un-shielded	3	N/A

**TEST SETUP - CONDUCTED TESTS**

The EUT was tested connected to a host Laptop via USB cable adapter and spectrum analyzer to antenna port. Test software exercised the EUT.

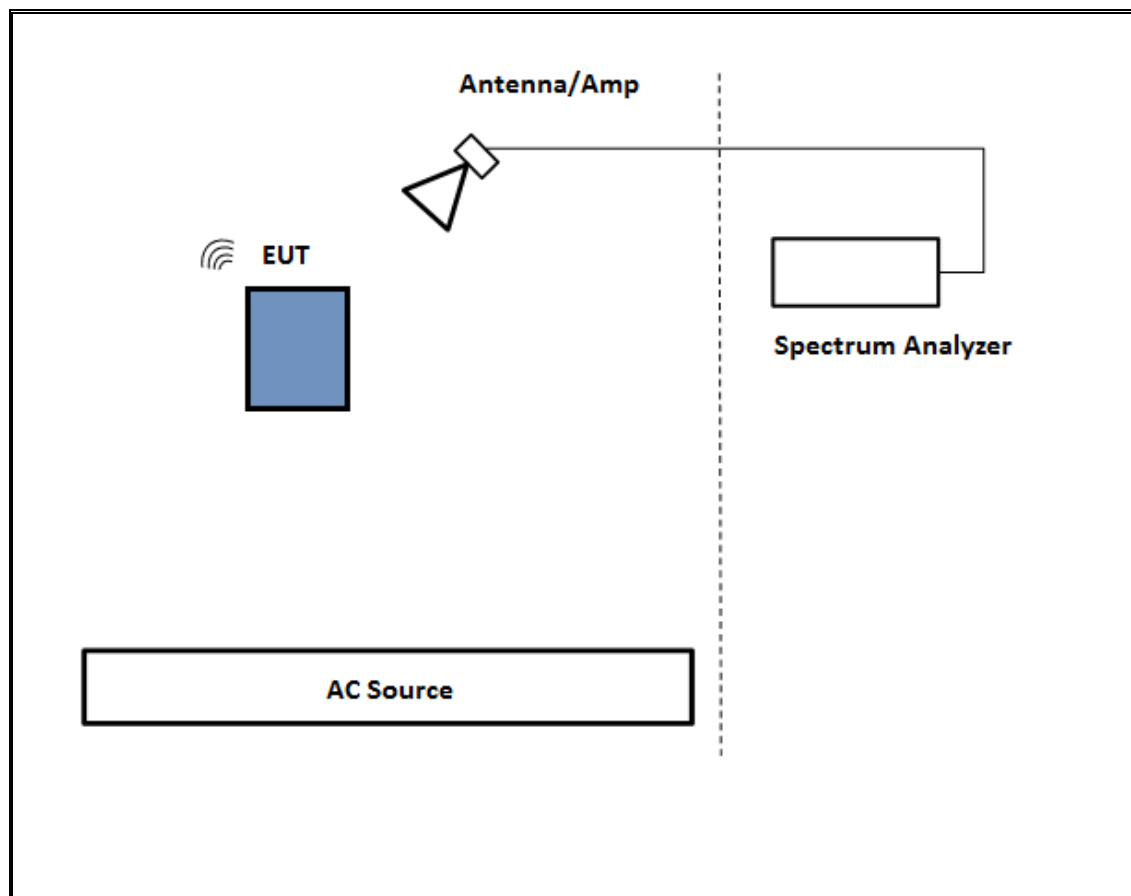
**SETUP DIAGRAM**



**TEST SETUP- RADIATED-ABOVE 1 GHZ**

The EUT was tested battery powered. Test software exercised the EUT.

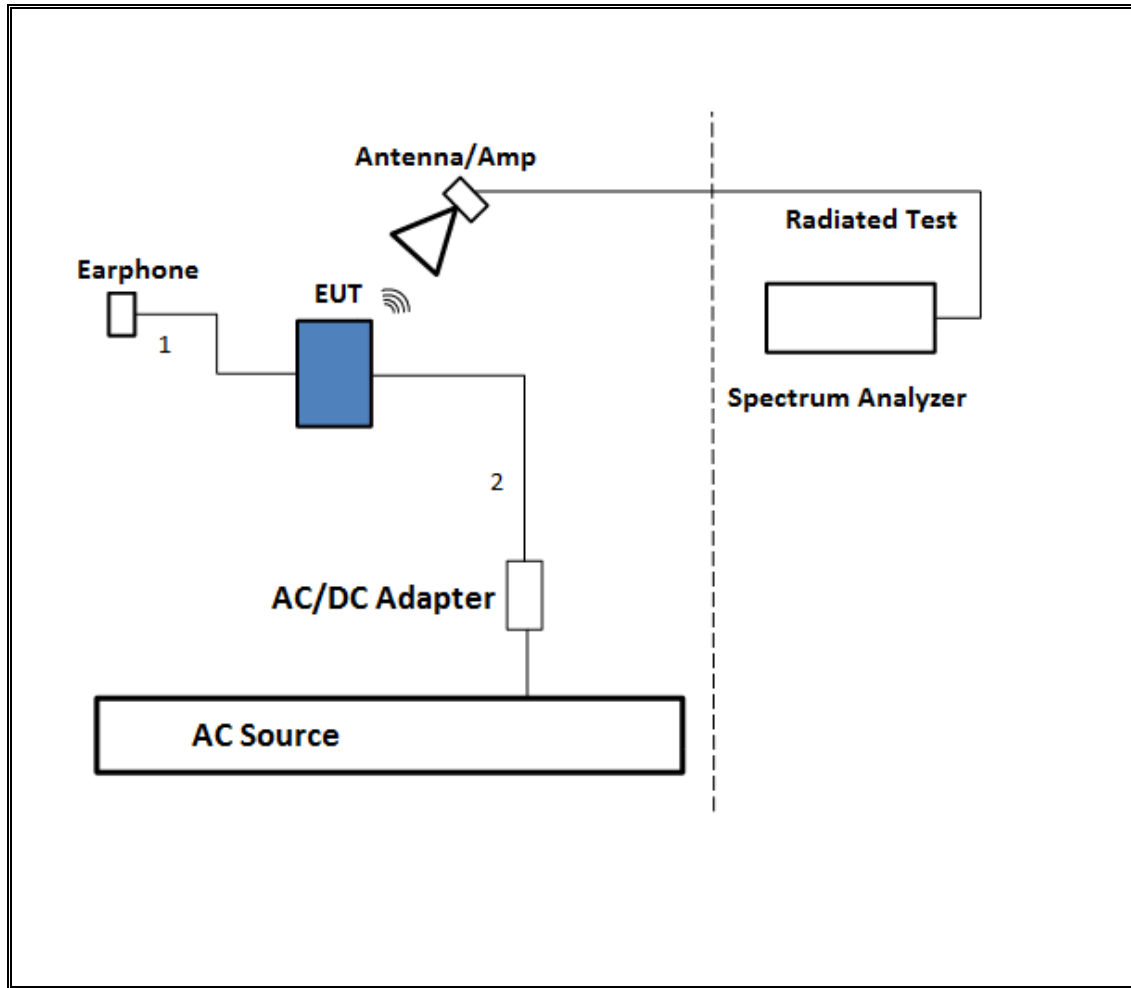
**SETUP DIAGRAM**



**TEST SETUP- BELOW 1GHz**

The EUT was tested with earphone connected and powered by AC adapter. Test software exercised the EUT.

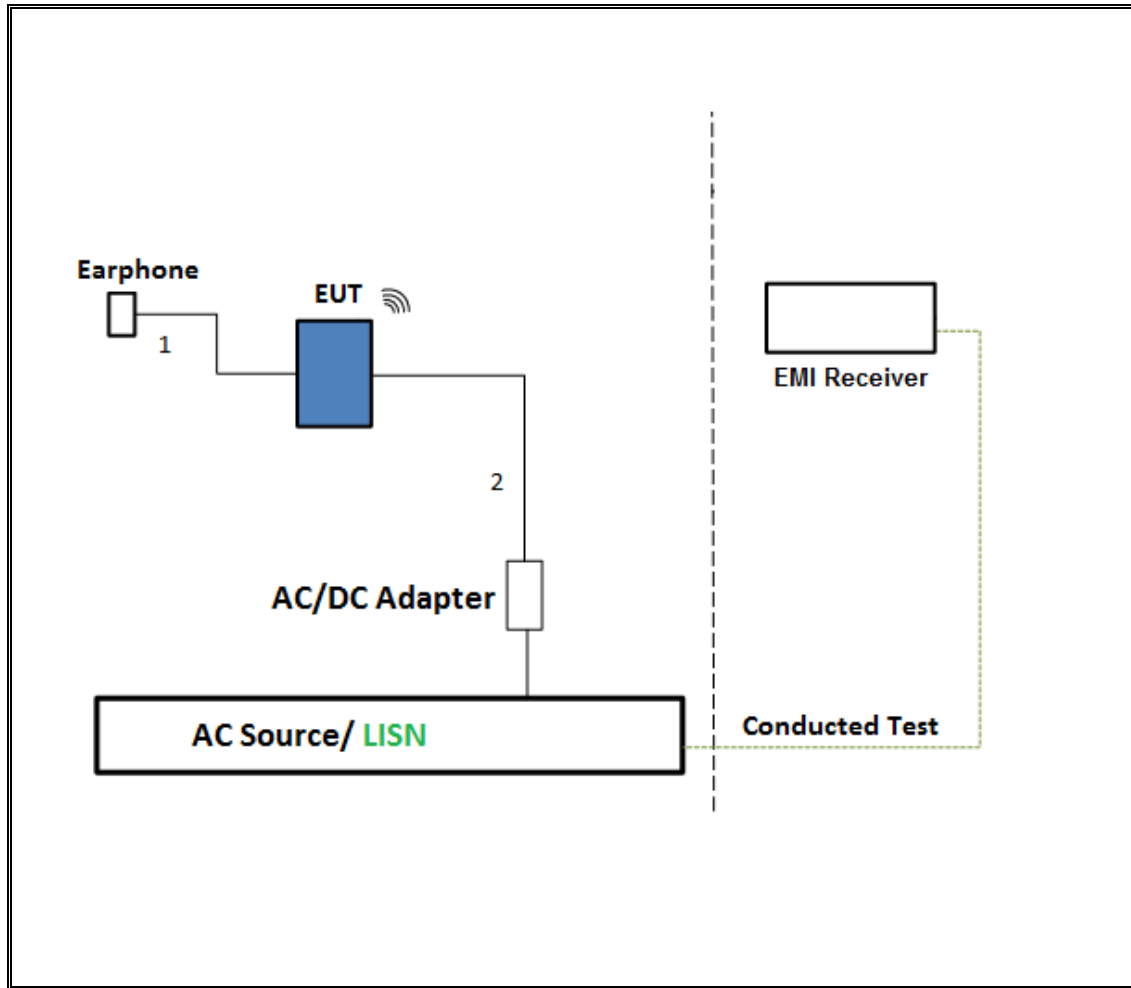
**SETUP DIAGRAM**



**TEST SETUP- AC LINE CONDUCTED: AC/DC ADAPTER**

The EUT was tested with earphone connected and powered by AC/DC adapter via USB cable. Test software exercised the EUT.

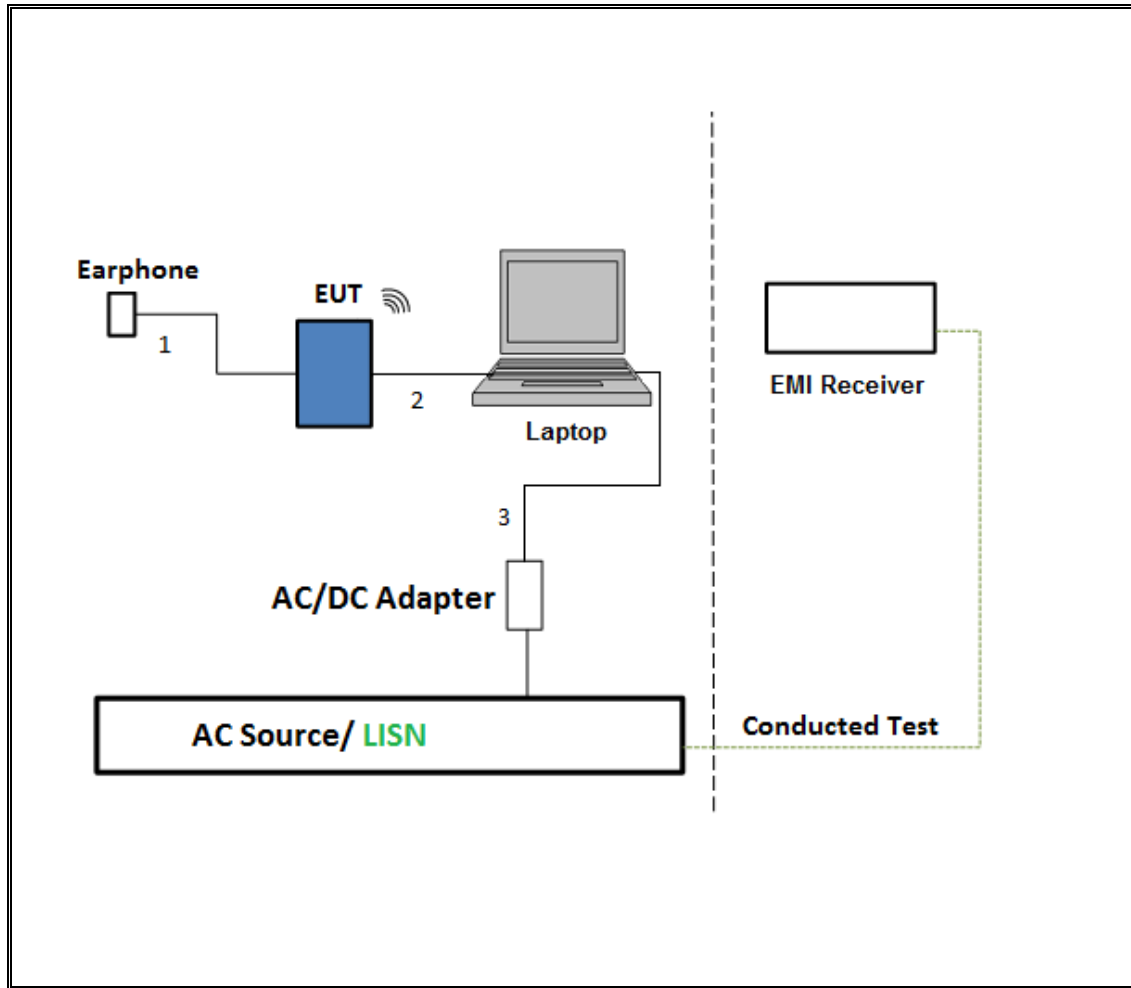
**SETUP DIAGRAM**



**TEST SETUP- AC LINE CONDUCTED: LAPTOP CONFIGURATION**

The EUT was tested with earphone connected and powered by host PC via USB cable. Test software exercised the EUT.

**SETUP DIAGRAM**



## 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List				
Description	Manufacturer	Model	Asset	Cal Due
Antenna, Horn 1-18GHz	ETS Lindgren	3117	00165318	4/10/2016
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB3	A022813-2	3/5/2016
Amplifier, 1 - 18GHz	Miteq	AFS42-00101800-25-S-42	1818464	4/25/2016
Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	323562	5/7/2016
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent	N9030A	MY53310972	3/31/2016
Antenna, Horn 1-18GHz	ETS Lindgren	3117	29310	3/26/2016
Amplifier, 1 - 18GHz	Miteq	AFS42-00101800-25-S-42	1818466	7/23/2016
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent	N9030A	MY51380911	10/15/2016
Antenna, Horn 1-18GHz	ETS Lindgren	3117	165318	4/10/2016
Amplifier, 1 - 18GHz	Miteq	AFS42-00101800-25-S-42	1818464	4/25/2016
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent	N9030A	MY53311010	5/26/2016
Power Meter, P-series single channel	Agilent	N1911A	MY53060011	4/7/2016
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Agilent	N1921A	MY53020038	3/5/2016
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826	209336	5/12/2016
Horn Antenna, 40GHz	ARA	MWH-2640/B	1029	7/28/2016
Spectrum Analyzer, 40 GHz	Agilent	8564E	3943A01643	8/14/2016
Amplifier, 26 - 40GHz	Miteq	NSP4000-SP2	924343	4/7/2016
Amplifier, 1 to 26.5GHz, 23.5dB Gain minimum	Agilent	8449B	3008A04710	6/29/2016
AC Line Conducted				
EMI Test Receiver 9KHz-7GHz	Rohde & Schwarz	ESCI7	100935	9/16/2016
**LISN for Conducted Emissions CISPR-16	FCC	50/250-25-2	114	1/16/2016
LISN for Conducted Emissions CISPR-16	Fischer	50/250-25-2	161124	9/16/2016
Power Cable, Line Conducted Emissions	UL	PG1	7/28/2015	7/28/2016
UL SOFTWARE				
* Radiated Software	UL	UL EMC	Ver 9.5, July 22, 2014	
* Conducted Software	UL	UL EMC	Ver 2.2, March 31, 2015	

Note: \* indicates automation software version used in the compliance certification testing  
 \*\*testing is completed before equipment calibration expiration date.

## 7. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

### 7.1. ON TIME AND DUTY CYCLE

#### LIMITS

None; for reporting purposes only.

#### PROCEDURE

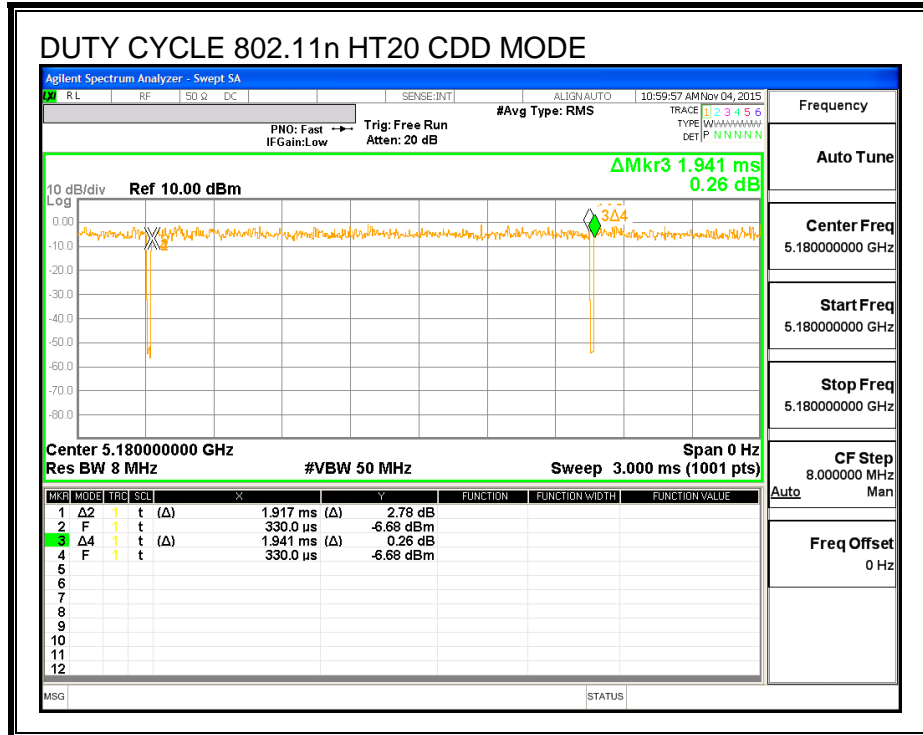
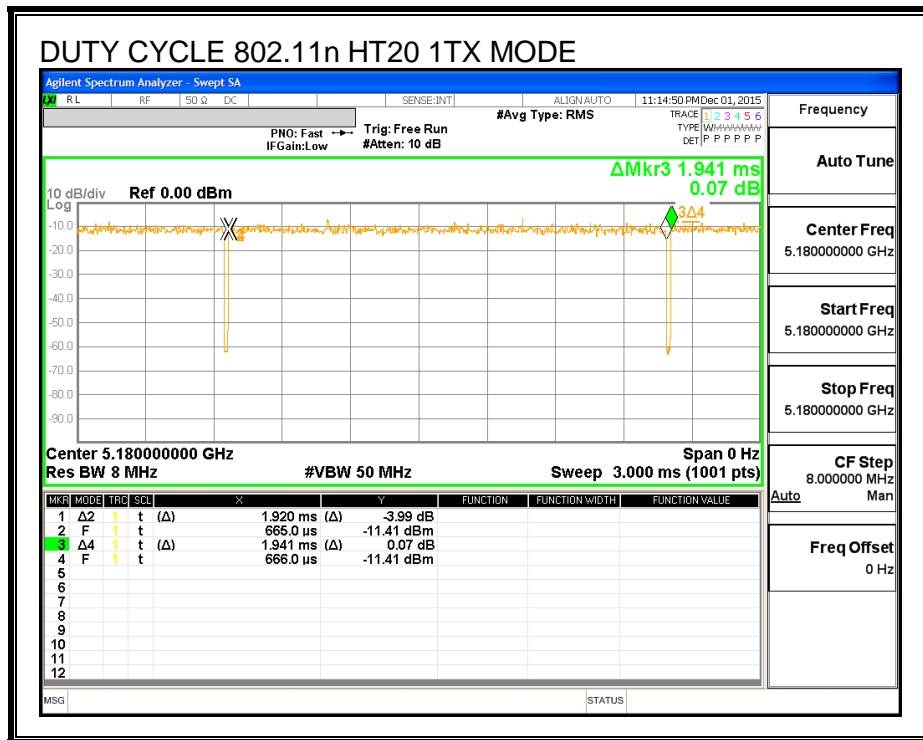
KDB 789033 Zero-Span Spectrum Analyzer Method.

