



CERTIFICATION TEST REPORT

Report Number. : 16U23816-E4V4

Applicant : APPLE, INC.
1 INFINITE LOOP
CUPERTINO, CA 95014, U.S.A.

Model : A1671, A1821

FCC ID : BCGA1671

EUT Description : TABLET DEVICE

Test Standard(s) : FCC 47 CFR PART 15 SUBPART E

Date Of Issue:

March 09, 2017

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

Rev.	Issue Date	Revisions	Revised By
V1	02/21/2017	Initial Issue	Chin Pang
V2	02/27/2017	Updated 5.3G antenna A to 4.11 & EUT description under the DFS Section antenna.	Joe Vang
V3	02/28/2017	Addressed TCB Questions	Francisco Guarnero
V4	03/09/2017	Addressed TCB Questions	Mengistu Mekuria

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	11
2. TEST METHODOLOGY	12
3. FACILITIES AND ACCREDITATION	12
4. CALIBRATION AND UNCERTAINTY	13
4.1. MEASURING INSTRUMENT CALIBRATION	13
4.2. SAMPLE CALCULATION	13
4.3. MEASUREMENT UNCERTAINTY	13
5. EQUIPMENT UNDER TEST.....	13
5.1. DESCRIPTION OF EUT.....	13
5.2. DESCRIPTION OF MODELS DIFFERENCES	14
5.3. MAXIMUM OUTPUT POWER	14
5.4. DESCRIPTION OF AVAILABLE ANTENNAS.....	16
5.5. SOFTWARE AND FIRMWARE	16
5.6. WORST-CASE CONFIGURATION AND MODE.....	17
5.7. DESCRIPTION OF TEST SETUP	18
6. TEST AND MEASUREMENT EQUIPMENT	24
7. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS	25
7.1. ON TIME AND DUTY CYCLE.....	25
7.2. MEASUREMENT METHODS.....	29
8. ANTENNA PORT TEST RESULTS.....	30
8.1. 802.11n HT20 Antenna A MODE IN THE 5.2 GHz BAND	30
8.1.1. 26 dB BANDWIDTH	30
8.1.2. 99% BANDWIDTH.....	33
8.1.3. AVERAGE POWER.....	36
8.1.4. OUTPUT POWER AND PSD	37
8.2. 802.11n HT20 Antenna B MODE IN THE 5.2 GHz BAND	41
8.2.1. 26 dB BANDWIDTH	41
8.2.2. 99% BANDWIDTH.....	44
8.2.3. AVERAGE POWER.....	47
8.2.4. OUTPUT POWER AND PSD	48
8.3. 802.11n HT20 2Tx (Antenna A + Antenna B) CDD MODE IN THE 5.2 GHz BAND	52
8.3.1. 26 dB BANDWIDTH	52
8.3.2. 99% BANDWIDTH.....	56
8.3.3. AVERAGE POWER.....	60
8.3.4. OUTPUT POWER AND PSD	61
8.4. 802.11n HT20 2Tx (Ant A + Ant B) STBC MODE IN THE 5.2 GHz BAND	67
8.4.1. 26 dB BANDWIDTH	67