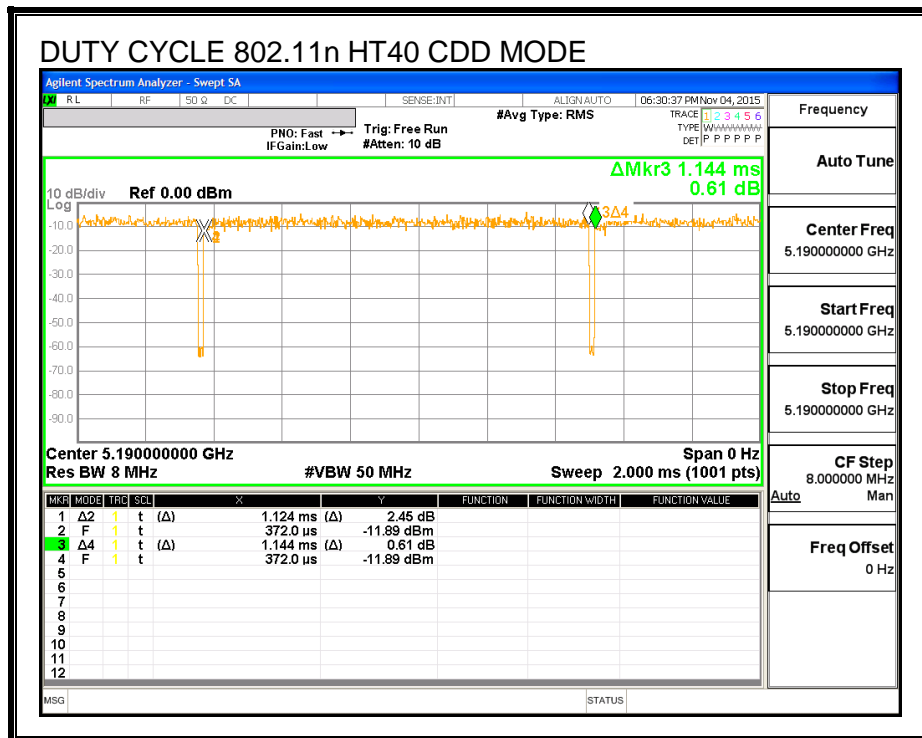
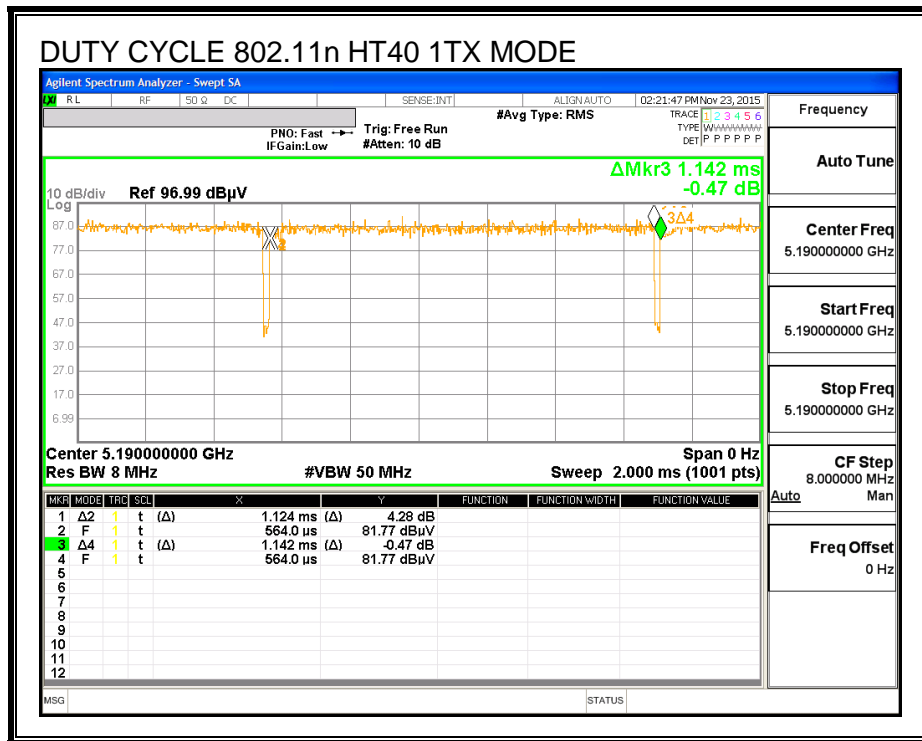
#### RESULTS

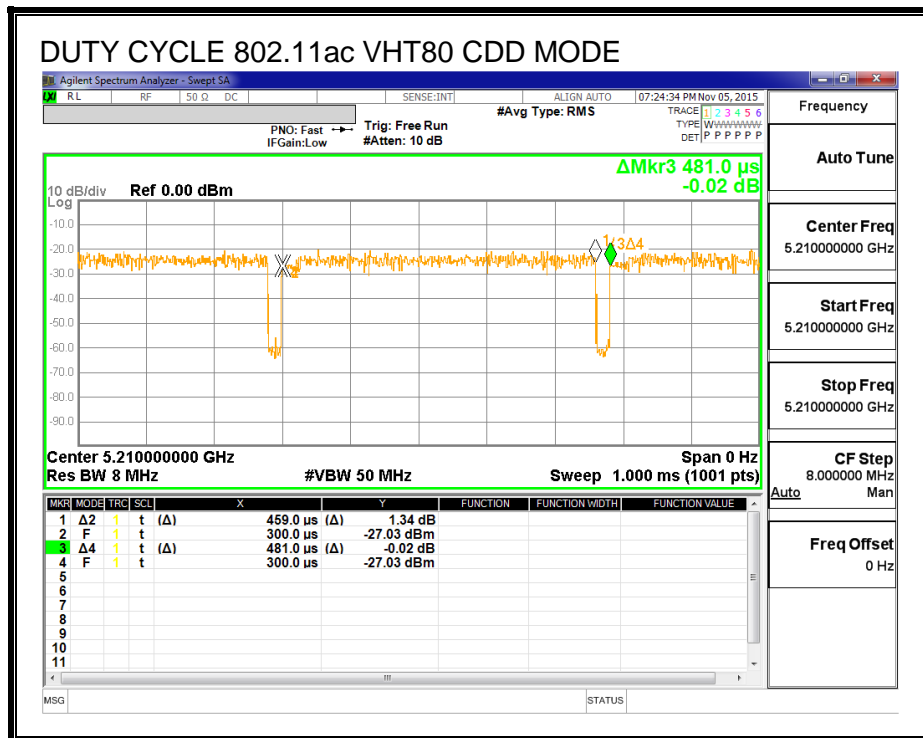
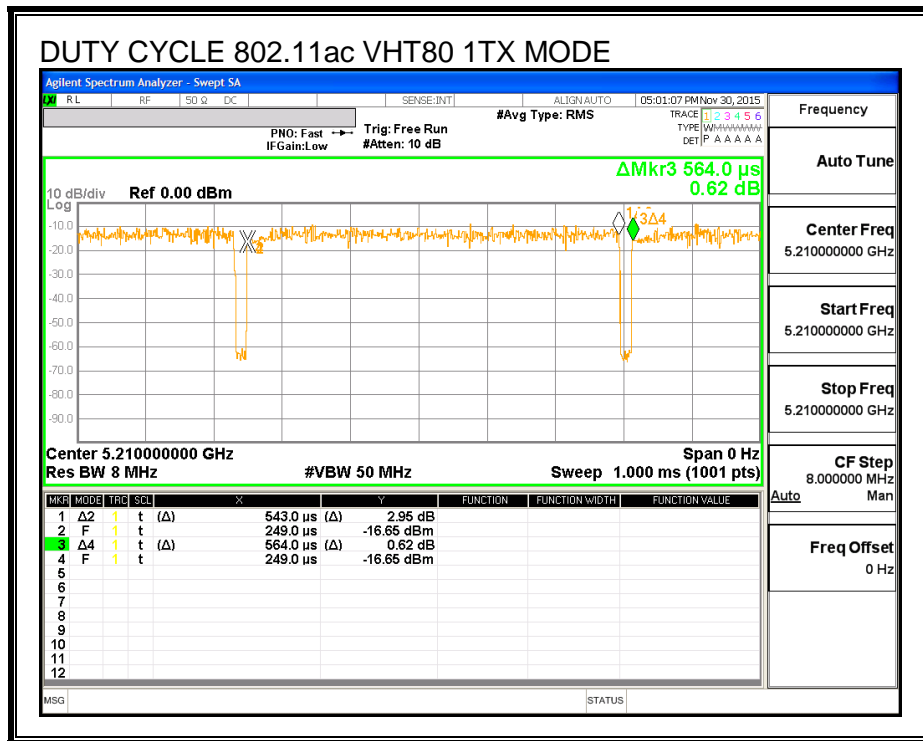
Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
802.11n HT20 1TX	1.920	1.941	0.989	98.92%	0.00	0.010
802.11n HT20 CDD	1.917	1.941	0.988	98.76%	0.00	0.010
802.11n HT40 1TX	1.124	1.142	0.984	98.42%	0.00	0.010
802.11n HT40 CDD	1.124	1.144	0.983	98.25%	0.00	0.010
802.11ac VHT80 1TX	0.543	0.564	0.963	96.28%	0.16	1.842
802.11ac VHT80 CDD	0.459	0.481	0.954	95.43%	0.20	2.179



**DUTY CYCLE PLOTS**







## 7.2. MEASUREMENT METHODS

26 dB Emission BW: KDB 789033 D02 v01r01, Section C.

99% Occupied BW: KDB 789033 D02 v01r01, Section D.

Conducted Output Power: KDB 789033 D02 v01r01, Section E.3.b (Method PM-G).

Power Spectral Density: KDB 789033 D02 v01r01, Section F.

Unwanted emissions in restricted bands: KDB 789033 D02 v01r01, Sections G.3, G.4, G.5, and G.6.

Unwanted emissions in non-restricted bands: KDB 789033 D02 v01r01, Sections G.3, G.4, and G.5.

## 8. ANTENNA PORT TEST RESULTS

### 8.1. 802.11a ANTENNA - B MODE IN THE 5.2 GHz BAND

**Note:** Covered by 802.11n HT20 ANTENNA B MODE IN THE 5.2 GHz BAND

## 8.2. 802.11n HT20 ANTENNA - B MODE IN THE 5.2 GHz BAND

### 8.2.1. 26 dB BANDWIDTH

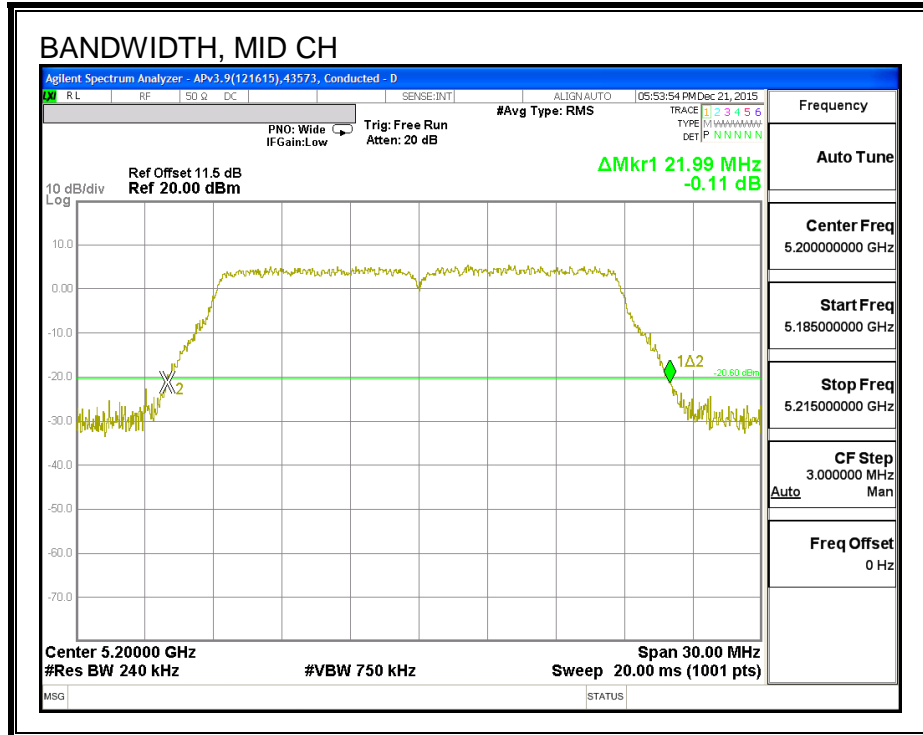
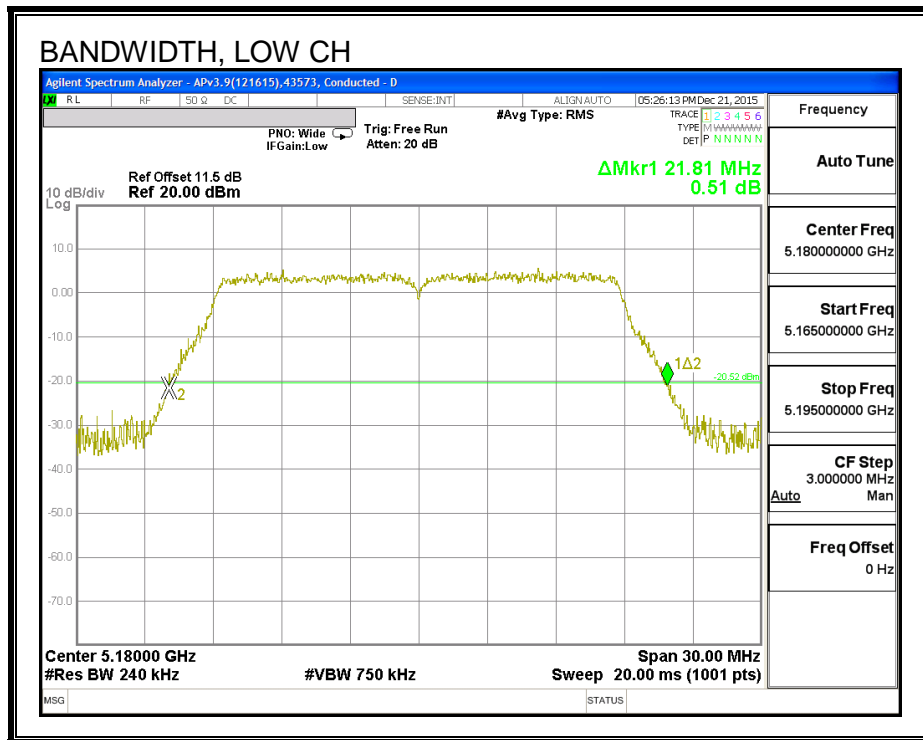
#### LIMITS

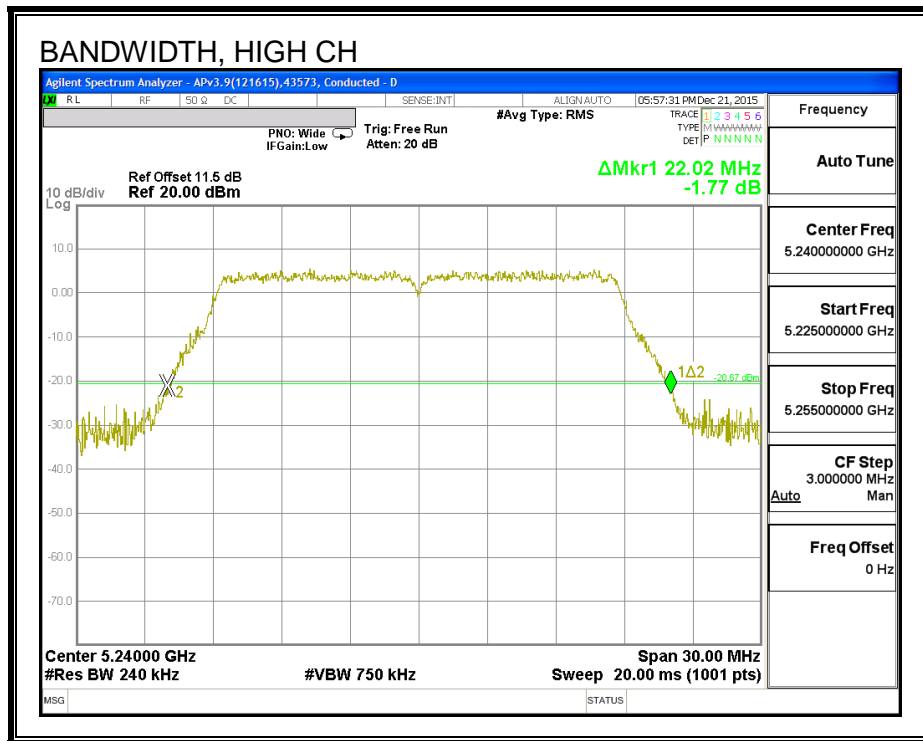
None; for reporting purposes only.

#### RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5180	21.81
Mid	5200	21.99
High	5240	22.02

**26 dB BANDWIDTH**







### 8.2.2. 99% BANDWIDTH

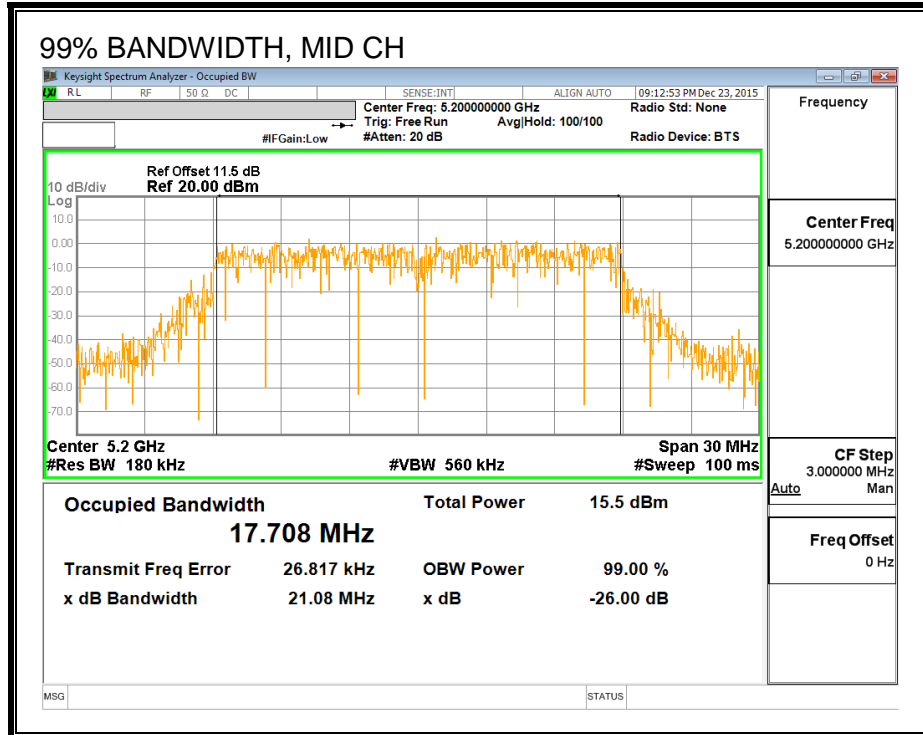
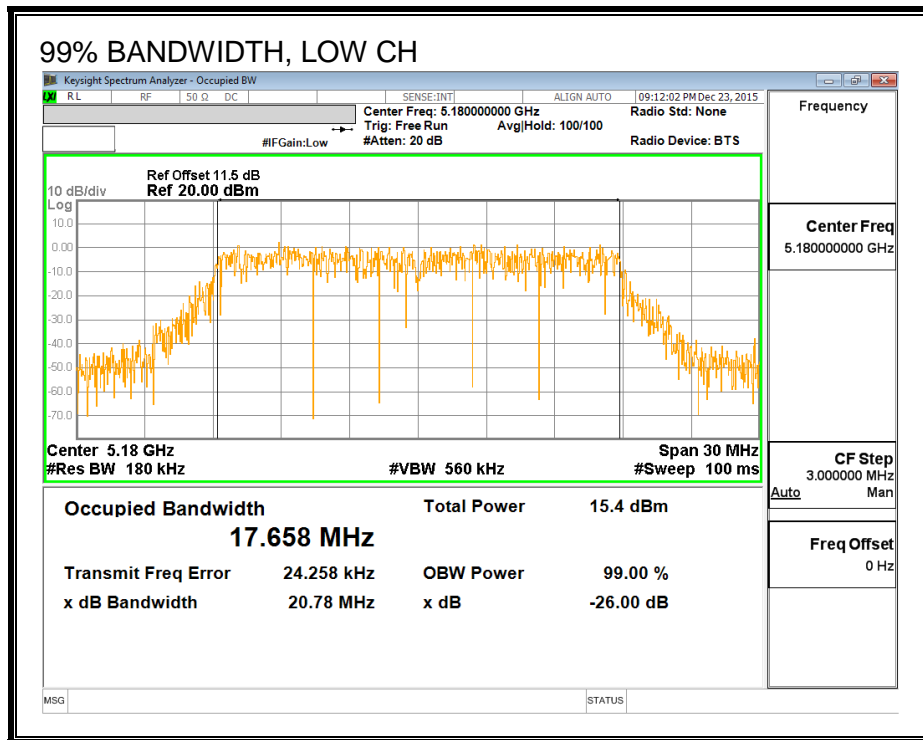
#### LIMITS

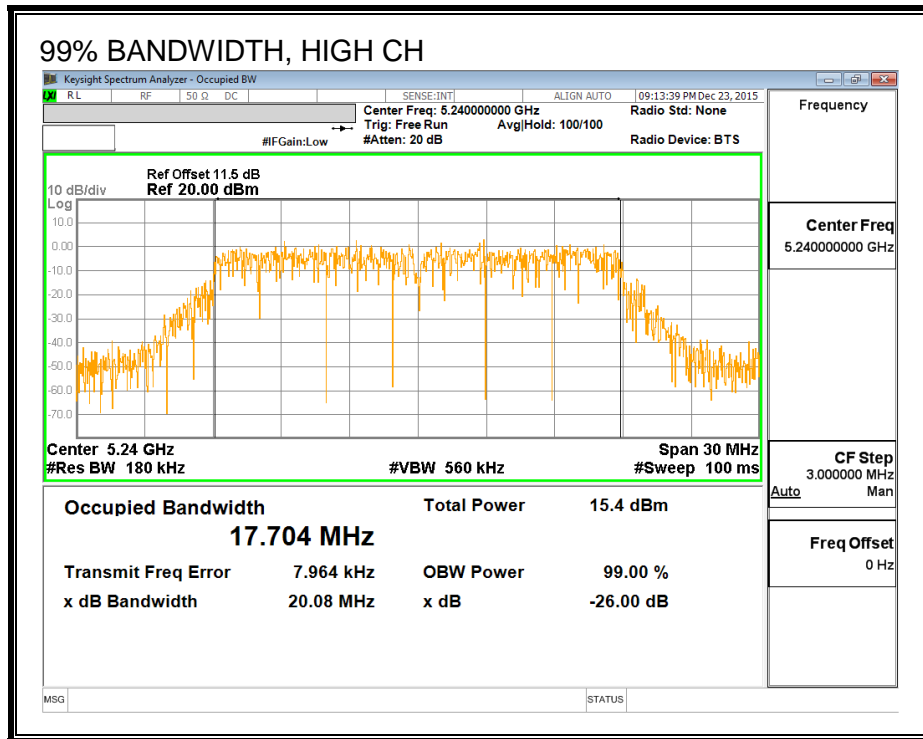
None; for reporting purposes only.