8.4.2.	99% BANDWIDTH.....	71
8.4.3.	AVERAGE POWER.....	75
8.4.4.	OUTPUT POWER AND PSD	76
8.5.	<i>802.11n HT40 Antenna A MODE IN THE 5.2 GHz BAND</i>	<i>82</i>
8.5.1.	26 dB BANDWIDTH	82
8.5.2.	99% BANDWIDTH.....	84
8.5.3.	AVERAGE POWER.....	86
8.5.4.	OUTPUT POWER AND PSD	87
8.6.	<i>802.11n HT40 Antenna B MODE IN THE 5.2 GHz BAND</i>	<i>90</i>
8.6.1.	26 dB BANDWIDTH	90
8.6.2.	99% BANDWIDTH.....	92
8.6.3.	AVERAGE POWER.....	94
8.6.4.	OUTPUT POWER AND PSD	95
8.7.	<i>802.11n HT40 2Tx (Antenna A + Antenna B) CDD MODE IN THE 5.2 GHz BAND</i>	<i>98</i>
8.7.1.	26 dB BANDWIDTH	98
8.7.2.	99% BANDWIDTH.....	101
8.7.3.	AVERAGE POWER.....	104
8.7.4.	OUTPUT POWER AND PSD	105
8.8.	<i>802.11ac VHT80 Antenna A MODE IN THE 5.2 GHz BAND</i>	<i>110</i>
8.8.1.	26 dB BANDWIDTH	110
8.8.2.	99% BANDWIDTH.....	111
8.8.3.	AVERAGE POWER.....	112
8.8.4.	OUTPUT POWER AND PSD	113
8.9.	<i>802.11ac VHT80 Antenna B MODE IN THE 5.2 GHz BAND</i>	<i>116</i>
8.9.1.	26 dB BANDWIDTH	116
8.9.2.	99% BANDWIDTH.....	117
8.9.3.	AVERAGE POWER.....	118
8.9.4.	OUTPUT POWER AND PSD	119
8.10.	<i>802.11ac VHT80 2Tx (Antenna A + Antenna B) CDD MODE IN THE 5.2 GHz BAND</i>	<i>122</i>
8.10.1.	26 dB BANDWIDTH.....	122
8.10.2.	99% BANDWIDTH.....	124
8.10.3.	AVERAGE POWER.....	126
8.10.4.	OUTPUT POWER AND PSD	127
8.11.	<i>802.11n HT20 Antenna A MODE IN THE 5.3 GHz BAND.....</i>	<i>131</i>
8.11.1.	26 dB BANDWIDTH.....	131
8.11.2.	99% BANDWIDTH.....	134
8.11.3.	AVERAGE POWER	137
8.11.4.	OUTPUT POWER AND PSD	138
8.12.	<i>802.11n HT20 Antenna B MODE IN THE 5.3 GHz BAND</i>	<i>142</i>
8.12.1.	26 dB BANDWIDTH.....	142
8.12.2.	99% BANDWIDTH.....	145
8.12.3.	AVERAGE POWER	148
8.12.4.	OUTPUT POWER AND PSD	149
8.13.	<i>802.11n HT20 2Tx (Antenna A + Antenna B) CDD MODE IN THE 5.3 GHz BAND.....</i>	<i>153</i>
8.13.1.	26 dB BANDWIDTH.....	153
8.13.2.	99% BANDWIDTH.....	157
8.13.3.	AVERAGE POWER	161
8.13.4.	OUTPUT POWER AND PSD	162

8.14.	802.11n HT20 2Tx (ANTENNA A + ANTENNA B) STBC MODE IN THE 5.3 GHz BAND	167
8.14.1.	26 dB BANDWIDTH	167
8.14.2.	99% BANDWIDTH	171
8.14.3.	AVERAGE POWER	175
8.14.4.	OUTPUT POWER AND PSD	176
8.15.	802.11n HT40 ANTENNA A MODE IN THE 5.3 GHz BAND	181
8.15.1.	26 dB BANDWIDTH	181
8.15.2.	99% BANDWIDTH	183
8.15.3.	AVERAGE POWER	185
8.15.4.	OUTPUT POWER AND PSD	186
8.16.	802.11n HT40 ANTENNA B MODE IN THE 5.3 GHz BAND	189
8.16.1.	26 dB BANDWIDTH	189
8.16.2.	99% BANDWIDTH	191
8.16.3.	AVERAGE POWER	193
8.16.4.	OUTPUT POWER AND PSD	194
8.17.	802.11n HT40 2Tx (ANTENNA A + ANTENNA B) CDD MODE IN THE 5.3 GHz BAND	197
8.17.1.	26 dB BANDWIDTH	197
8.17.2.	99% BANDWIDTH	200
8.17.3.	AVERAGE POWER	203
8.17.4.	OUTPUT POWER AND PSD	204
8.18.	802.11ac VHT80 Antenna A MODE IN THE 5.3 GHz BAND	208
8.18.1.	26 dB BANDWIDTH	208
8.18.2.	99% BANDWIDTH	209
8.18.3.	AVERAGE POWER	210
8.18.4.	OUTPUT POWER AND PSD	211
8.19.	802.11ac VHT80 Antenna B MODE IN THE 5.3 GHz BAND	214
8.19.1.	26 dB BANDWIDTH	214
8.19.2.	99% BANDWIDTH	215
8.19.3.	AVERAGE POWER	216
8.19.4.	OUTPUT POWER AND PSD	217
8.20.	802.11ac VHT80 2Tx (Antenna A + Antenna B) CDD MODE IN THE 5.3 GHz BAND	220
8.20.1.	26 dB BANDWIDTH	220
8.20.2.	99% BANDWIDTH	222
8.20.3.	AVERAGE POWER	224
8.20.4.	OUTPUT POWER AND PSD	225
8.21.	802.11n HT20 Antenna A MODE IN THE 5.6 GHz BAND	228
8.21.1.	26 dB BANDWIDTH	228
8.21.2.	99% BANDWIDTH	231
8.21.3.	AVERAGE POWER	234
8.21.4.	OUTPUT POWER AND PSD	235
8.22.	802.11ac VHT20 Antenna A STRADDLE CHANNEL 144 RESULTS	239
8.22.1.	OUTPUT POWER AND PSD	239
8.22.2.	6 dB BANDWIDTH	243
8.23.	802.11n HT20 Antenna B MODE IN THE 5.6 GHz BAND	244
8.23.1.	26 dB BANDWIDTH	244
8.23.2.	99% BANDWIDTH	247
8.23.3.	AVERAGE POWER	250
8.23.4.	OUTPUT POWER AND PSD	251

8.24.	802.11ac VHT20 Antenna B STRADDLE CHANNEL 144 RESULTS.....	255
8.24.1.	OUTPUT POWER AND PSD	255
8.24.2.	6 dB BANDWIDTH.....	259
8.25.	802.11n HT20 2Tx (ANTENNA A + ANTENNA B) CDD MODE IN THE 5.6 GHz BAND .	260
8.25.1.	26 dB BANDWIDTH.....	260
8.25.2.	99% BANDWIDTH.....	265
8.25.3.	AVERAGE POWER.....	270
8.25.4.	OUTPUT POWER AND PSD	271
8.26.	802.11ac VHT20 2Tx (ANTENNA A + ANTENNA B) CDD STRADDLE CHANNEL 144 RESULTS	277
8.26.1.	OUTPUT POWER AND PSD	277
8.26.2.	6 dB BANDWIDTH.....	283
8.27.	802.11n HT20 2Tx (ANTENNA A + ANTENNA B) STBC MODE IN THE 5.6 GHz BAND	285
8.27.1.	26 dB BANDWIDTH.....	285
8.27.2.	99% BANDWIDTH.....	290
8.27.3.	AVERAGE POWER.....	295
8.27.4.	OUTPUT POWER AND PSD	296
8.28.	802.11ac VHT20 2Tx (ANTENNA A + ANTENNA B) STBC STRADDLE CHANNEL 144 RESULTS	301
8.28.1.	OUTPUT POWER AND PSD	301
8.28.2.	6 dB BANDWIDTH.....	307
8.29.	802.11n HT40 ANTENNA A MODE IN THE 5.6 GHz BAND	309
8.29.1.	26 dB BANDWIDTH.....	309
8.29.2.	99% BANDWIDTH.....	312
8.29.3.	AVERAGE POWER.....	315
8.29.4.	OUTPUT POWER AND PSD	316
8.30.	802.11ac VHT40 ANTENNA A STRADDLE CH 142 RESULTS.....	320
8.30.1.	OUTPUT POWER AND PSD	320
8.30.2.	6 dB BANDWIDTH.....	324
8.31.	802.11n HT40 ANTENNA B MODE IN THE 5.6 GHz BAND	325
8.31.1.	26 dB BANDWIDTH.....	325
8.31.2.	99% BANDWIDTH.....	328
8.31.3.	AVERAGE POWER.....	331
8.31.4.	OUTPUT POWER AND PSD	332
8.32.	802.11ac VHT40 ANTENNA B STRADDLE CH 142 RESULTS.....	336
8.32.1.	OUTPUT POWER AND PSD	336
8.32.2.	6 dB BANDWIDTH.....	340
8.33.	802.11n HT40 2Tx (ANTENNA A + ANTENNA B) CDD MODE IN THE 5.6 GHz BAND .	341
8.33.1.	26 dB BANDWIDTH.....	341
8.33.2.	99% BANDWIDTH.....	346
8.33.3.	AVERAGE POWER.....	351
8.33.4.	OUTPUT POWER AND PSD	352
8.34.	802.11ac VHT40 2Tx (ANTENNA A + ANTENNA B) CDD STRADDLE CHANNEL 142 RESULTS	358
8.34.1.	OUTPUT POWER AND PSD	358
8.34.2.	6 dB BANDWIDTH.....	364
8.35.	802.11ac VHT80 ANTENNA A MODE IN THE 5.6 GHz BAND	366
8.35.1.	26 dB BANDWIDTH.....	366