#### RESULTS

Channel	Frequency (MHz)	99% BW (MHz)
Low	5180	17.658
Mid	5200	17.708
High	5240	17.704

**99% BANDWIDTH**





### 8.2.3. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

#### RESULTS

Channel	Frequency (MHz)	Power (dBm)
Low	5180	15.98
Mid	5200	16.45
High	5240	16.48

## 8.2.4. OUTPUT POWER AND PSD

### LIMITS

FCC §15.407 (a) (1)

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### TEST PROCEDURE

Measurements perform using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

### DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

**RESULTS**

**Antenna Gain and Limits**

Channel	Frequency (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
Low	5180	3.04	3.04	24.00	11.00
Mid	5200	3.04	3.04	24.00	11.00
High	5240	3.04	3.04	24.00	11.00

<b>Duty Cycle CF (dB)</b>	0.00	<b>Included in Calculations of Corr'd PSD</b>
---------------------------	------	---

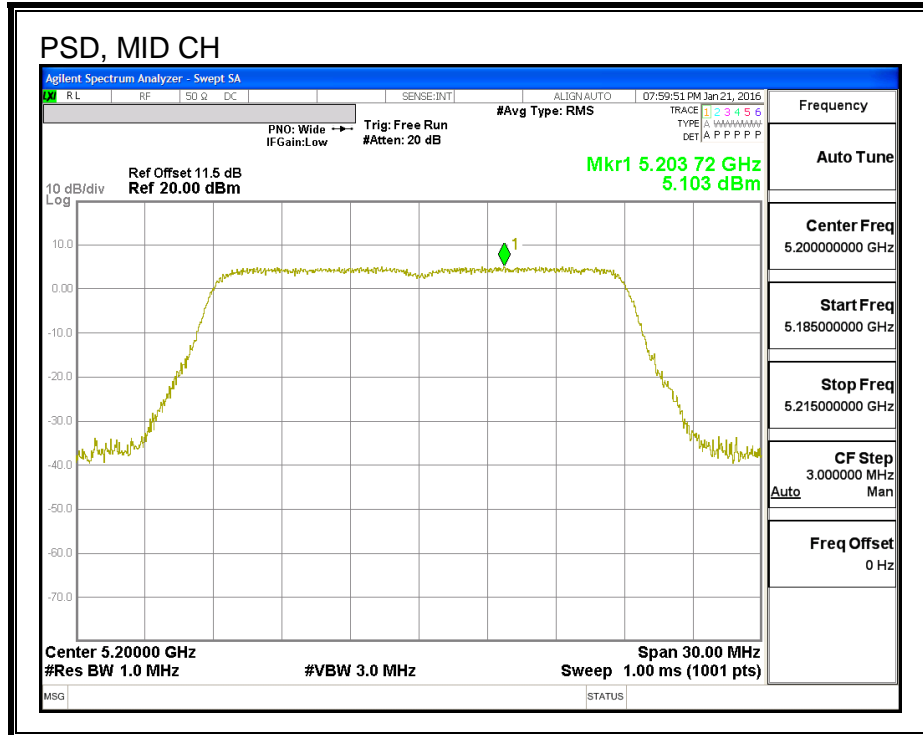
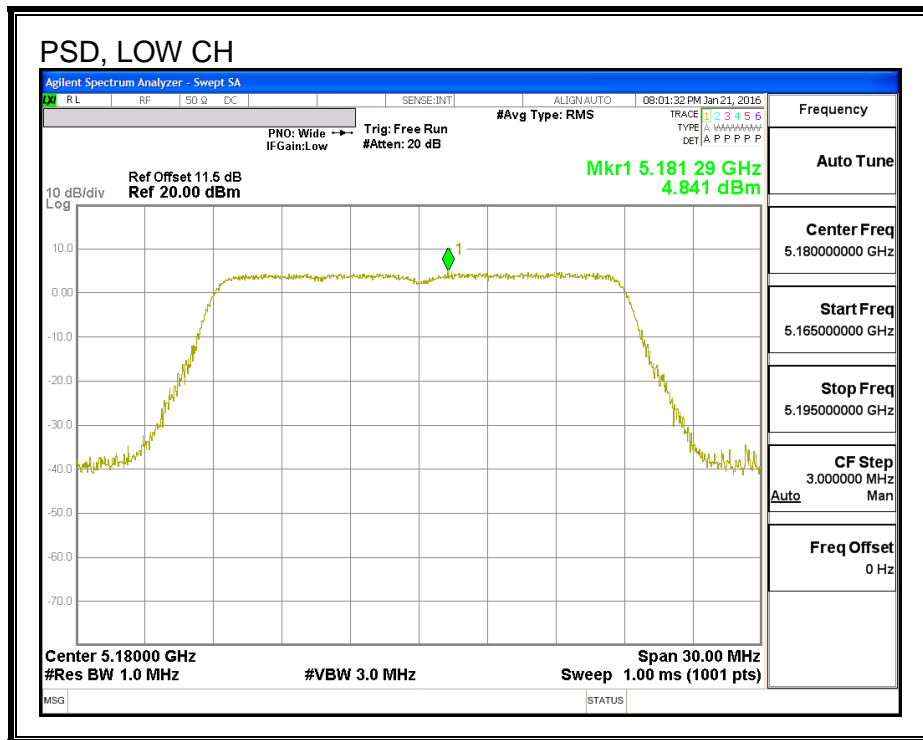
**Output Power Results**

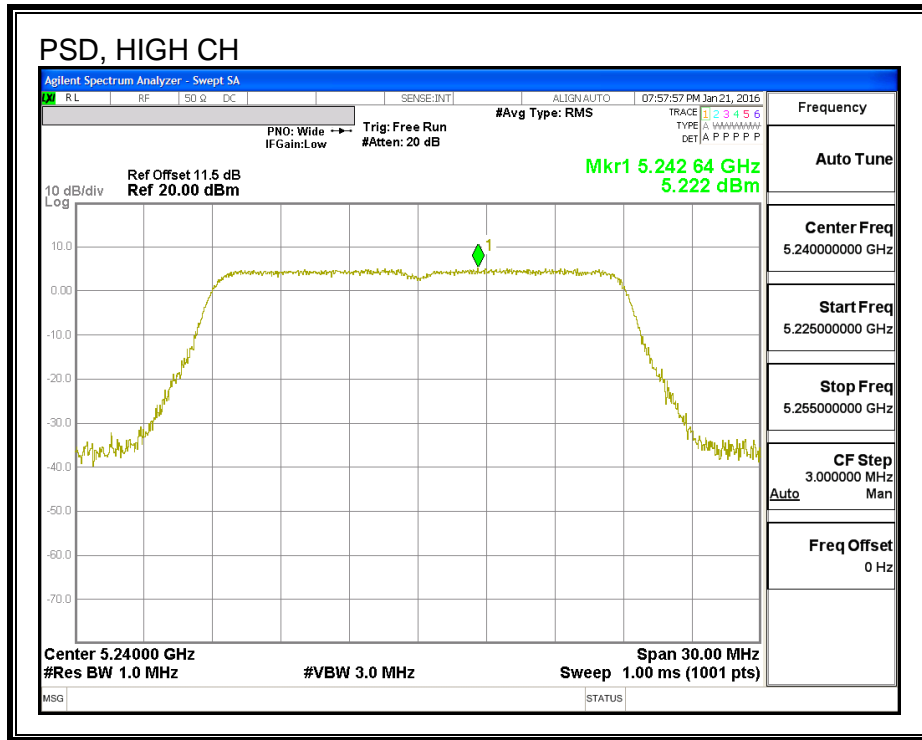
Channel	Frequency (MHz)	Antenna B Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	15.98	15.98	24.00	-8.02
Mid	5200	16.45	16.45	24.00	-7.55
High	5240	16.48	16.48	24.00	-7.52

**PSD Results**

Channel	Frequency (MHz)	Antenna B Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5180	4.84	4.84	11.00	-6.16
Mid	5200	5.10	5.10	11.00	-5.90
High	5240	5.22	5.22	11.00	-5.78

**PSD**







### **8.3. 802.11a ANTENNA - A MODE IN THE 5.2 GHz BAND**

**Note:** Covered by 802.11n HT20 ANTENNA A MODE IN THE 5.2 GHz BAND

## 8.4. 802.11n HT20 ANTENNA - A MODE IN THE 5.2 GHz BAND

### 8.4.1. 26 dB BANDWIDTH

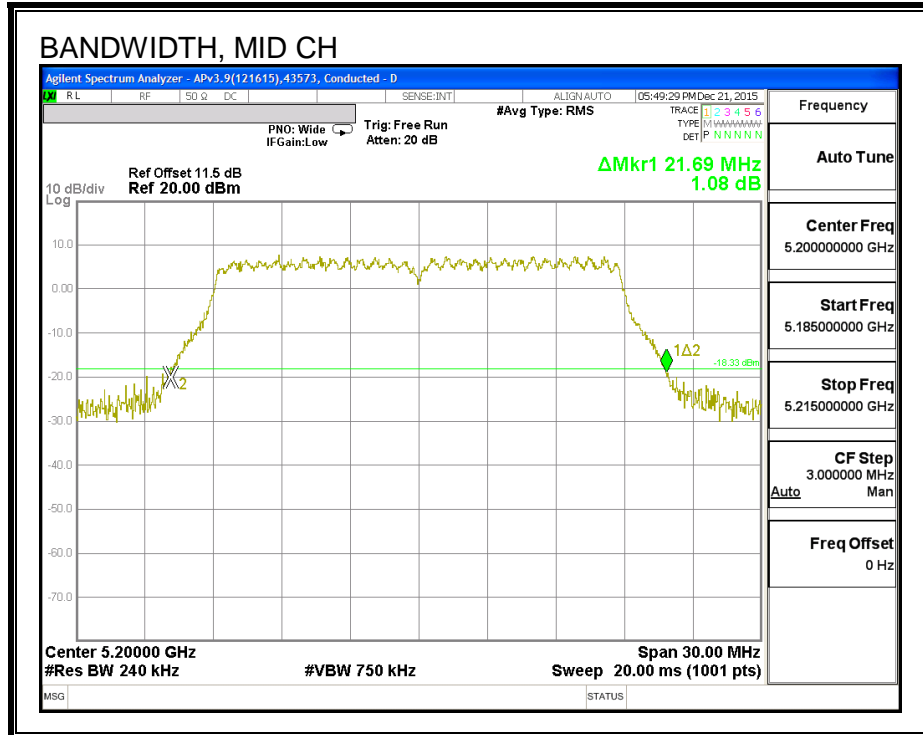
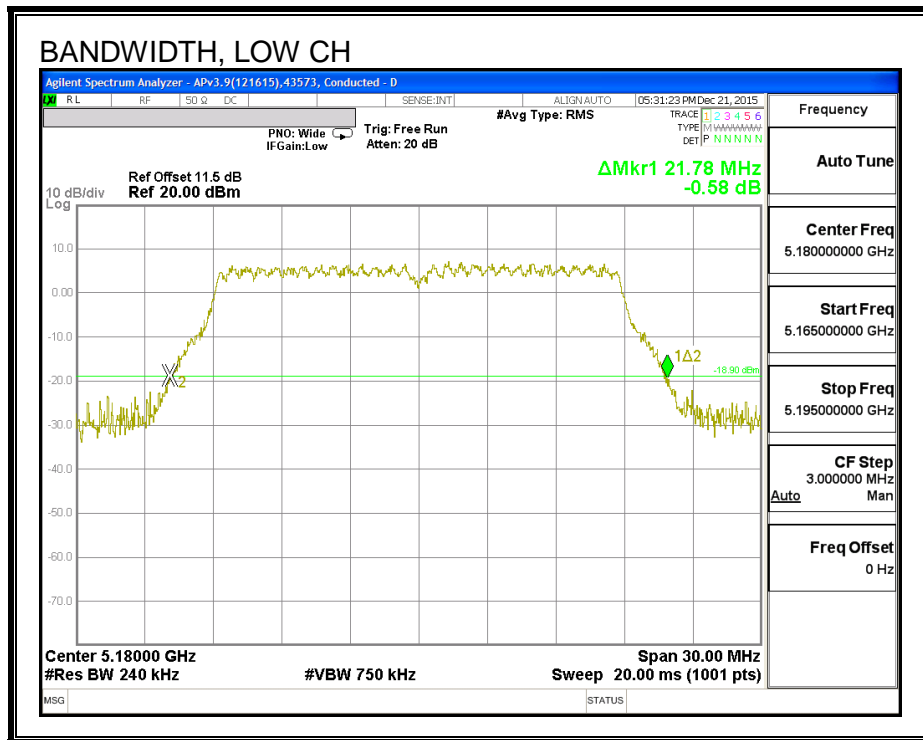
#### LIMITS

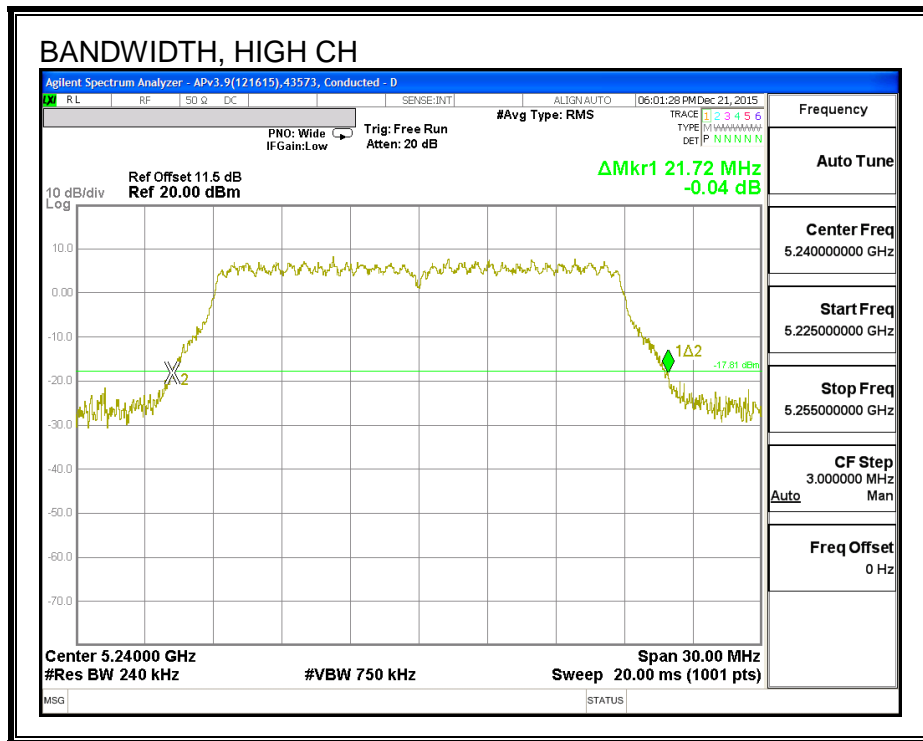
None; for reporting purposes only.

#### RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5180	21.78
Mid	5200	21.69
High	5240	21.72

**26 dB BANDWIDTH**





### 8.4.2. 99% BANDWIDTH

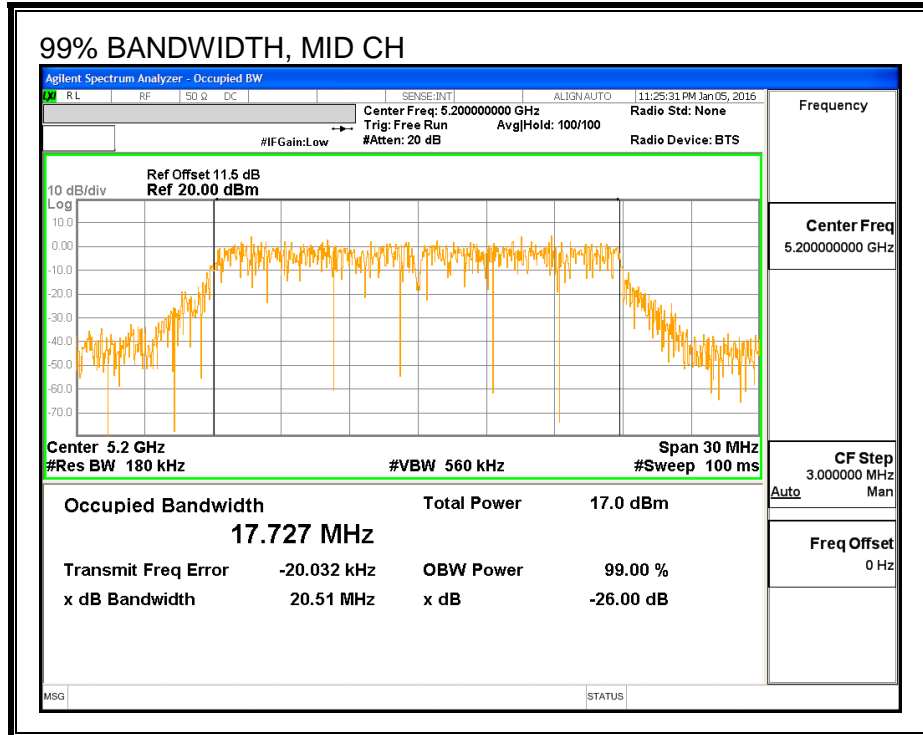
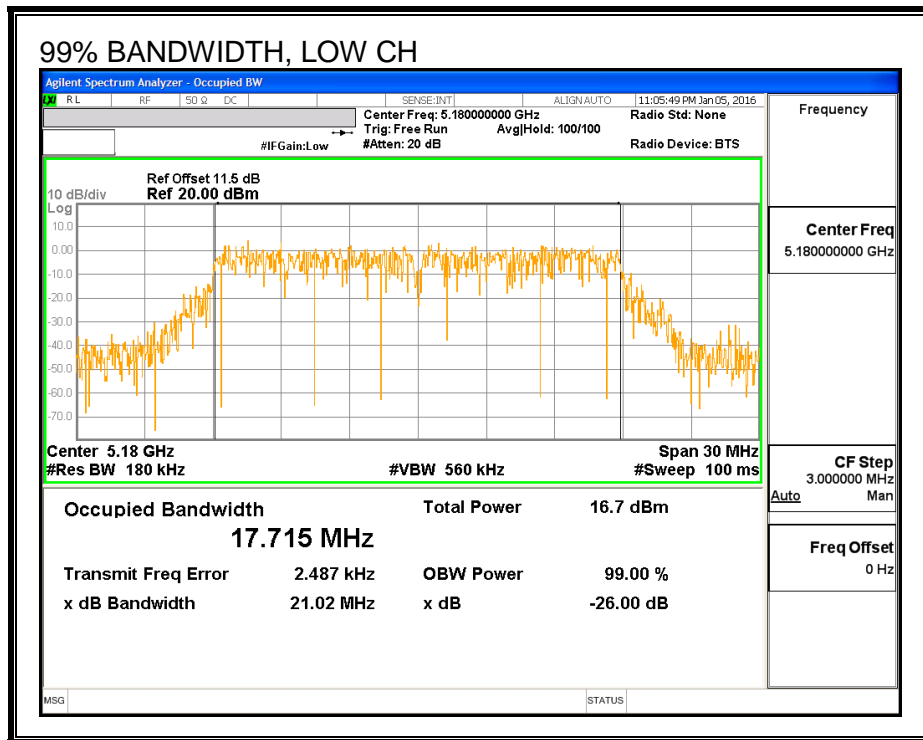
#### LIMITS

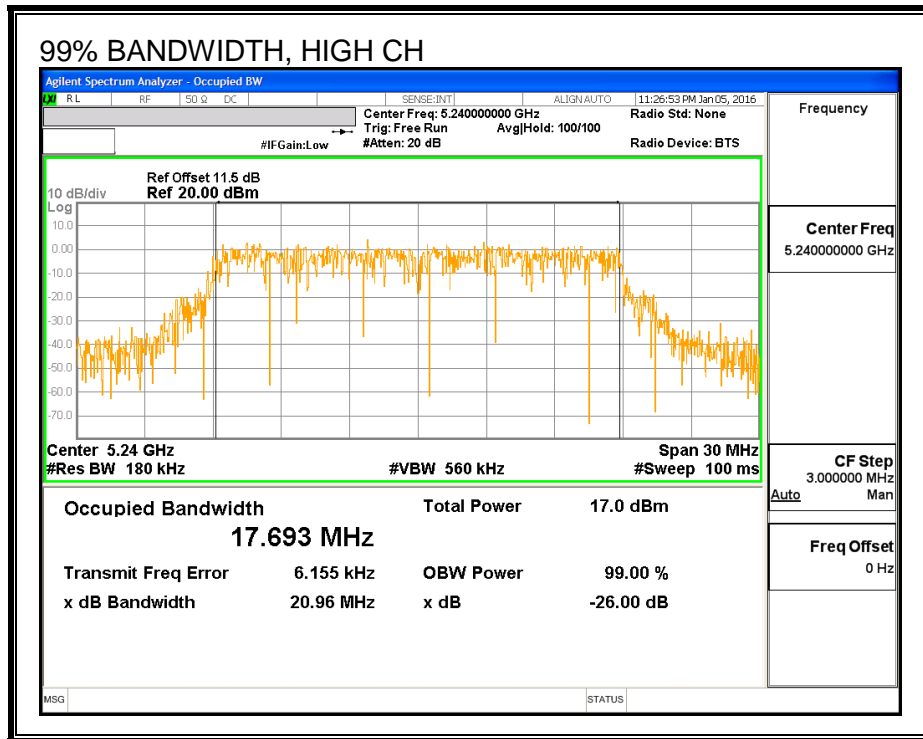
None; for reporting purposes only.