8.35.2.	99% BANDWIDTH	369
8.35.3.	AVERAGE POWER	372
8.35.4.	OUTPUT POWER AND PSD	373
8.36.	802.11ac VHT80 ANTENNA A STRADDLE CHANNEL 138 RESULTS	376
8.36.1.	OUTPUT POWER AND PSD	376
8.36.2.	6 dB BANDWIDTH.....	380
8.37.	802.11ac VHT80 ANTENNA B MODE IN THE 5.6 GHz BAND	381
8.37.1.	26 dB BANDWIDTH.....	381
8.37.2.	99% BANDWIDTH	384
8.37.3.	AVERAGE POWER	387
8.37.4.	OUTPUT POWER AND PSD	388
8.38.	802.11ac VHT80 ANTENNA B STRADDLE CHANNEL 138 RESULTS	391
8.38.1.	OUTPUT POWER AND PSD	391
8.38.2.	6 dB BANDWIDTH.....	395
8.39.	802.11ac VHT80 2Tx (ANTENNA A + ANTENNA B) CDD MODE IN THE 5.6 GHz BAND (5610MHz for FCC only)	396
8.39.1.	26 dB BANDWIDTH.....	396
8.39.2.	99% BANDWIDTH	400
8.39.3.	AVERAGE POWER	404
8.39.4.	OUTPUT POWER AND PSD	405
8.40.	802.11ac VHT80 2Tx (ANTENNA A + ANTENNA B) CDD STRADDLE CHANNEL 138 RESULTS	410
8.40.1.	OUTPUT POWER AND PSD	410
8.40.2.	6 dB BANDWIDTH.....	416
8.41.	802.11n HT20 ANTENNA A MODE IN THE 5.8 GHz BAND	418
8.41.1.	6 dB BANDWIDTH.....	418
8.41.2.	26 dB BANDWIDTH.....	421
8.41.3.	99% BANDWIDTH	424
8.41.4.	AVERAGE POWER	427
8.41.5.	OUTPUT POWER.....	428
8.41.6.	PSD	430
8.42.	802.11n HT20 ANTENNA B MODE IN THE 5.8 GHz BAND	433
8.42.1.	6 dB BANDWIDTH.....	433
8.42.2.	26 dB BANDWIDTH.....	436
8.42.3.	99% BANDWIDTH	439
8.42.4.	AVERAGE POWER	442
8.42.5.	OUTPUT POWER.....	443
8.42.6.	PSD	445
8.43.	802.11n HT20 2Tx (ANTENNA A + ANTENNA B) CDD MODE IN THE 5.8 GHz BAND ..	448
8.43.1.	6 dB BANDWIDTH.....	448
8.43.2.	26 dB BANDWIDTH.....	452
8.43.3.	99% BANDWIDTH	456
8.43.4.	AVERAGE POWER	460
8.43.5.	OUTPUT POWER.....	461
8.43.6.	PSD	463
8.44.	802.11n HT20 2Tx (ANTENNA A + ANTENNA B) STBC MODE IN THE 5.8 GHz BAND	468
8.44.1.	6 dB BANDWIDTH.....	468
8.44.2.	99% BANDWIDTH	472
8.44.3.	AVERAGE POWER	476