#### RESULTS

Channel	Frequency (MHz)	99% BW (MHz)
Low	5180	17.715
Mid	5200	17.727
High	5240	17.693

**99% BANDWIDTH**





### 8.4.3. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

#### RESULTS

Channel	Frequency (MHz)	Power (dBm)
Low	5180	15.95
Mid	5200	16.98
High	5240	16.90



## 8.4.4. OUTPUT POWER AND PSD

### LIMITS

FCC §15.407 (a) (1)

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### TEST PROCEDURE

Measurements perform using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

### DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

**RESULTS**

**Antenna Gain and Limits**

Channel	Frequency (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
Low	5180	2.30	2.30	24.00	11.00
Mid	5200	2.30	2.30	24.00	11.00
High	5240	2.30	2.30	24.00	11.00

<b>Duty Cycle CF (dB)</b>	0.00	<b>Included in Calculations of Corr'd PSD</b>
---------------------------	------	---

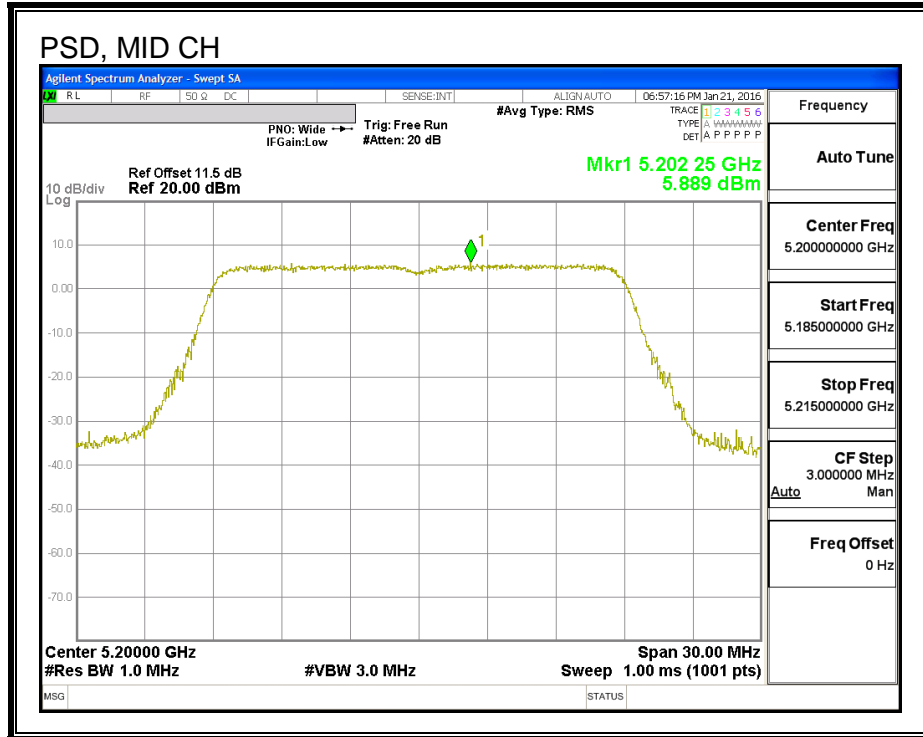
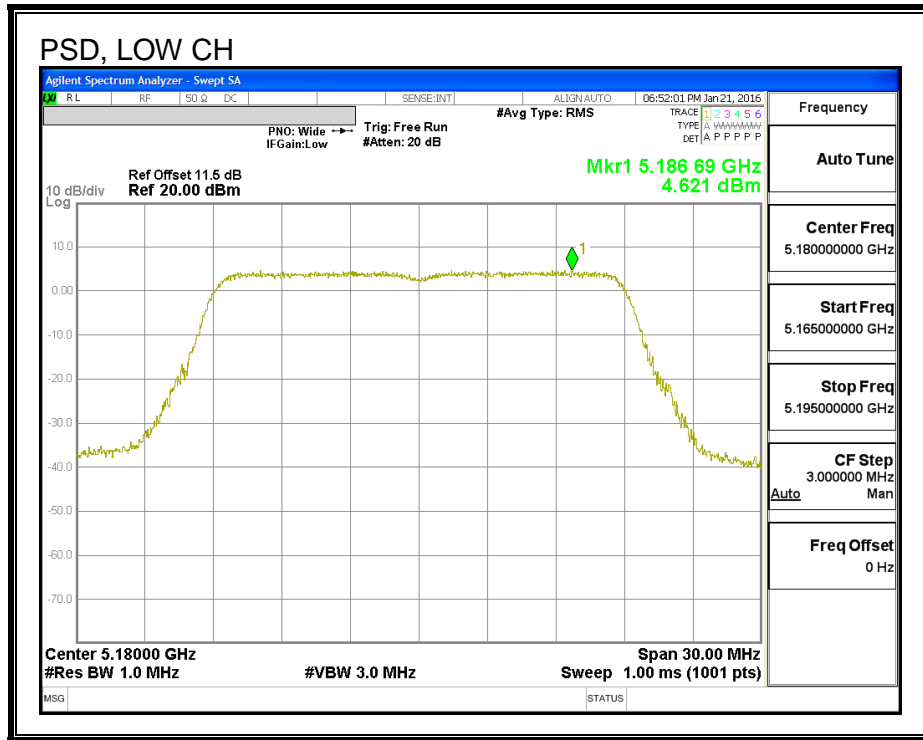
**Output Power Results**

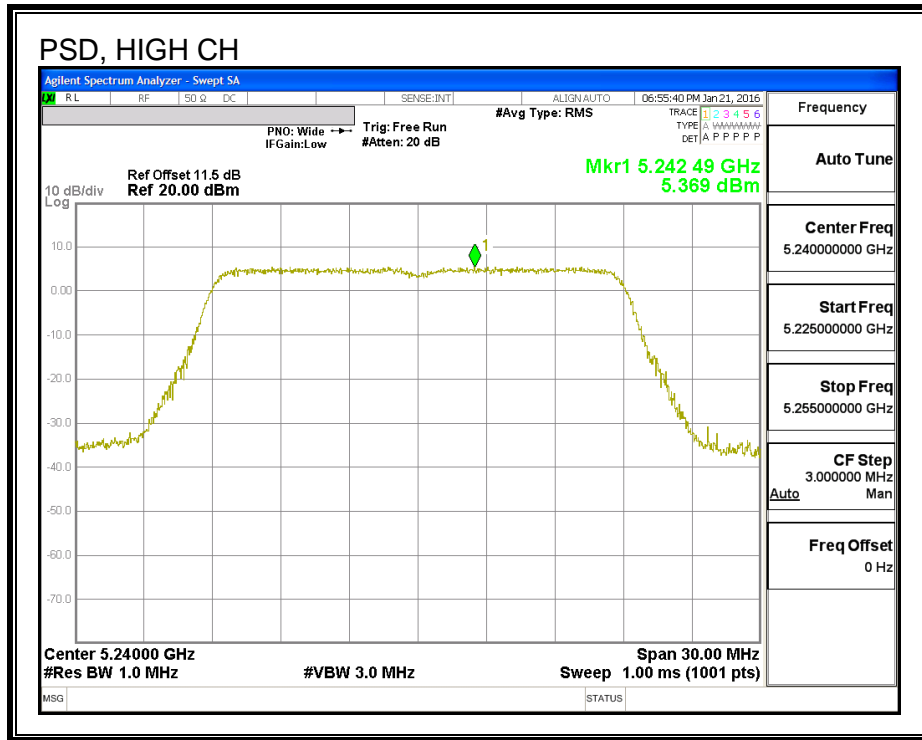
Channel	Frequency (MHz)	Antenna A Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	15.95	15.95	24.00	-8.05
Mid	5200	16.98	16.98	24.00	-7.02
High	5240	16.90	16.90	24.00	-7.10

**PSD Results**

Channel	Frequency (MHz)	Antenna A Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5180	4.62	4.62	11.00	-6.38
Mid	5200	5.89	5.89	11.00	-5.11
High	5240	5.37	5.37	11.00	-5.63

**PSD**





## **8.5. 802.11a ANTENNA - C MODE IN THE 5.2 GHz BAND**

**Note:** Covered by 802.11n HT20 ANTENNA C MODE IN THE 5.2 GHz BAND

## 8.6. 802.11n HT20 ANTENNA - C MODE IN THE 5.2 GHz BAND

### 8.6.1. 26 dB BANDWIDTH

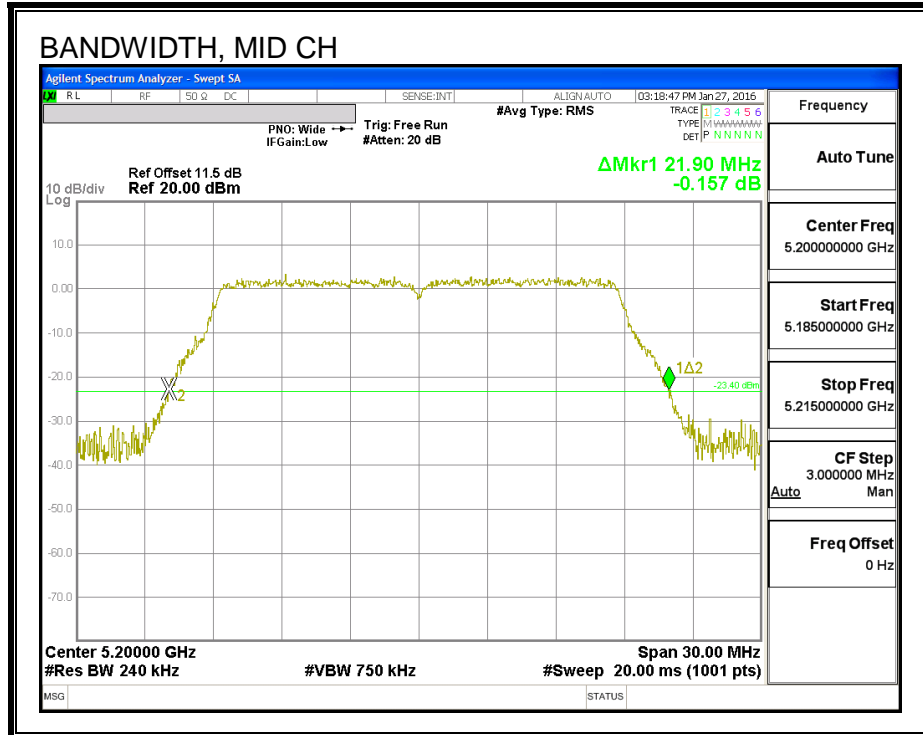
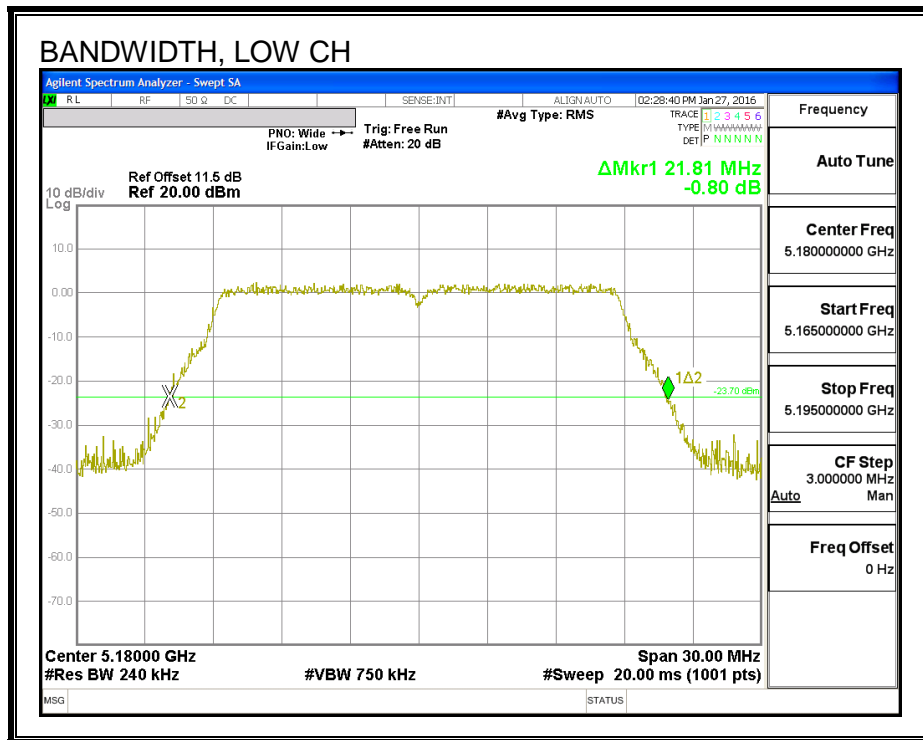
#### LIMITS

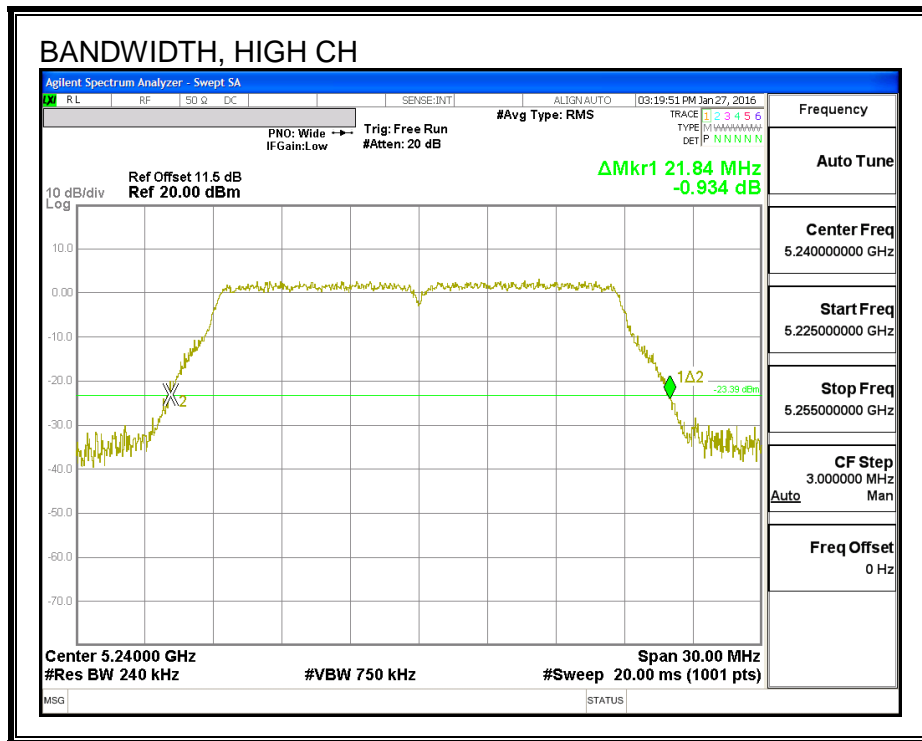
None; for reporting purposes only.

#### RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5180	21.81
Mid	5200	21.90
High	5240	21.84

**26 dB BANDWIDTH**







### 8.6.2. 99% BANDWIDTH

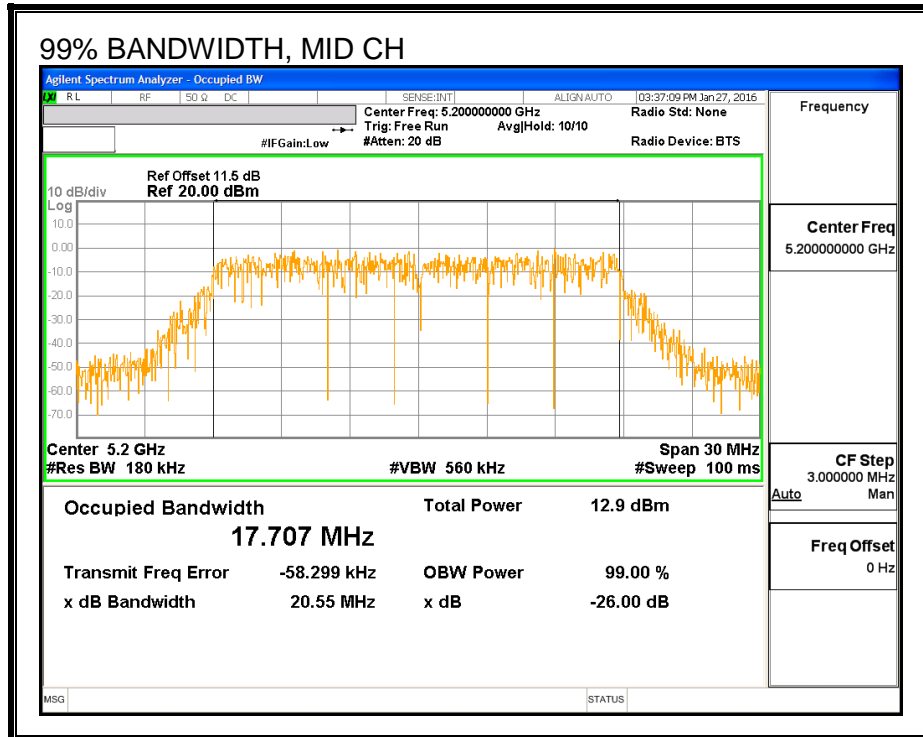
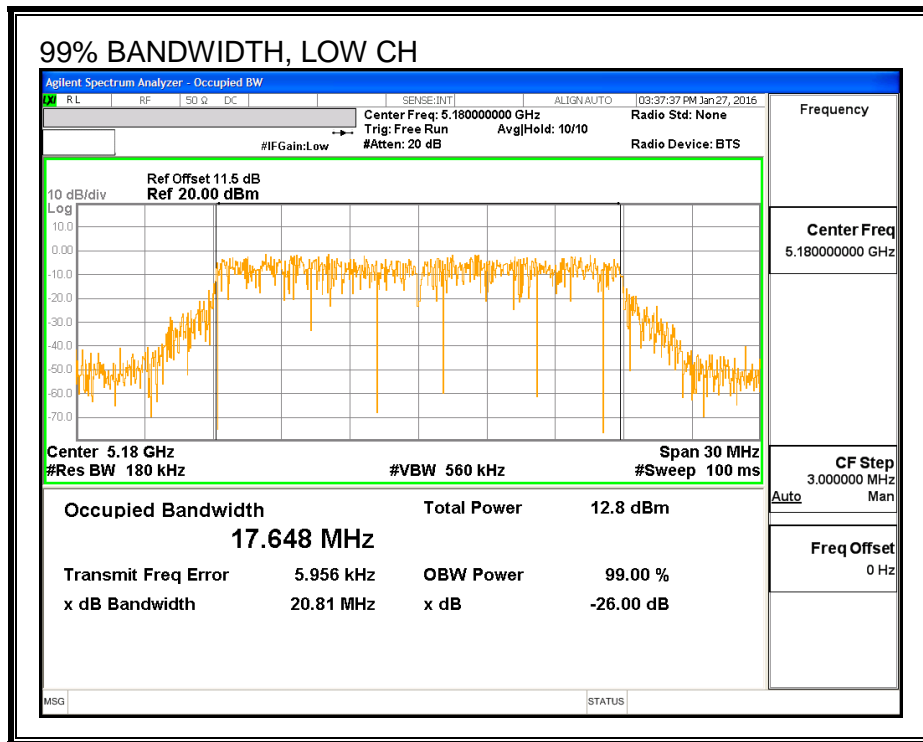
#### LIMITS

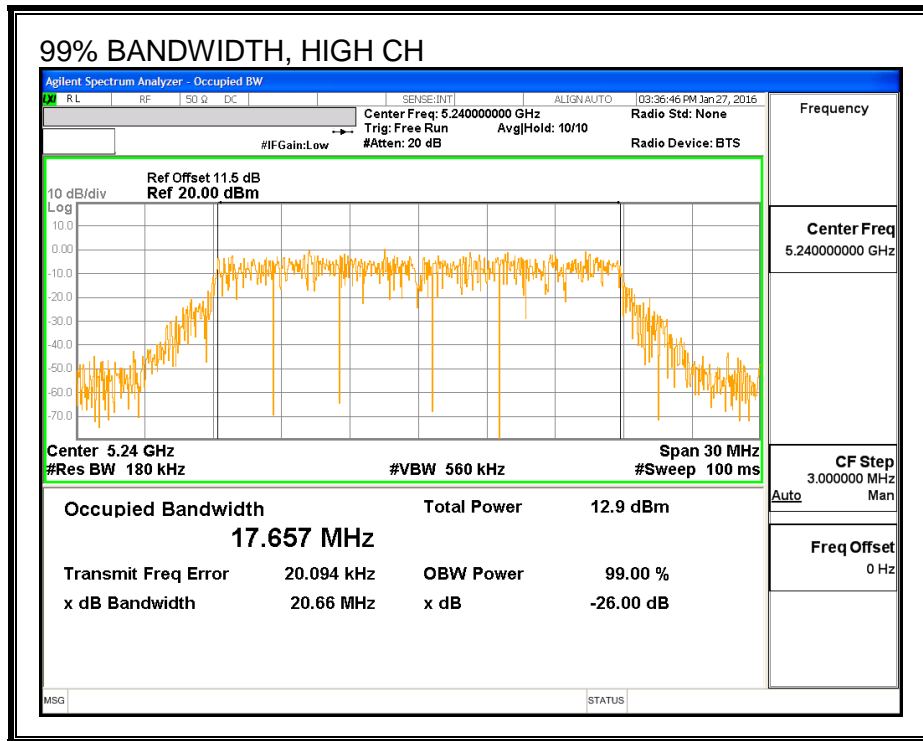
None; for reporting purposes only.

#### RESULTS

Channel	Frequency (MHz)	99% BW (MHz)
Low	5180	17.648
Mid	5200	17.707
High	5240	17.657

**99% BANDWIDTH**





### 8.6.3. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

#### RESULTS

Channel	Frequency (MHz)	Power (dBm)
Low	5180	15.92
Mid	5200	16.95
High	5240	16.98

## 8.6.4. OUTPUT POWER AND PSD

### LIMITS

FCC §15.407 (a) (1)

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### TEST PROCEDURE

Measurements perform using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

### DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

**RESULTS**

**Antenna Gain and Limits**

Channel	Frequency (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
Low	5180	1.36	1.36	24.00	11.00
Mid	5200	1.36	1.36	24.00	11.00
High	5240	1.36	1.36	24.00	11.00

<b>Duty Cycle CF (dB)</b>	0.00	<b>Included in Calculations of Corr'd PSD</b>
---------------------------	------	---

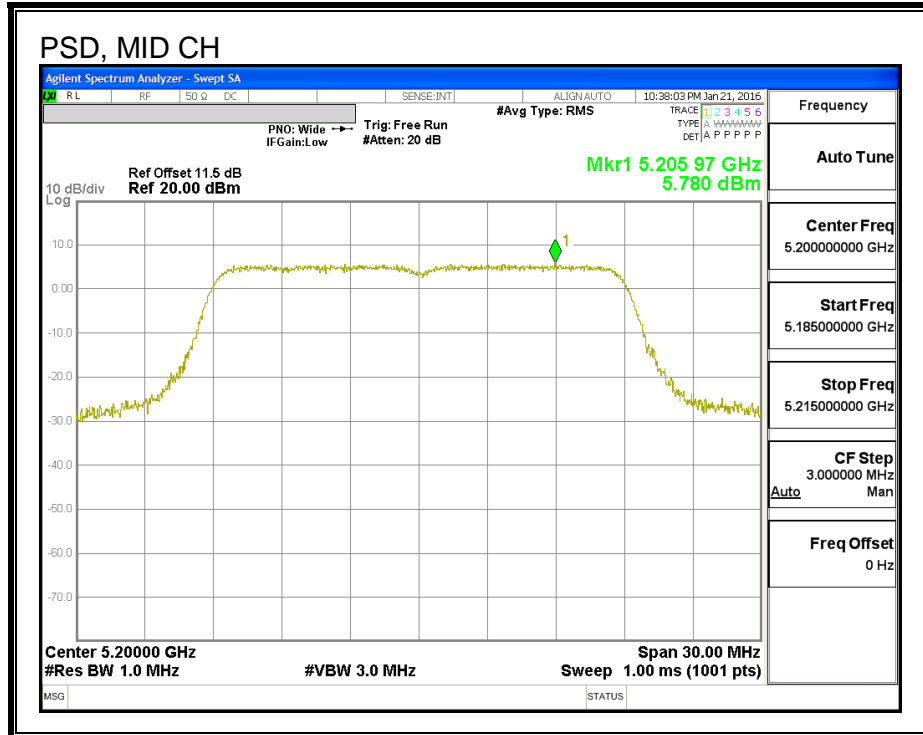
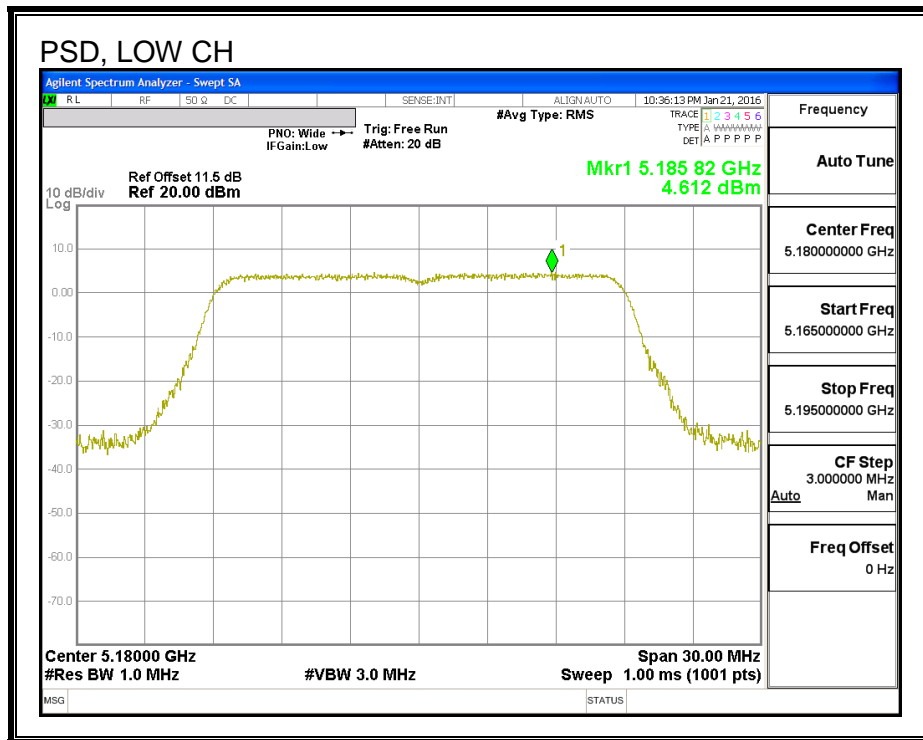
**Output Power Results**

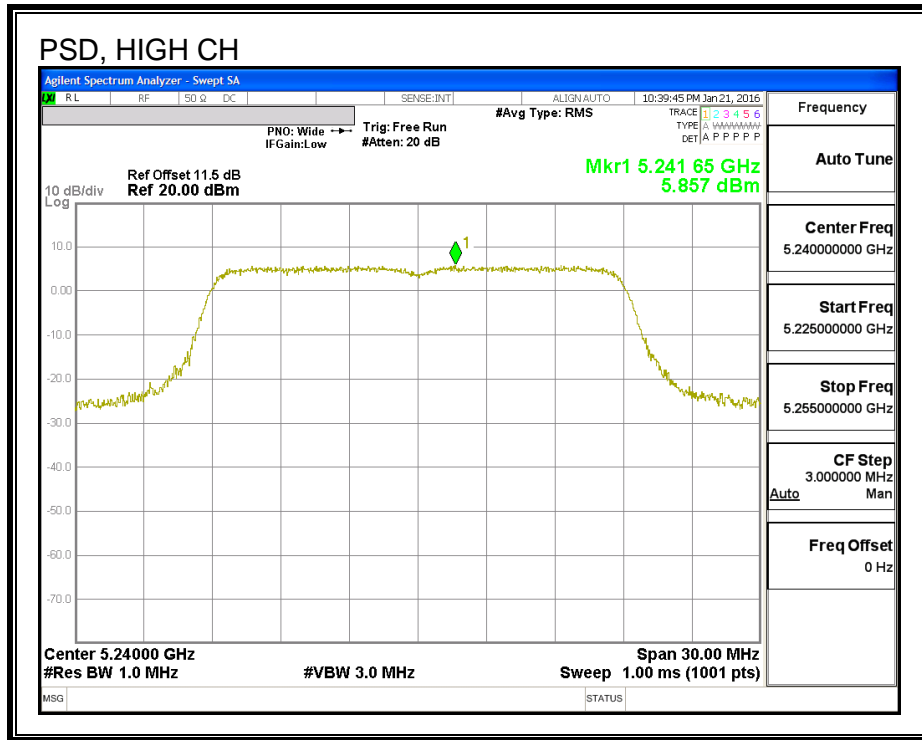
Channel	Frequency (MHz)	Antenna C Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	15.92	15.92	24.00	-8.08
Mid	5200	16.95	16.95	24.00	-7.05
High	5240	16.98	16.98	24.00	-7.02

**PSD Results**

Channel	Frequency (MHz)	Antenna C Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5180	4.61	4.61	11.00	-6.39
Mid	5200	5.78	5.78	11.00	-5.22
High	5240	5.86	5.86	11.00	-5.14

**PSD**







**8.7. 802.11a ANTENNA B+A CDD MODE IN THE 5.2 GHz BAND**

**Noted:** Covered by 802.11n HT20 ANTENNA B+A CDD MODE IN THE 5.2 GHz BAND

## 8.8. 802.11n HT20 ANTENNA B+A CDD MODE IN THE 5.2 GHz BAND

### 8.8.1. 26 dB BANDWIDTH

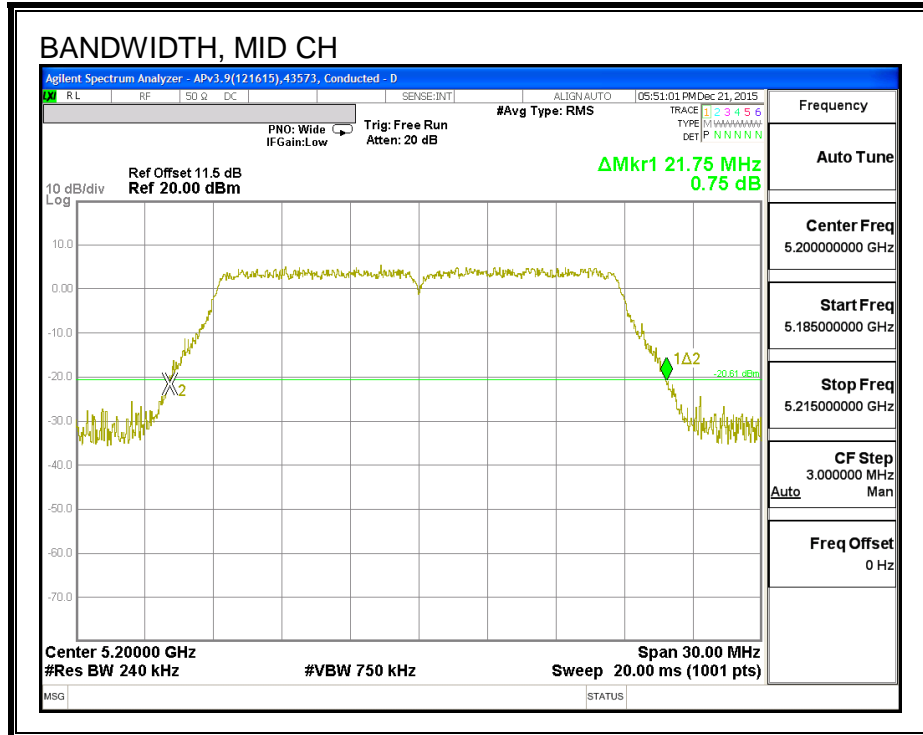
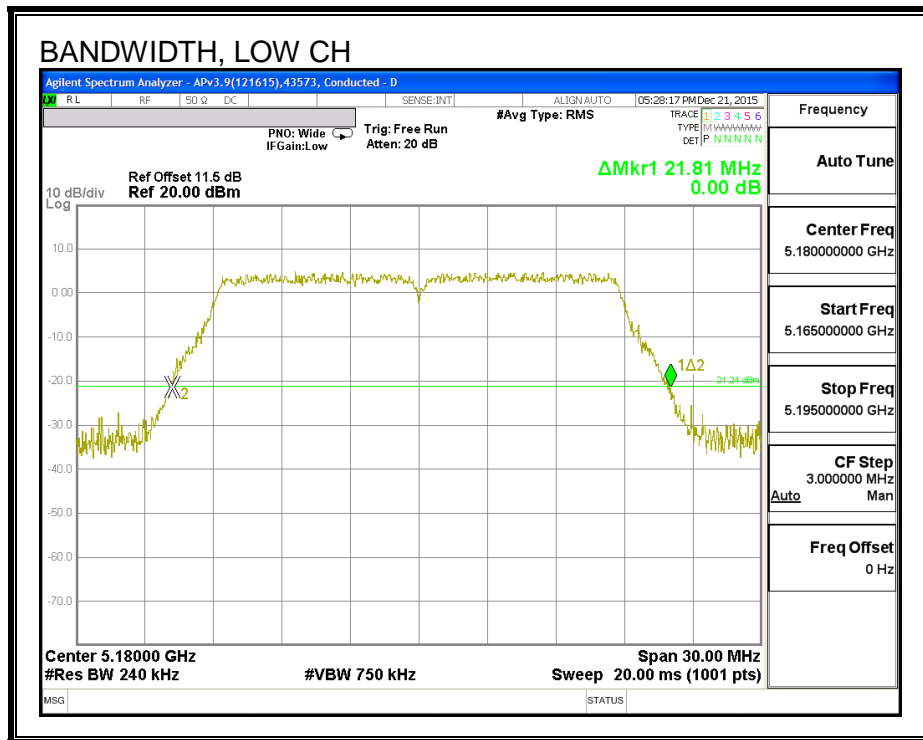
#### LIMITS

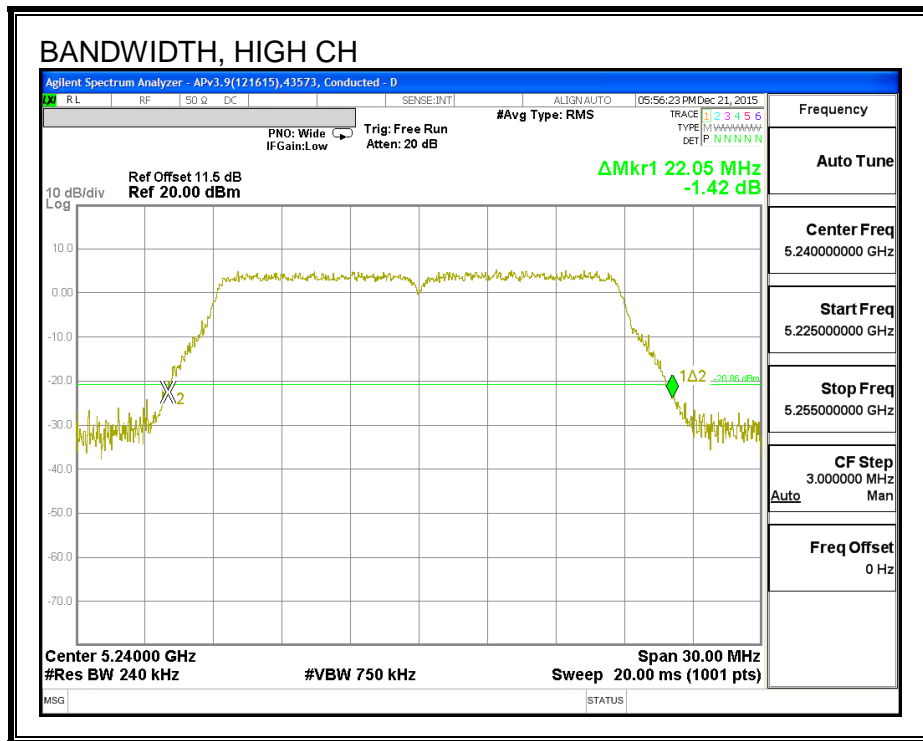
None; for reporting purposes only.

#### RESULTS

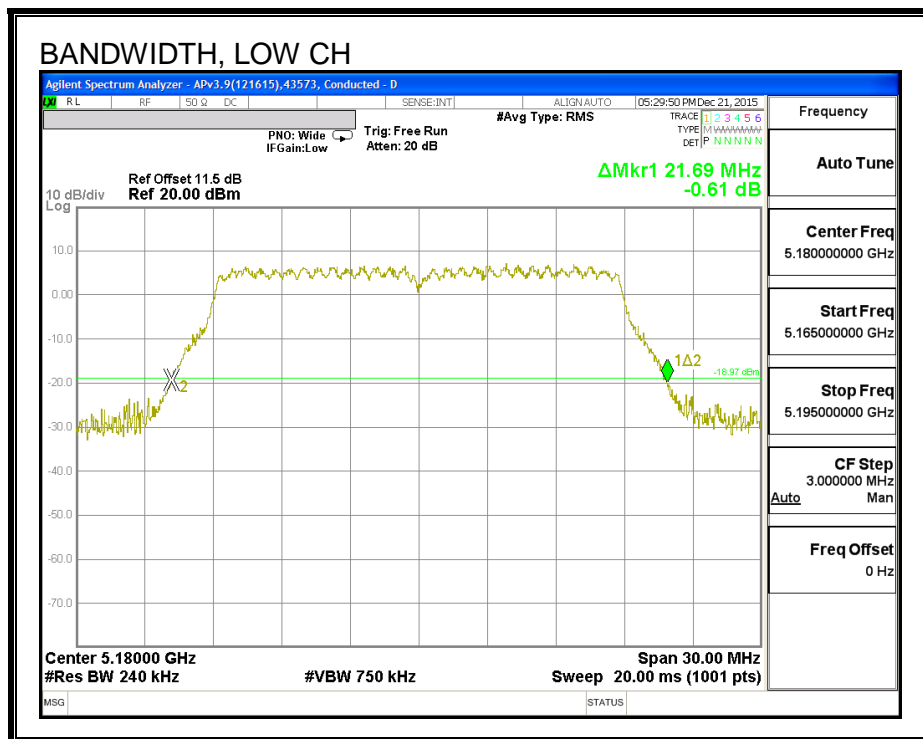
Channel	Frequency (MHz)	26 dB BW Antenna B (MHz)	26 dB BW Antenna A (MHz)
Low	5180	21.81	21.69
Mid	5200	21.75	21.72
High	5240	22.05	21.78

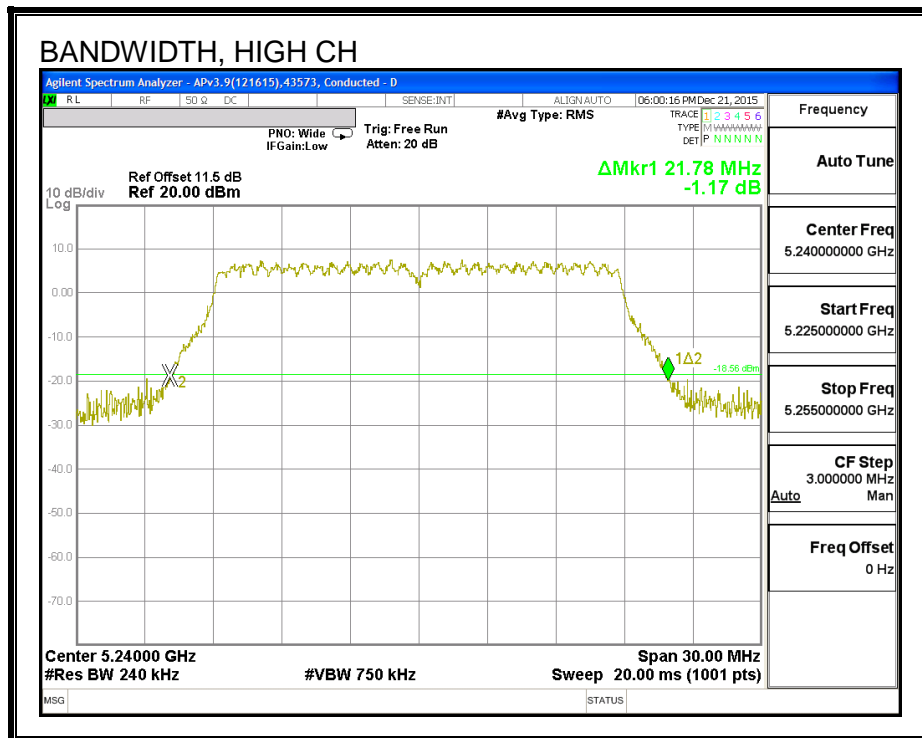
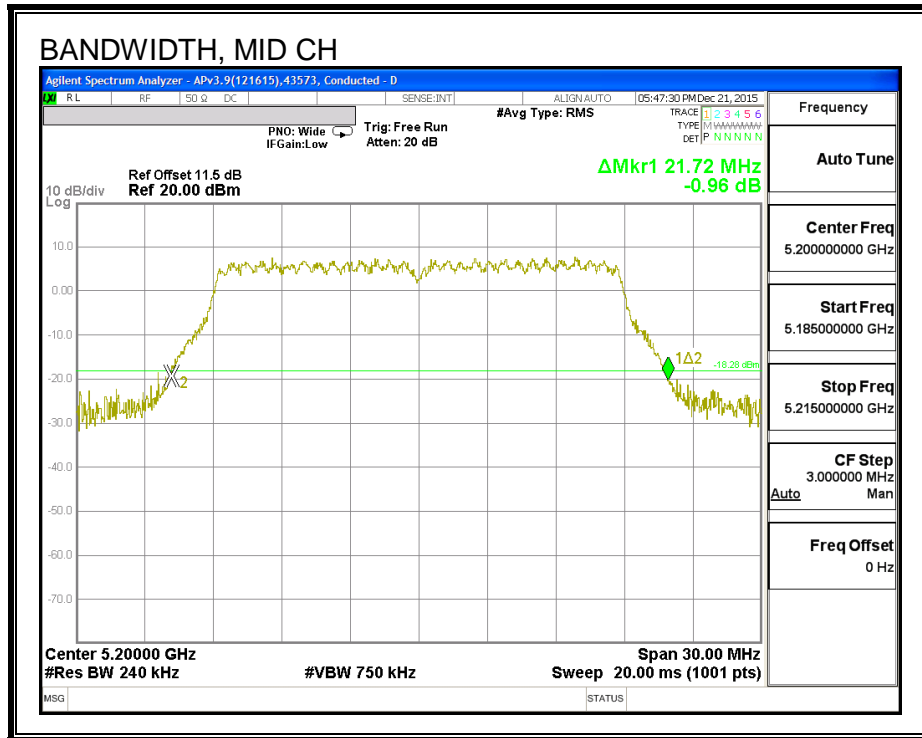
**26 DB BANDWIDTH, ANTENNA - B**





**26 DB BANDWIDTH, ANTENNA - A**





### 8.8.2. 99% BANDWIDTH

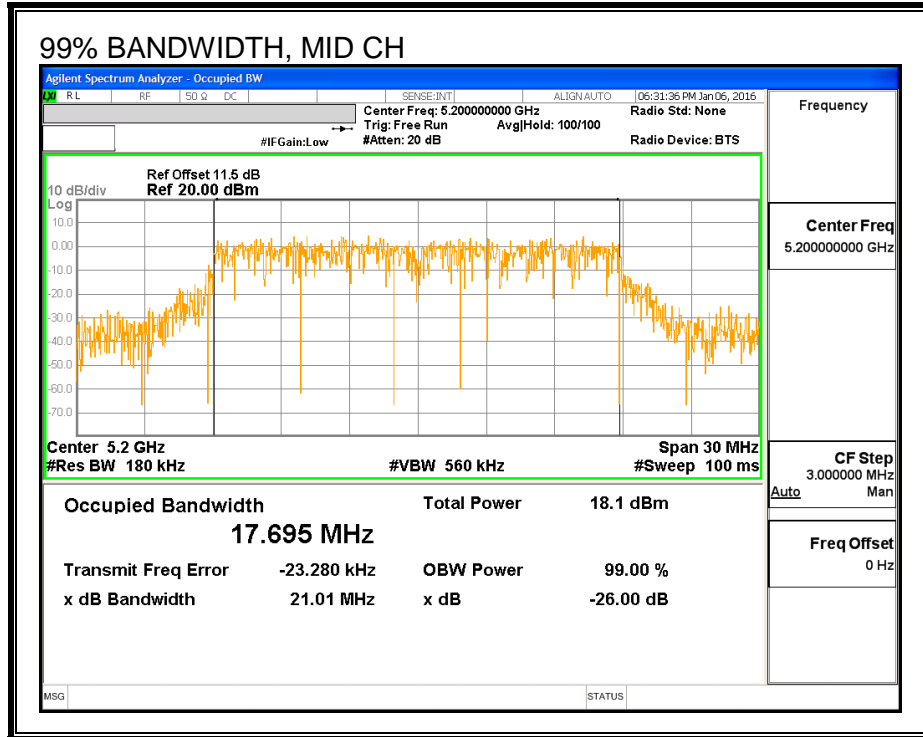
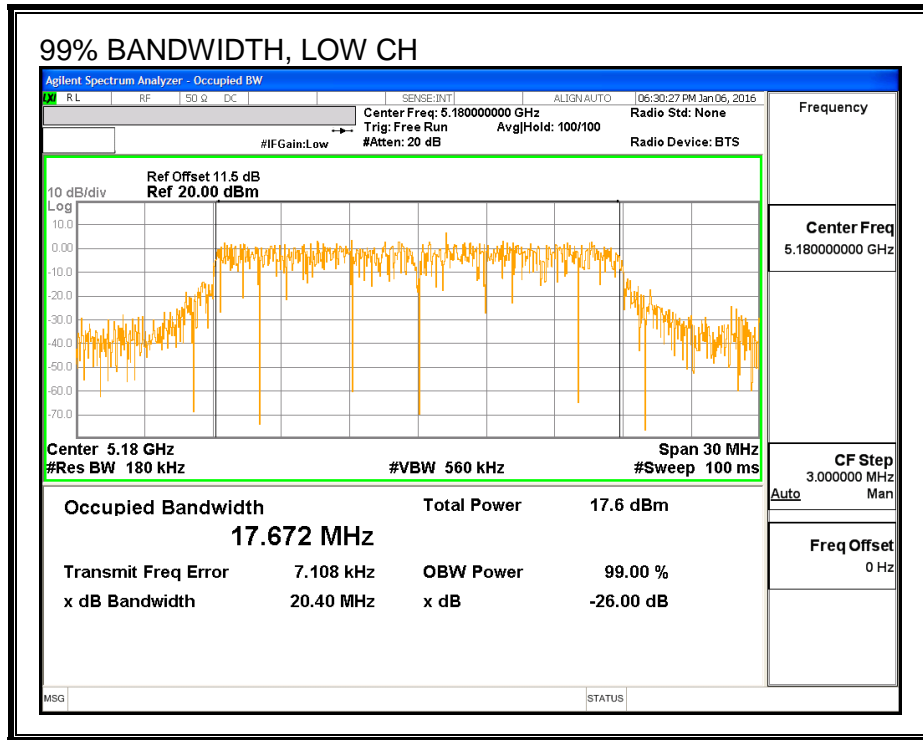
#### LIMITS

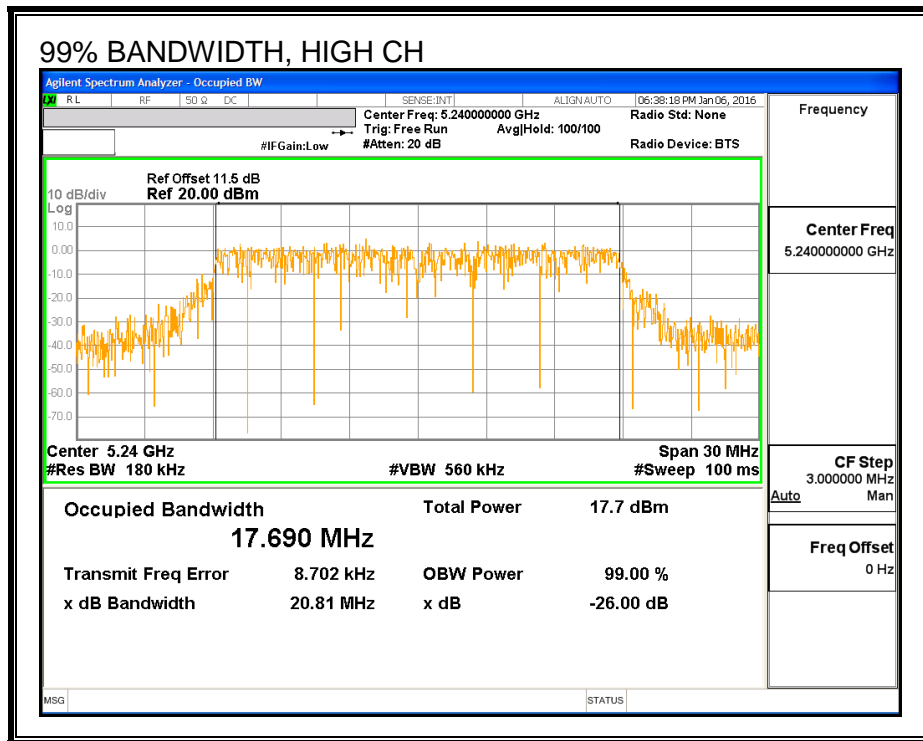
None; for reporting purposes only.