8.44.4.	OUTPUT POWER.....	477
8.44.5.	PSD	479
8.45.	<i>802.11n HT40 ANTENNA A MODE IN THE 5.8 GHz BAND</i>	<i>484</i>
8.45.1.	6 dB BANDWIDTH.....	484
8.45.2.	26 dB BANDWIDTH.....	486
8.45.3.	99% BANDWIDTH.....	488
8.45.4.	AVERAGE POWER	490
8.45.5.	OUTPUT POWER.....	491
8.45.6.	PSD	493
8.46.	<i>802.11n HT40 ANTENNA B MODE IN THE 5.8 GHz BAND</i>	<i>496</i>
8.46.1.	6 dB BANDWIDTH.....	496
8.46.2.	26 dB BANDWIDTH.....	498
8.46.3.	99% BANDWIDTH.....	500
8.46.4.	AVERAGE POWER	502
8.46.5.	OUTPUT POWER.....	503
8.46.6.	PSD	505
8.47.	<i>802.11n HT40 2Tx (ANTENNA A + ANTENNA B) CDD MODE IN THE 5.8 GHz BAND .</i>	<i>508</i>
8.47.1.	6 dB BANDWIDTH.....	508
8.47.2.	26 dB BANDWIDTH.....	511
8.47.3.	99% BANDWIDTH.....	514
8.47.4.	AVERAGE POWER	517
8.47.5.	OUTPUT POWER.....	518
8.47.6.	PSD	520
8.48.	<i>802.11ac VHT80 ANTENNA A MODE IN THE 5.8 GHz BAND</i>	<i>524</i>
8.48.1.	6 dB BANDWIDTH.....	524
8.48.2.	26 dB BANDWIDTH.....	525
8.48.3.	99% BANDWIDTH.....	526
8.48.4.	AVERAGE POWER	527
8.48.5.	OUTPUT POWER.....	528
8.48.6.	PSD	530
8.49.	<i>802.11ac VHT80 ANTENNA B MODE IN THE 5.8 GHz BAND</i>	<i>532</i>
8.49.1.	6 dB BANDWIDTH.....	532
8.49.2.	26 dB BANDWIDTH.....	533
8.49.3.	99% BANDWIDTH.....	534
8.49.4.	AVERAGE POWER	535
8.49.5.	OUTPUT POWER.....	536
8.49.6.	PSD	538
8.50.	<i>802.11ac VHT80 2Tx (ANTENNA A + ANTENNA B) CDD MODE IN THE 5.8 GHz BAND</i>	<i>540</i>
8.50.1.	6 dB BANDWIDTH.....	540
8.50.2.	26 dB BANDWIDTH.....	542
8.50.3.	99% BANDWIDTH.....	544
8.50.4.	AVERAGE POWER	546
8.50.5.	OUTPUT POWER.....	547
8.50.6.	PSD	549
9.	RADIATED RESULTS	552
9.1.	<i>LIMITS AND PROCEDURE.....</i>	<i>552</i>
9.2.	<i>TRANSMITTER ABOVE 1 GHz.....</i>	<i>553</i>