#### RESULTS

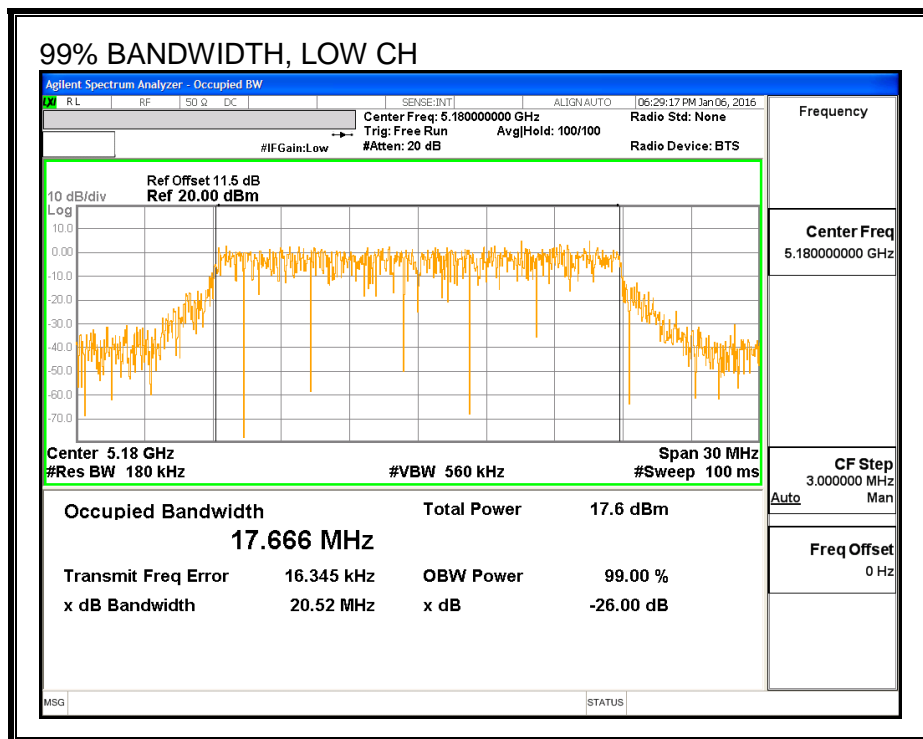
Channel	Frequency (MHz)	99% BW Antenna B (MHz)	99% BW Antenna A (MHz)
Low	5180	17.672	17.666
Mid	5200	17.695	17.687
High	5240	17.690	17.733

**99% BANDWIDTH, ANTENNA - B**

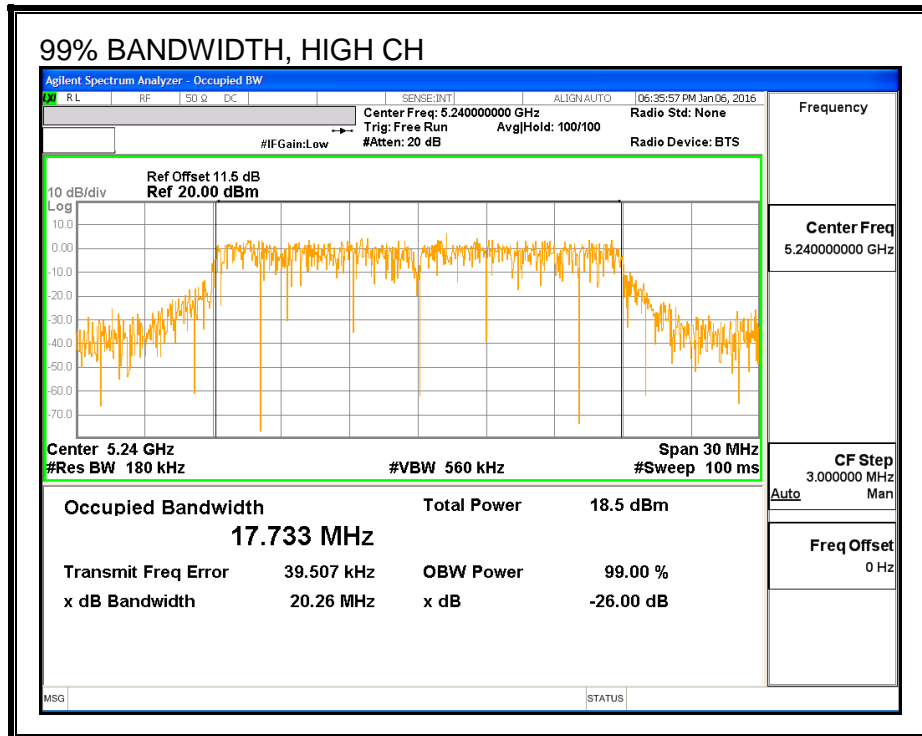
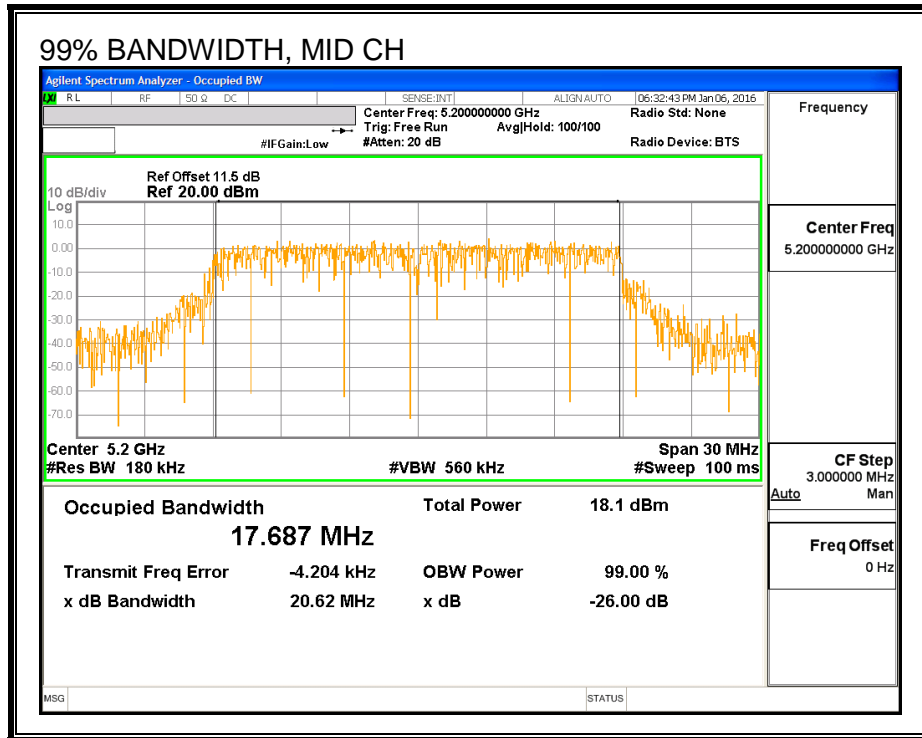




**99% BANDWIDTH, ANTENNA - A**







### 8.8.3. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

#### RESULTS

Channel	Frequency (MHz)	Antenna B Power (dBm)	Antenna A Power (dBm)	Total Power (dBm)
Low	5180	14.48	14.46	17.48
Mid	5200	15.97	15.91	18.95
High	5240	15.95	15.99	18.98

## 8.8.4. OUTPUT POWER AND PSD

### LIMITS

FCC §15.407 (a) (1)

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### TEST PROCEDURE

Measurements perform using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

**DIRECTIONAL ANTENNA GAIN**

The TX chains are uncorrelated and the antenna gain is unequal among the chains. The directional gain is:

<b>Antenna B</b>	<b>Antenna A</b>	<b>Uncorrelated Chains</b>
<b>Gain (dBi)</b>	<b>Gain (dBi)</b>	<b>Directional Gain (dBi)</b>
3.04	2.30	2.69

The TX chains are correlated and the antenna gain is unequal among the chains. The directional gain is:

<b>Antenna B</b>	<b>Antenna A</b>	<b>Correlated Chains</b>
<b>Gain (dBi)</b>	<b>Gain (dBi)</b>	<b>Directional Gain (dBi)</b>
3.04	2.30	5.69

**RESULTS**

**Antenna Gain and Limits**

Channel	Frequency (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
Low	5180	2.69	5.69	24.00	11.00
Mid	5200	2.69	5.69	24.00	11.00
High	5240	2.69	5.69	24.00	11.00

<b>Duty Cycle CF (dB)</b>	0.00	<b>Included in Calculations of Corr'd PSD</b>
---------------------------	------	---

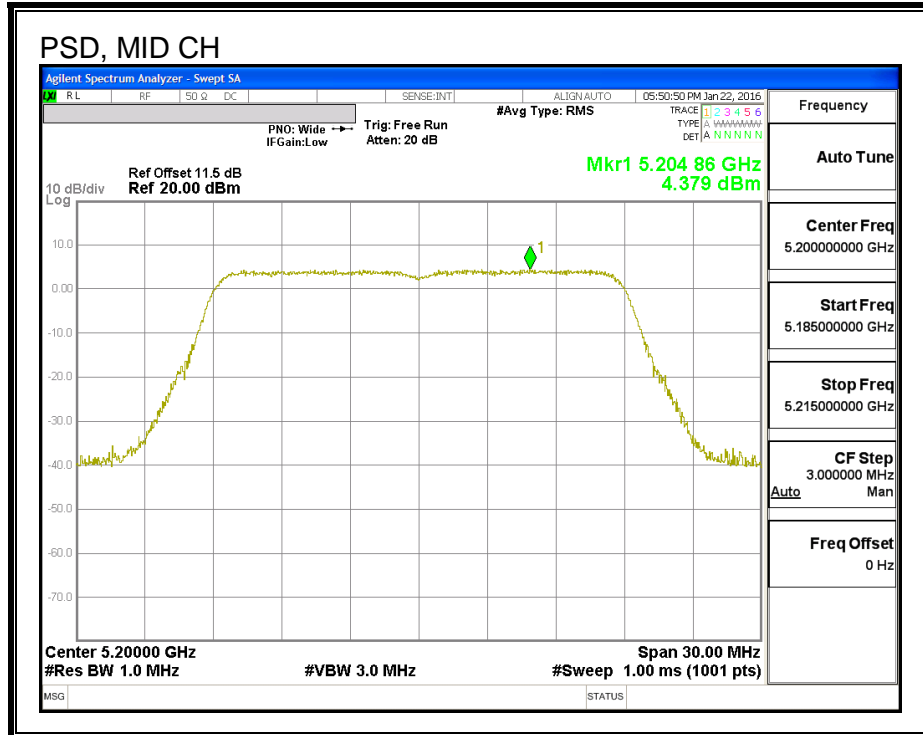
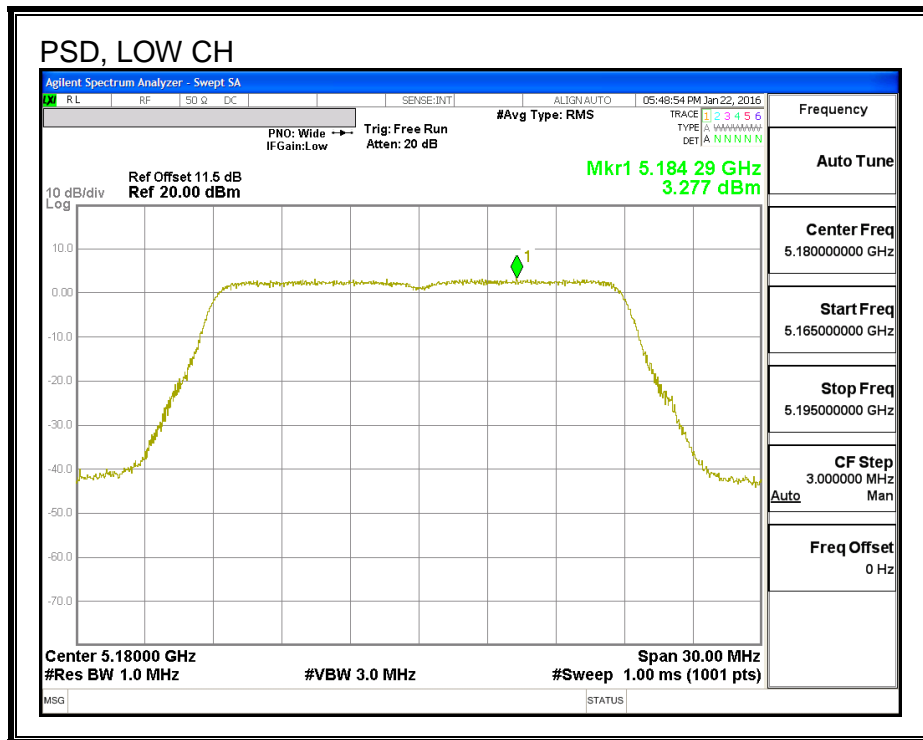
**Output Power Results**

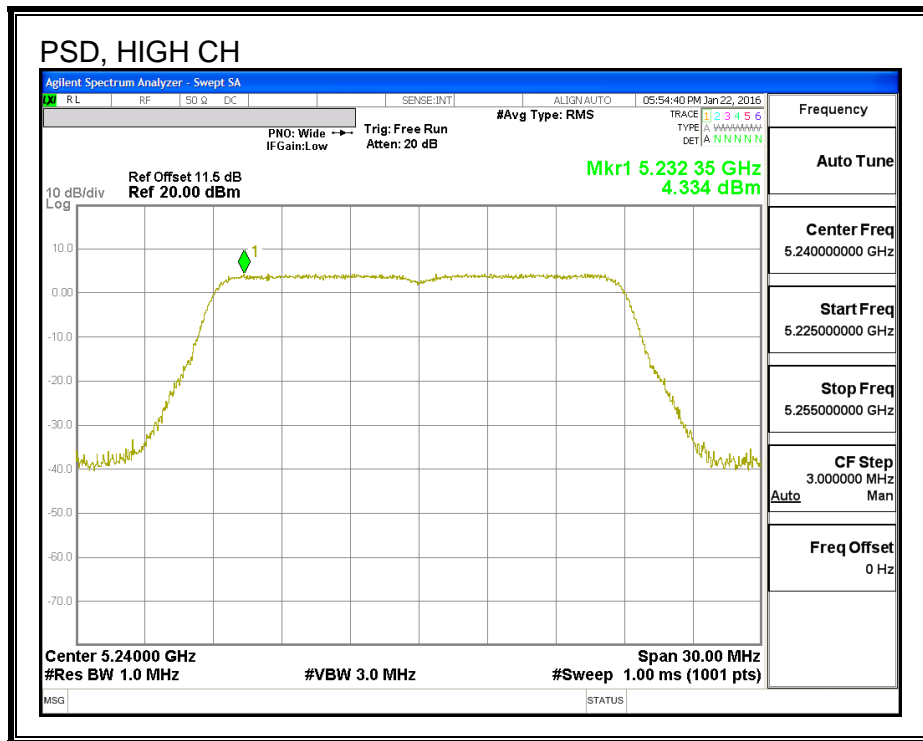
Channel	Frequency (MHz)	Antenna B Meas Power (dBm)	Antenna A Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	14.48	14.46	17.48	24.00	-6.52
Mid	5200	15.97	15.91	18.95	24.00	-5.05
High	5240	15.95	15.99	18.98	24.00	-5.02

**PSD Results**

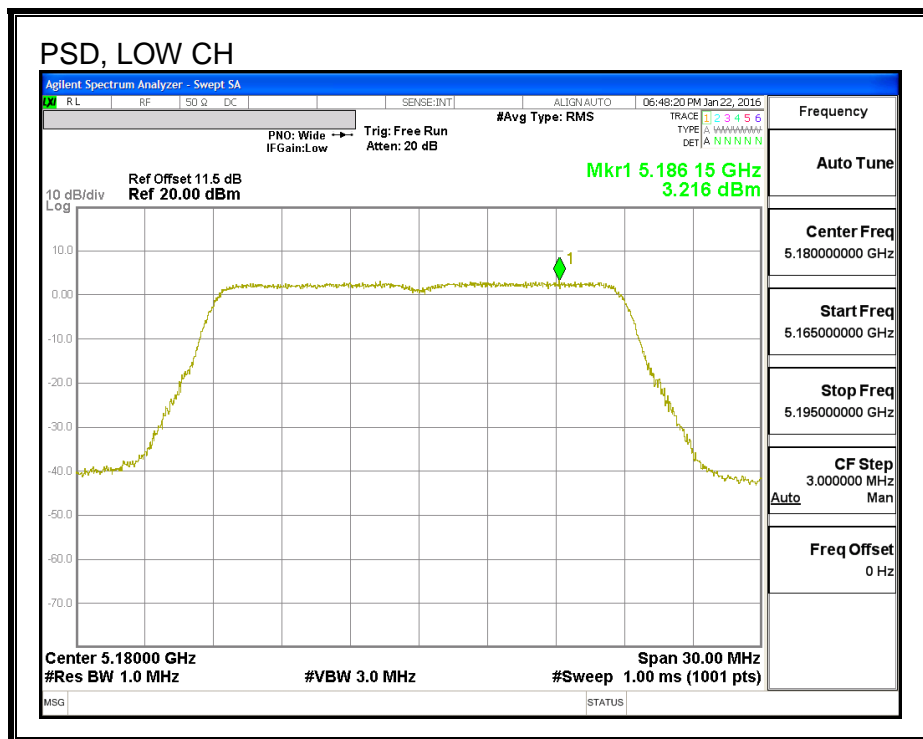
Channel	Frequency (MHz)	Antenna B Meas PSD (dBm)	Antenna A Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5180	3.28	3.22	6.26	11.00	-4.74
Mid	5200	4.38	4.31	7.35	11.00	-3.65
High	5240	4.33	4.58	7.47	11.00	-3.53

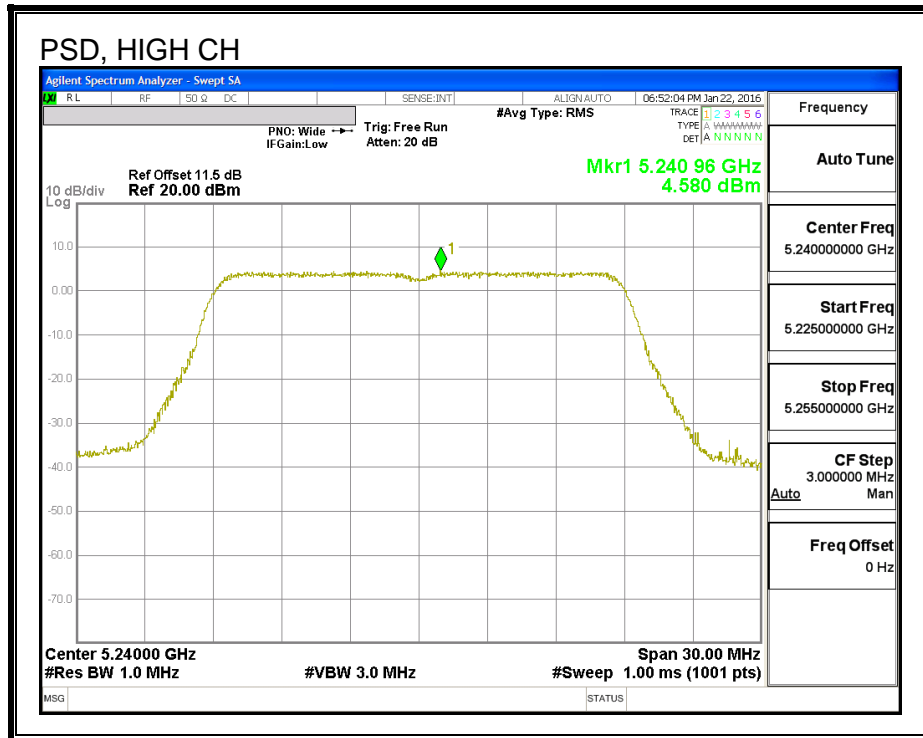
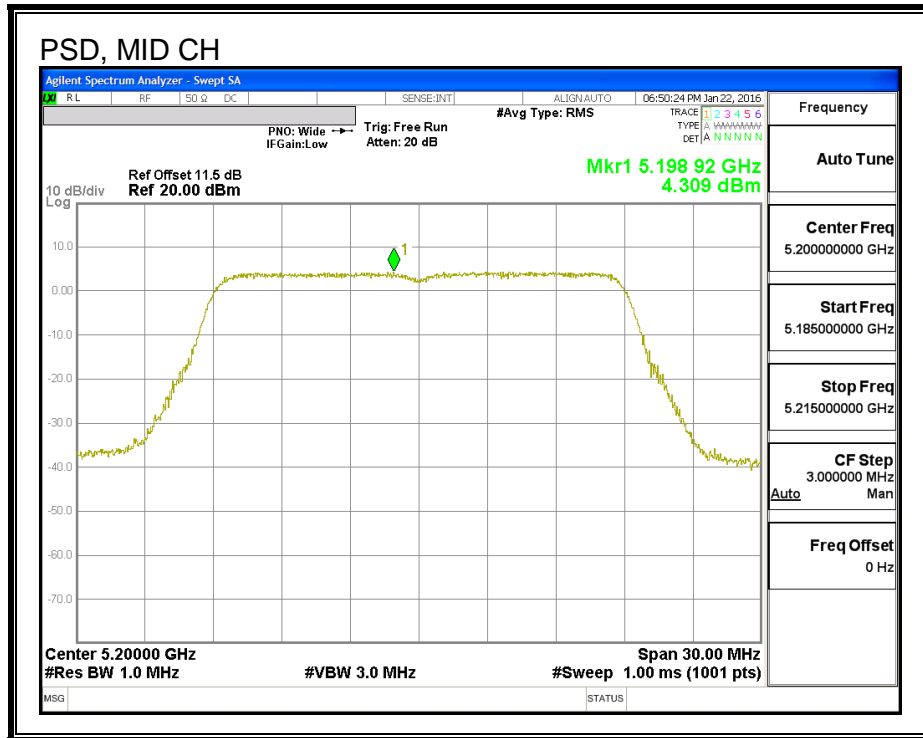
**PSD, ANTENNA - B**





**PSD, ANTENNA - A**







**8.9. 802.11a ANTENNA A+C CDD MODE IN THE 5.2 GHz BAND**

**Noted:** Covered by 802.11n HT20 ANTENNA A+C CDD MODE IN THE 5.2 GHz BAND

## 8.10. 802.11n HT20 ANTENNA A+C CDD MODE IN THE 5.2 GHz BAND

### 8.10.1. 26 dB BANDWIDTH

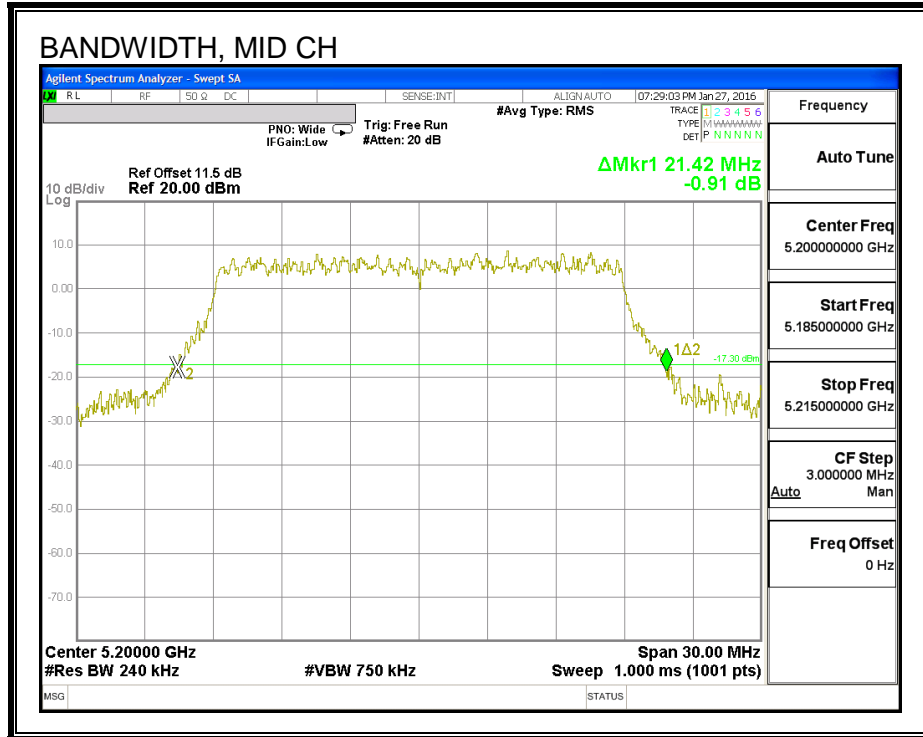
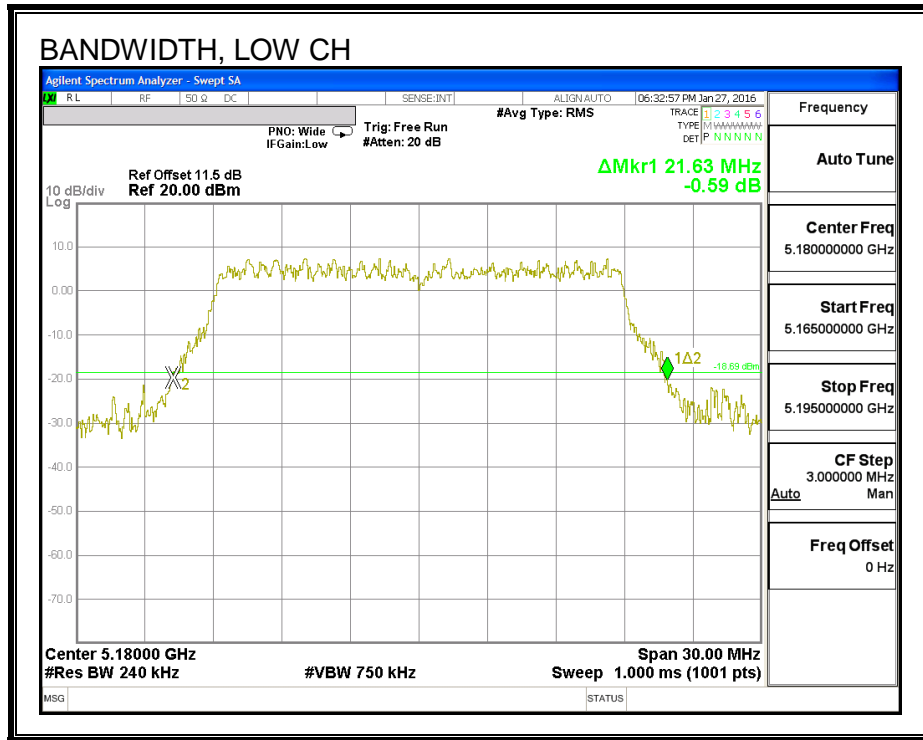
#### LIMITS

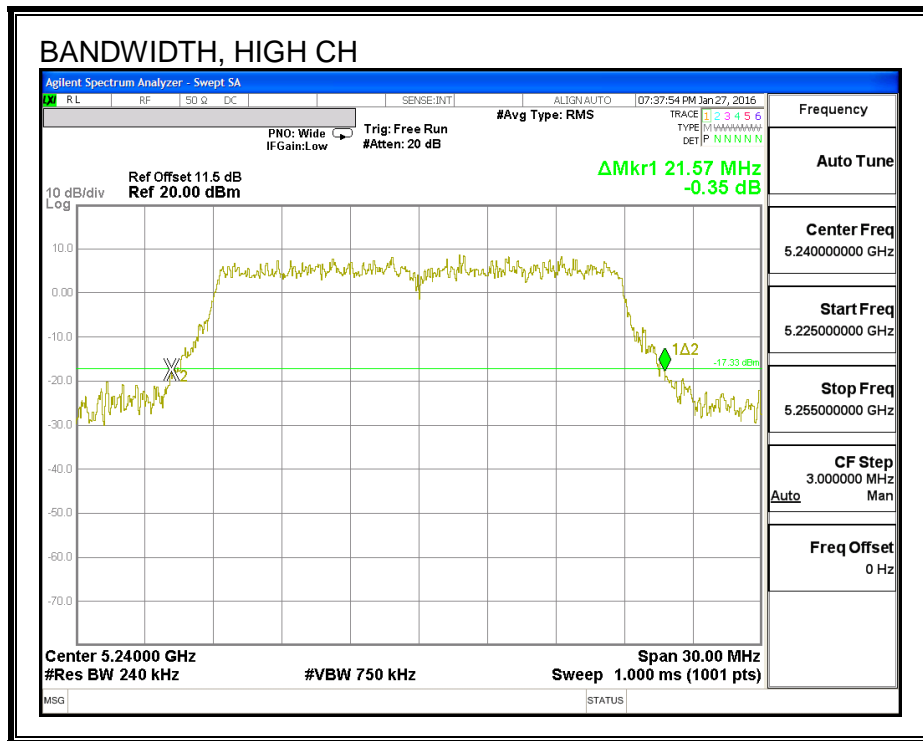
None; for reporting purposes only.

#### RESULTS

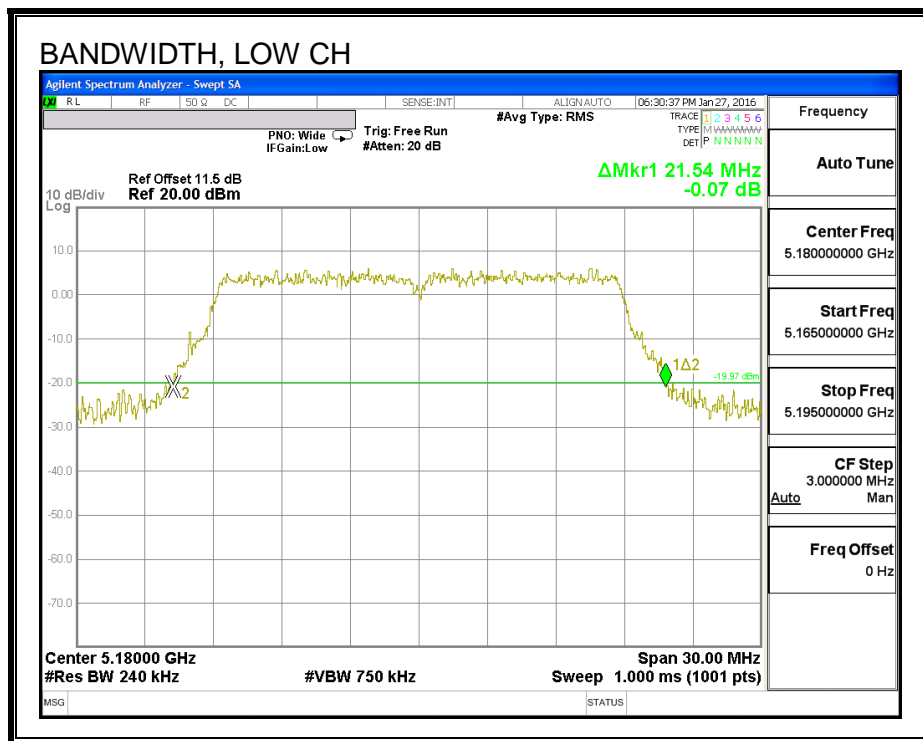
Channel	Frequency (MHz)	26 dB BW Antenna A (MHz)	26 dB BW Antenna C (MHz)
Low	5180	21.63	21.54
Mid	5200	21.42	21.60
High	5240	21.57	21.36

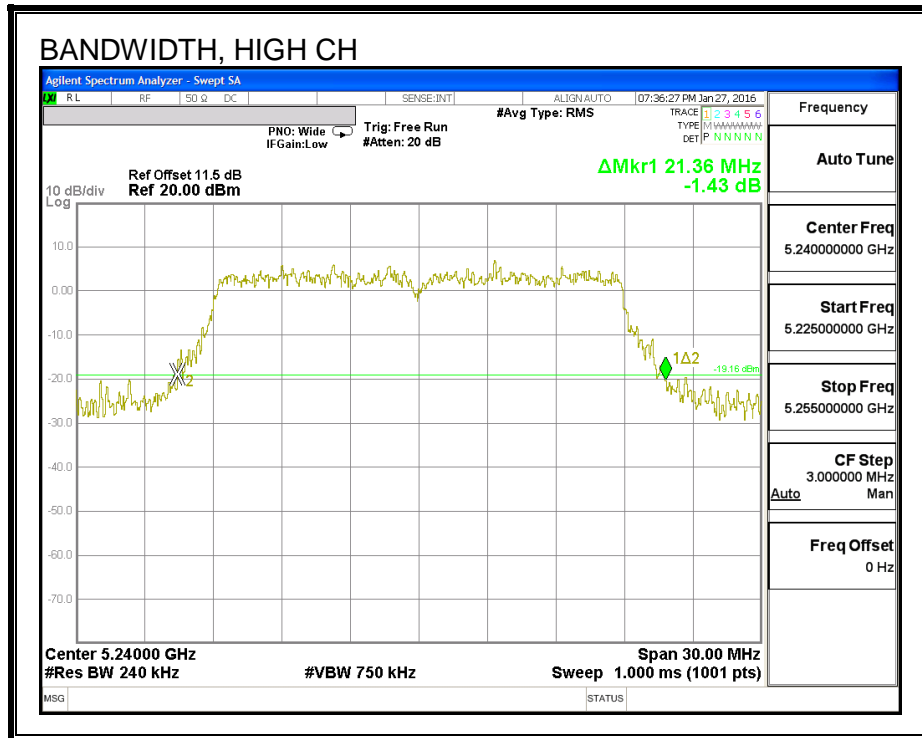
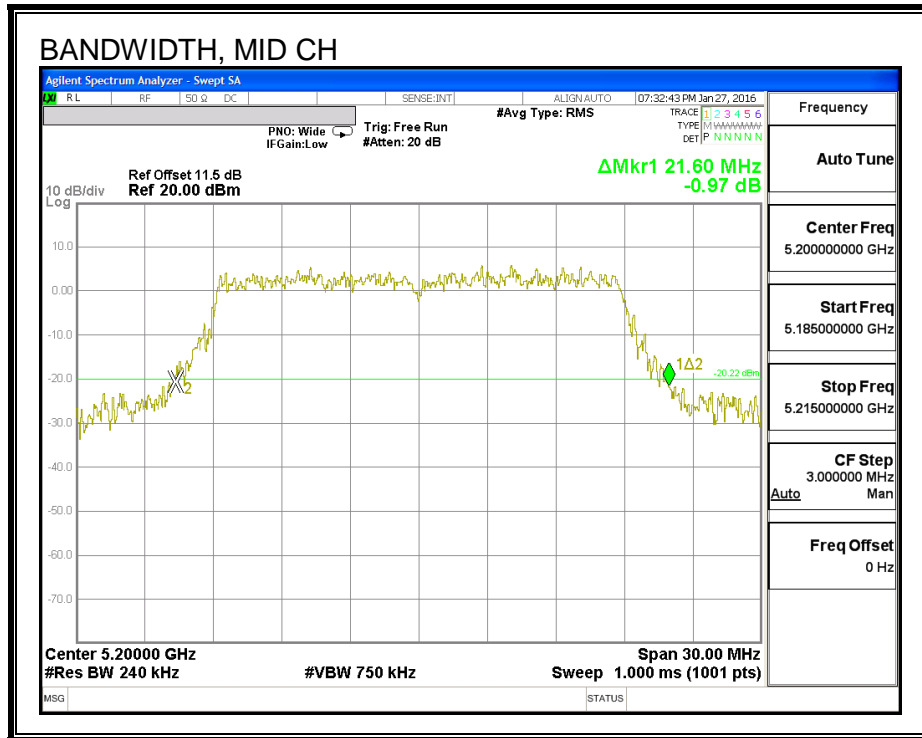
**26 DB BANDWIDTH, ANTENNA - A**





**26 DB BANDWIDTH, ANTENNA - C**





### 8.10.2. 99% BANDWIDTH

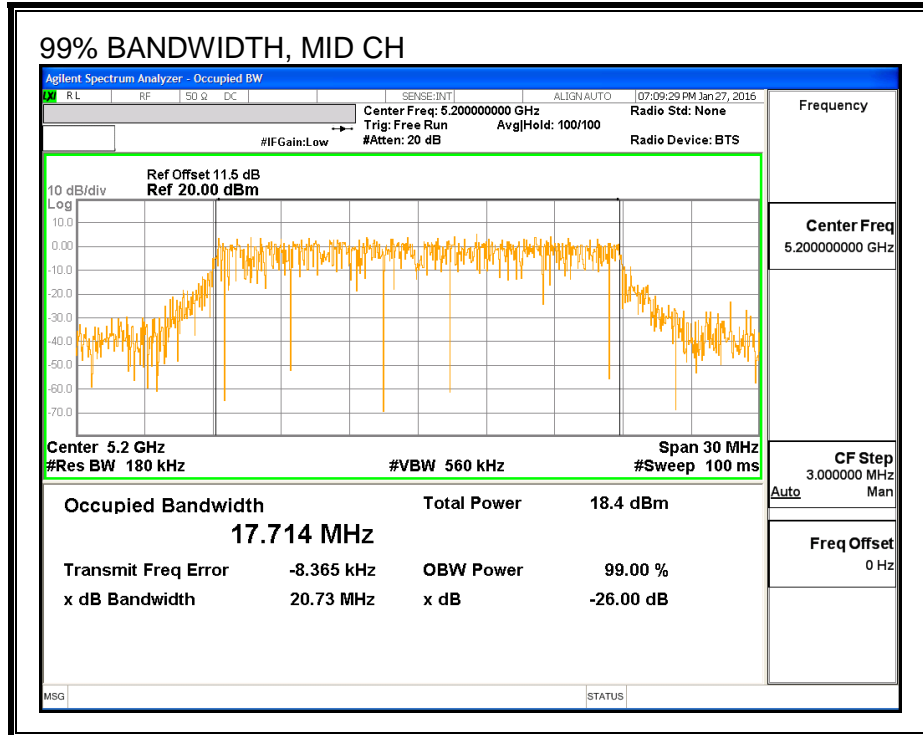
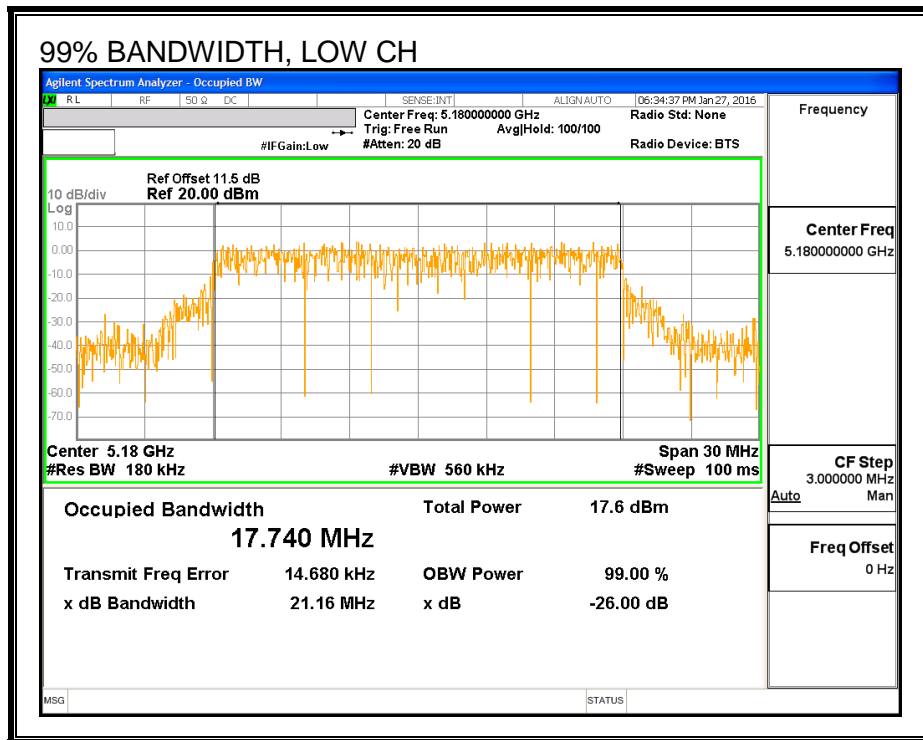
#### LIMITS

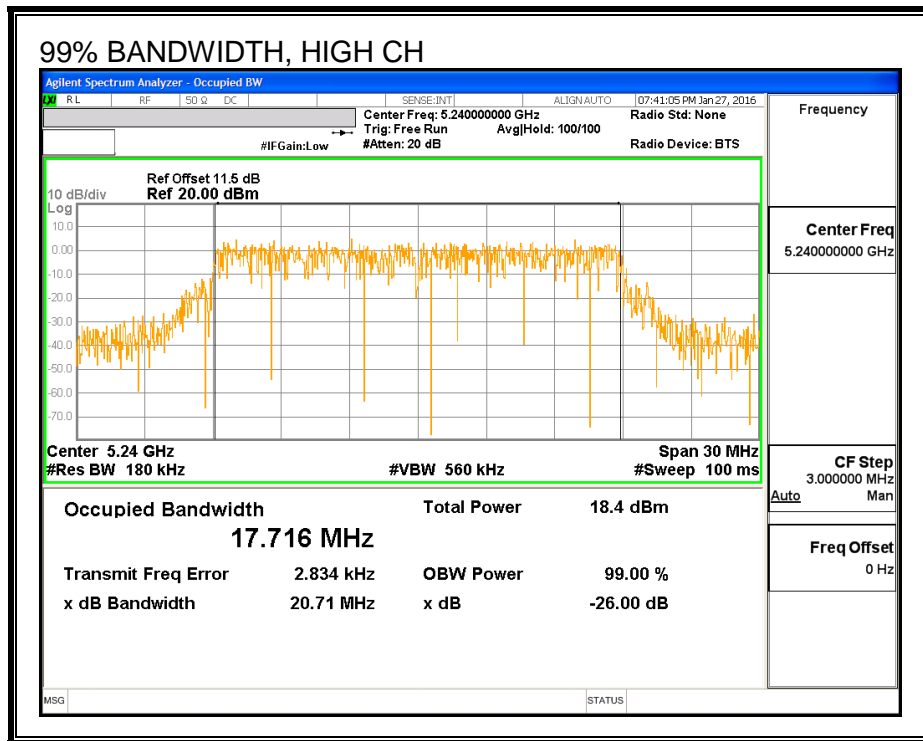
None; for reporting purposes only.