9.2.1.	11n HT20 ANTENNA A SISO MODE IN THE 5.2GHz BAND	553
9.2.2.	11n HT20 ANTENNA B SISO MODE IN THE 5.2GHz BAND	561
9.2.3.	11n HT20 2TX CDD MIMO MODE IN THE 5.2GHz BAND	569
9.2.4.	11n HT40 ANTENNA A SISO MODE IN THE 5.2GHz BAND	577
9.2.5.	11n HT40 ANTENNA B SISO MODE IN THE 5.2GHz BAND	583
9.2.6.	11n HT40 2TX CDD MIMO MODE IN THE 5.2GHz BAND	589
9.2.7.	11ac HT80 ANTENNA A SISO MODE IN THE 5.2GHz BAND	595
9.2.8.	11ac HT80 ANTENNA B SISO MODE IN THE 5.2GHz BAND	599
9.2.9.	11ac HT80 2TX CDD MIMO MODE IN THE 5.2GHz BAND	603
9.2.10.	11n HT20 ANTENNA A SISO MODE IN THE 5.3GHz BAND	607
9.2.11.	11n HT20 ANTENNA B SISO MODE IN THE 5.3GHz BAND	615
9.2.12.	11n HT20 2TX CDD MIMO MODE IN THE 5.3GHz BAND	623
9.2.13.	11n HT40 ANTENNA A SISO MODE IN THE 5.3GHz BAND	631
9.2.14.	11n HT40 ANTENNA B SISO MODE IN THE 5.3GHz BAND	637
9.2.15.	11n HT40 2TX CDD MIMO MODE IN THE 5.3GHz BAND	643
9.2.16.	11ac HT80 ANTENNA A SISO MODE IN THE 5.3GHz BAND	649
9.2.17.	11ac HT80 ANTENNA B SISO MODE IN THE 5.3GHz BAND	653
9.2.18.	11ac HT80 2TX CDD MIMO MODE IN THE 5.3GHz BAND	657
9.2.19.	11n HT20 ANTENNA A SISO MODE IN THE 5.6GHz BAND	661
9.2.20.	11ac HT20 ANTENNA A SISO STRADDLE CHANNEL 144	671
9.2.21.	11n HT20 ANTENNA B SISO MODE IN THE 5.6GHz BAND	673
9.2.22.	11ac HT20 ANTENNA B SISO STRADDLE CHANNEL 144	683
9.2.23.	11n HT20 2TX CDD MIMO MODE IN THE 5.6GHz BAND	685
9.2.24.	11ac HT20 2TX CDD MIMO STRADDLE CHANNEL 144	695
9.2.25.	11n HT40 ANTENNA A SISO MODE IN THE 5.6GHz BAND	697
9.2.26.	11ac HT40 ANTENNA A SISO STRADDLE CHANNEL 142	707
9.2.27.	11n HT40 ANTENNA B SISO MODE IN THE 5.6GHz BAND	709
9.2.28.	11ac HT40 ANTENNA B SISO STRADDLE CHANNEL 142	719
9.2.29.	11n HT40 2TX CDD MIMO MODE IN THE 5.6GHz BAND	721
9.2.30.	11ac HT40 2TX CDD MIMO STRADDLE CHANNEL 142	731
9.2.31.	11ac HT80 ANTENNA A SISO MODE IN THE 5.6GHz BAND	733
9.2.32.	11ac HT80 ANTENNA A SISO STRADDLE CHANNEL 138	739
9.2.33.	11ac HT80 ANTENNA B SISO MODE IN THE 5.6GHz BAND	741
9.2.34.	11ac HT80 ANTENNA B SISO STRADDLE CHANNEL 138	747
9.2.35.	11ac HT80 2TX CDD MIMO MODE IN THE 5.6GHz BAND	749
9.2.36.	11ac HT80 2TX CDD MIMO STRADDLE CHANNEL 138	755
9.2.37.	11n HT20 ANTENNA A SISO MODE IN THE 5.8GHz BAND	757
9.2.38.	11n HT20 ANTENNA B SISO MODE IN THE 5.8GHz BAND	767
9.2.39.	11n HT20 2TX CDD MIMO MODE IN THE 5.8GHz BAND	777
9.2.40.	11n HT40 ANTENNA A SISO MODE IN THE 5.8GHz BAND	787
9.2.41.	11n HT40 ANTENNA B SISO MODE IN THE 5.8GHz BAND	795
9.2.42.	11n HT40 2TX CDD MIMO MODE IN THE 5.8GHz BAND	803
9.2.43.	11ac HT80 ANTENNA A SISO MODE IN THE 5.8GHz BAND	811
9.2.44.	11ac HT80 ANTENNA B SISO MODE IN THE 5.8GHz BAND	817
9.2.45.	11ac HT80 2TX CDD MIMO MODE IN THE 5.8GHz BAND	823
9.3.	WORST-CASE CO-LOCATION	829
9.4.	WORST-CASE BELOW 1 GHz	833
9.5.	WORST-CASE 18 to 26 GHz	835
9.6.	WORST-CASE 26 to 40 GHz	837
10.	AC POWER LINE CONDUCTED EMISSIONS	839