#### RESULTS

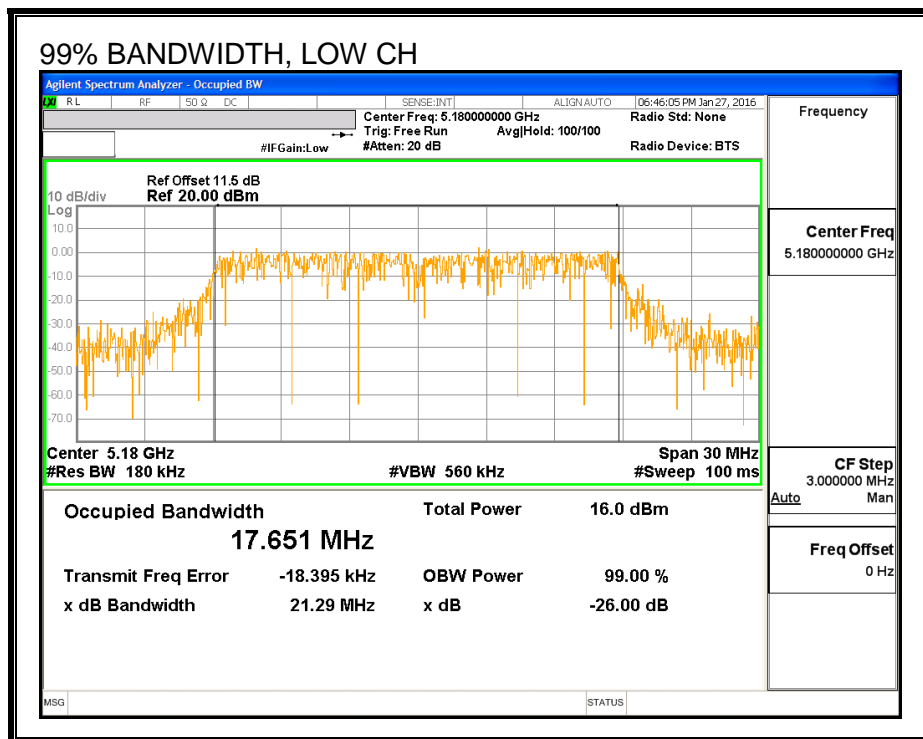
Channel	Frequency (MHz)	99% BW Antenna A (MHz)	99% BW Antenna C (MHz)
Low	5180	17.740	17.651
Mid	5200	17.714	17.714
High	5240	17.716	17.738

**99% BANDWIDTH, ANTENNA - A**

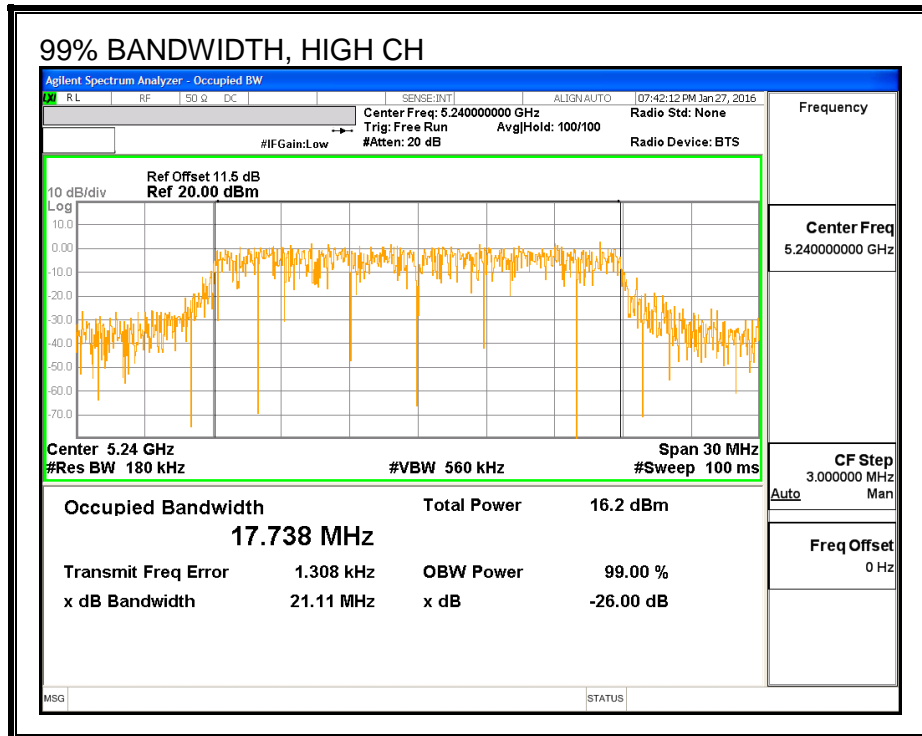
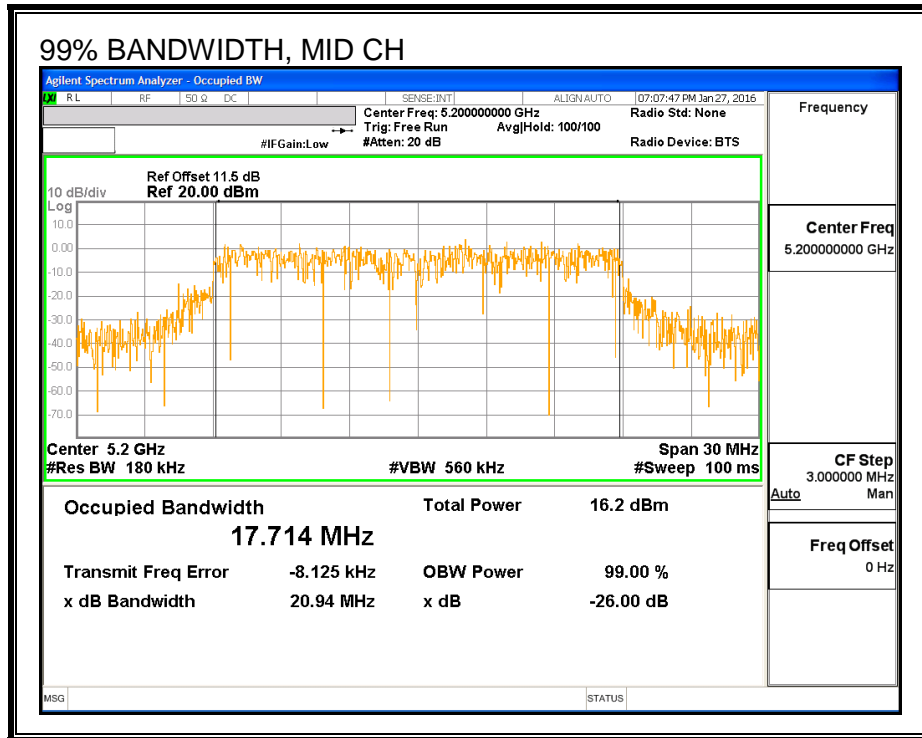




**99% BANDWIDTH, ANTENNA - C**







### 8.10.3. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

#### RESULTS

Channel	Frequency (MHz)	Antenna A Power (dBm)	Antenna C Power (dBm)	Total Power (dBm)
Low	5180	14.47	14.55	17.52
Mid	5200	15.99	15.95	18.98
High	5240	15.96	16.00	18.99

## 8.10.4. OUTPUT POWER AND PSD

### LIMITS

FCC §15.407 (a) (1)

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### TEST PROCEDURE

Measurements perform using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

**DIRECTIONAL ANTENNA GAIN**

The TX chains are uncorrelated and the antenna gain is unequal among the chains. The directional gain is:

<b>Antenna A</b>	<b>Antenna C</b>	<b>Uncorrelated Chains</b>
<b>Gain (dBi)</b>	<b>Gain (dBi)</b>	<b>Directional Gain (dBi)</b>
2.30	1.36	1.86

The TX chains are correlated and the antenna gain is unequal among the chains. The directional gain is:

<b>Antenna A</b>	<b>Antenna C</b>	<b>Correlated Chains</b>
<b>Gain (dBi)</b>	<b>Gain (dBi)</b>	<b>Directional Gain (dBi)</b>
2.30	1.36	4.85

**RESULTS**

**Antenna Gain and Limits**

Channel	Frequency (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
Low	5180	1.86	4.85	24.00	11.00
Mid	5200	1.86	4.85	24.00	11.00
High	5240	1.86	4.85	24.00	11.00

<b>Duty Cycle CF (dB)</b>	0.00	<b>Included in Calculations of Corr'd PSD</b>
---------------------------	------	---

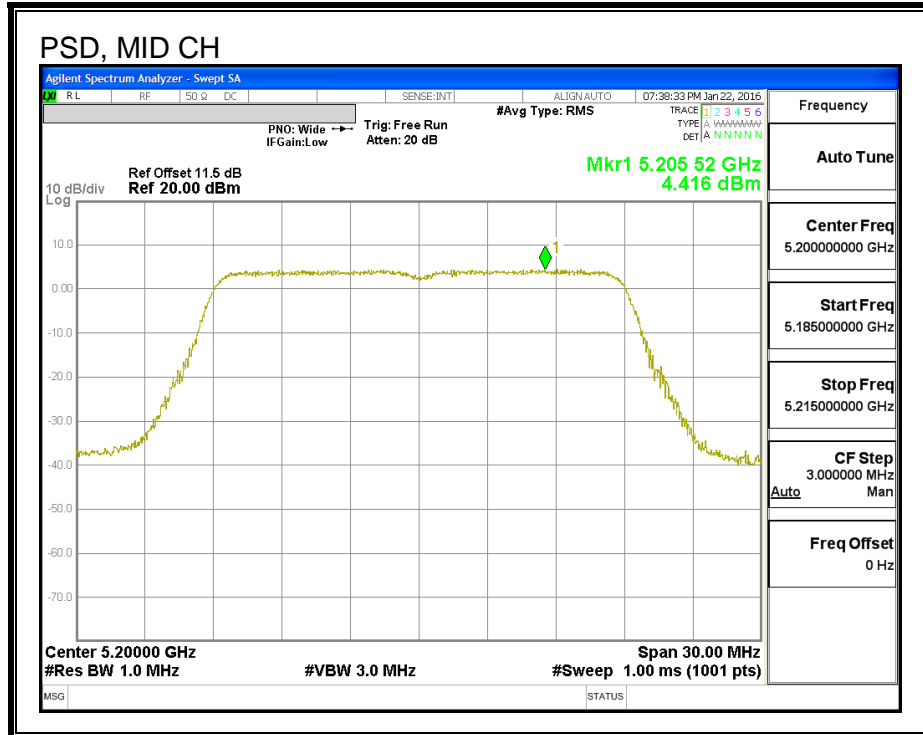
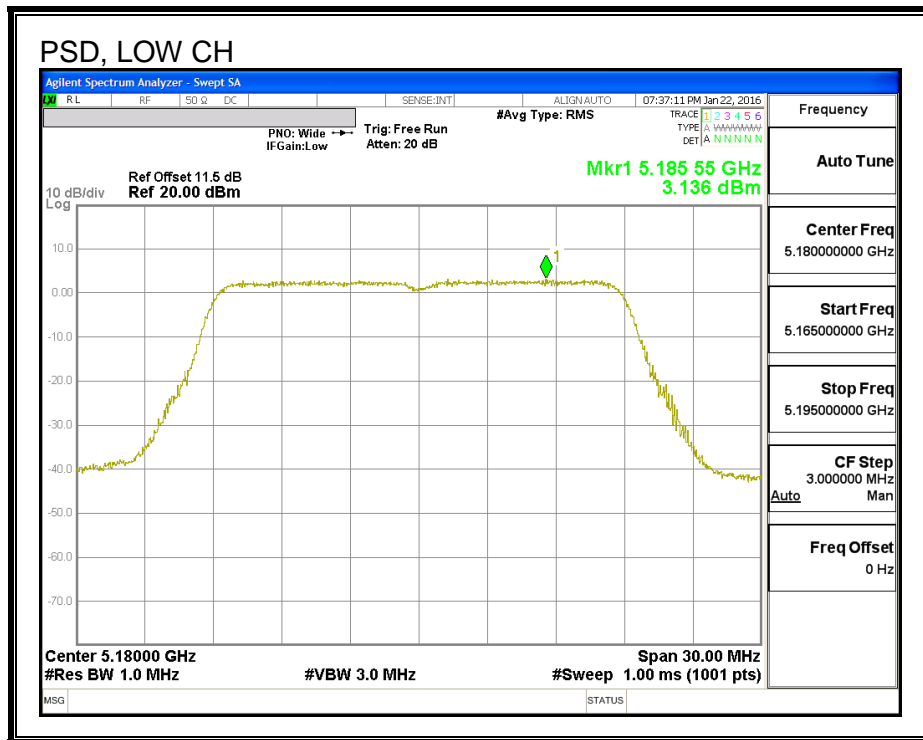
**Output Power Results**

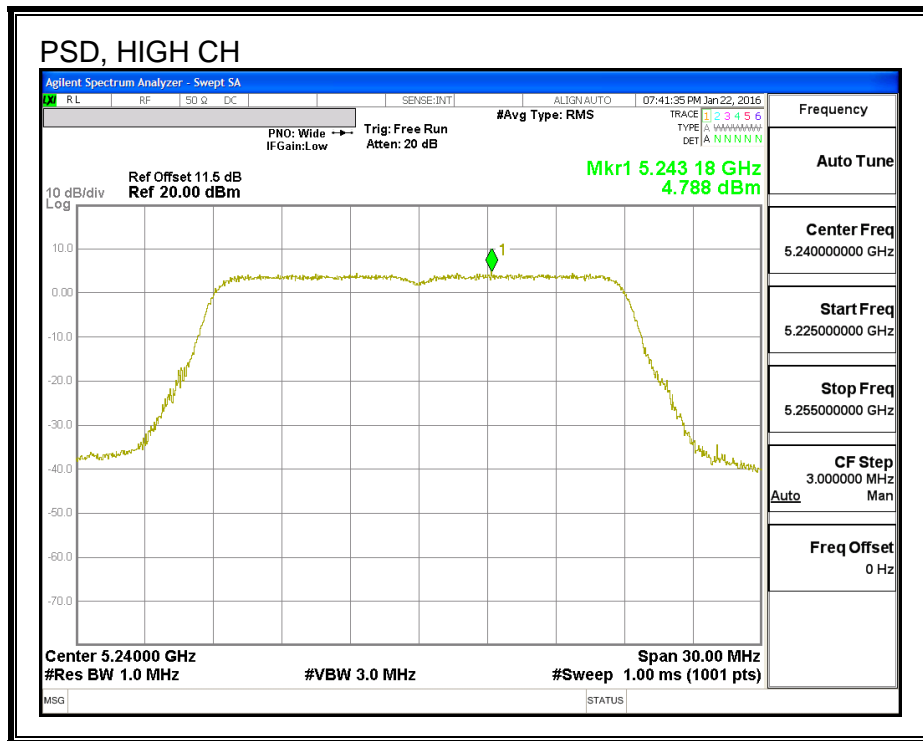
Channel	Frequency (MHz)	Antenna A Meas Power (dBm)	Antenna C Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	14.47	14.55	17.52	24.00	-6.48
Mid	5200	15.99	15.95	18.98	24.00	-5.02
High	5240	15.96	16.00	18.99	24.00	-5.01

**PSD Results**

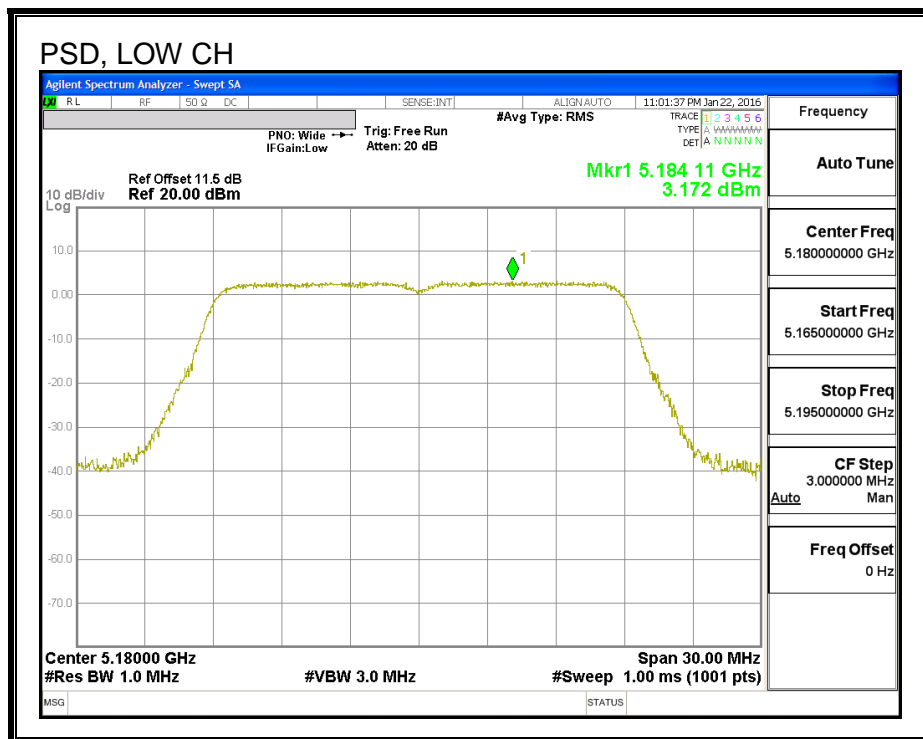
Channel	Frequency (MHz)	Antenna A Meas PSD (dBm)	Antenna C Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5180	3.14	3.17	6.16	11.00	-4.84
Mid	5200	4.42	4.67	7.55	11.00	-3.45
High	5240	4.78	4.54	7.67	11.00	-3.33

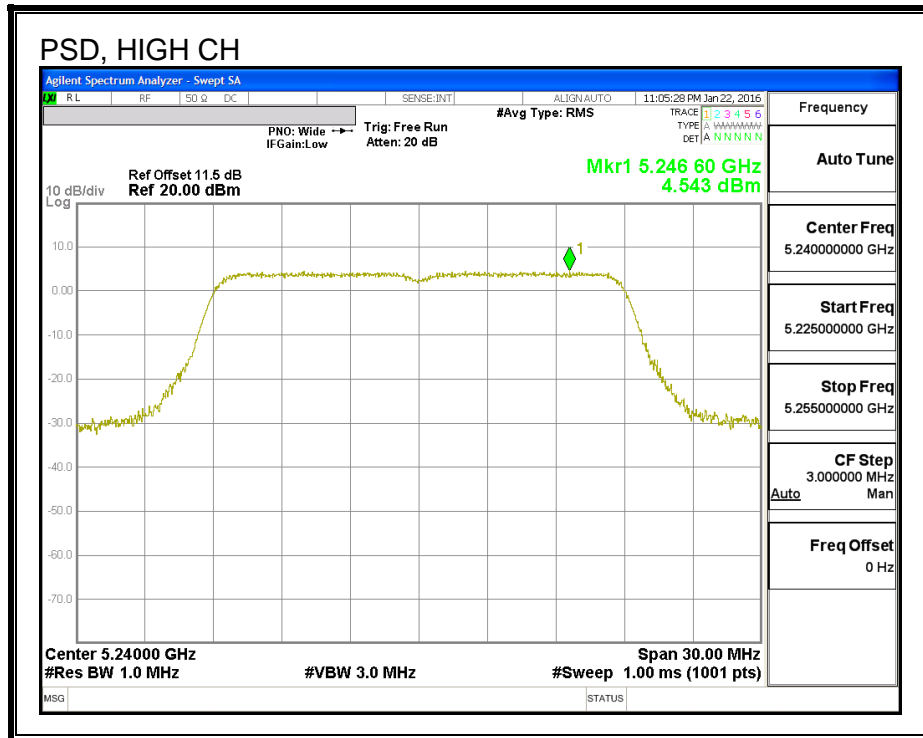
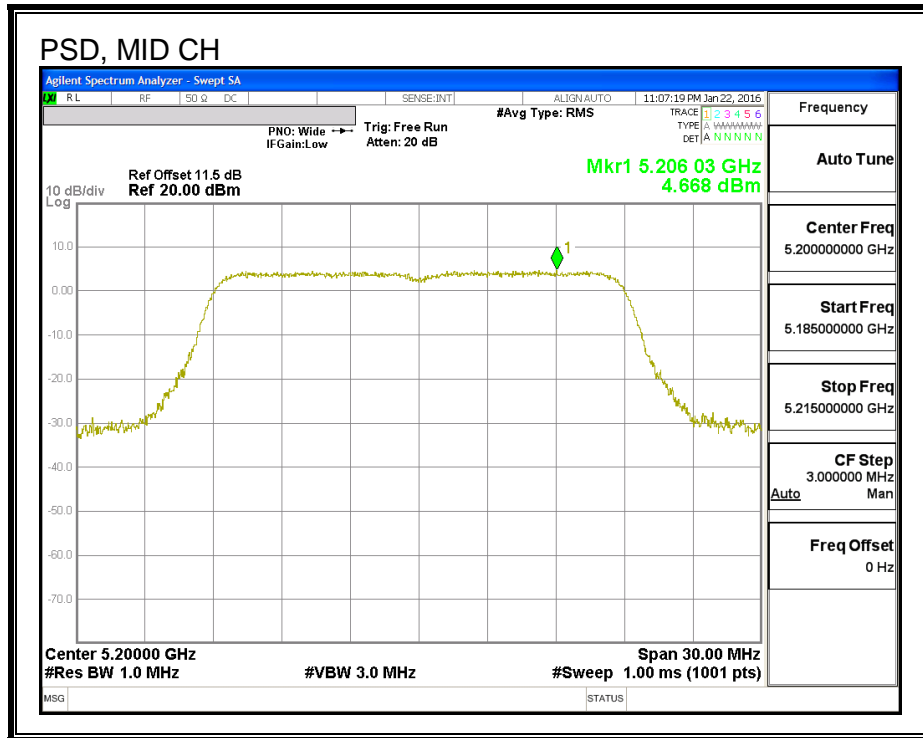
**PSD, ANTENNA - A**





### PSD, ANTENNA - C







## 8.11. 802.11n HT20 ANTENNA B+A STBC MODE IN THE 5.2 GHz BAND

### 8.11.1. 26 dB BANDWIDTH

#### LIMITS

None; for reporting purposes only.

#### RESULTS

Channel	Frequency (MHz)	26 dB BW Antenna B (MHz)	26 dB BW Antenna A (MHz)
Low	5180	21.65	21.71
Mid	5200	21.65	21.81
High	5240	21.55	21.68