10.1.	EUT POWERED BY AC/DC ADAPTER VIA USB CABLE	840
10.2.	EUT POWERED BY HOST PC VIA USB CABLE	842
11.	DYNAMIC FREQUENCY SELECTION.....	844
11.1.	OVERVIEW	844
11.1.1.	LIMITS.....	844
11.1.2.	TEST AND MEASUREMENT SYSTEM.....	848
11.1.3.	TEST AND MEASUREMENT SOFTWARE.....	850
11.1.4.	SETUP OF EUT (CLIENT MODE)	851
11.1.5.	SETUP OF EUT (CLIENT-TO-CLIENT COMMUNICATIONS MODE).....	852
11.1.6.	DESCRIPTION OF EUT	853
11.2.	CLIENT MODE RESULTS FOR 20 MHz BANDWIDTH	855
11.2.1.	TEST CHANNEL.....	855
11.2.2.	RADAR WAVEFORM AND TRAFFIC	855
11.2.3.	OVERLAPPING CHANNEL TESTS.....	858
11.2.4.	MOVE AND CLOSING TIME	858
11.3.	CLIENT MODE RESULTS FOR 40 MHz BANDWIDTH	862
11.3.1.	TEST CHANNEL.....	862
11.3.2.	RADAR WAVEFORM AND TRAFFIC	862
11.3.3.	OVERLAPPING CHANNEL TESTS.....	865
11.3.4.	MOVE AND CLOSING TIME	865
11.4.	CLIENT MODE RESULTS FOR 80 MHz BANDWIDTH	869
11.4.1.	TEST CHANNEL.....	869
11.4.2.	RADAR WAVEFORM AND TRAFFIC	869
11.4.3.	OVERLAPPING CHANNEL TESTS.....	872
11.4.4.	MOVE AND CLOSING TIME	872
11.4.5.	10-MINUTE CLIENT Tx MONITORING PERIOD	876
11.5.	CLIENT-TO-CLIENT COMMUNICATIONS MODE RESULTS FOR 20 MHz BANDWIDTH 877	
11.5.1.	TEST CHANNEL.....	877
11.5.2.	RADAR WAVEFORM AND TRAFFIC	877
11.5.3.	OVERLAPPING CHANNEL TESTS.....	880
11.5.4.	MOVE AND CLOSING TIME	880
11.6.	CLIENT-TO-CLIENT COMMUNICATIONS MODE RESULTS FOR 40 MHz BANDWIDTH 884	
11.6.1.	TEST CHANNEL.....	884
11.6.2.	RADAR WAVEFORM AND TRAFFIC	884
11.6.3.	OVERLAPPING CHANNEL TESTS.....	887
11.6.4.	MOVE AND CLOSING TIME	887
11.7.	CLIENT-TO-CLIENT COMMUNICATIONS MODE RESULTS FOR 80 MHz BANDWIDTH 891	
11.7.1.	TEST CHANNEL.....	891
11.7.2.	RADAR WAVEFORM AND TRAFFIC	891
11.7.3.	OVERLAPPING CHANNEL TESTS.....	894
11.7.4.	MOVE AND CLOSING TIME	894
11.7.5.	10-MINUTE CLIENT Tx MONITORING PERIOD	898
12.	SETUP PHOTOS.....	899

1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: TABLET DEVICE

MODEL: A1671, A1821

SERIAL NUMBER: DLXST016HPJQ (CONDUCTED); DLXST00NHPJQ (RADIATED)
DLXST013HPJQ (DFS)

DATE TESTED: NOVEMBER 28, 2016 – FEBRUARY 14, 2017

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:

Prepared By:



CHIN PANG
SENIOR ENGINEER
UL VERIFICATION SERVICES INC.



JOE VANG
EMC WISE ENGINEER
UL VERIFICATION SERVICES INC.

2. TEST METHODOLOGY

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 v02/D03 v01r02/D06 v02/ D07 v02, FCC KDB 789033 D02 v01r03, 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
☐ Chamber A (IC:2324B-1)	☒ Chamber D (IC:2324B-4)
☐ Chamber B (IC:2324B-2)	☒ Chamber E (IC:2324B-5)
☐ Chamber C (IC:2324B-3)	☐ Chamber F (IC:2324B-6)
	☐ Chamber G (IC:2324B-7)
	☐ Chamber H (IC:2324B-8)

The above test sites and facilities are covered under FCC Test Firm Registration # 208313.

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, 9KHz to 0.15 MHz	3.84 dB
Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Radiated Disturbance, 1000 to 18000 MHz	4.32 dB
Radiated Disturbance, 18000 to 26000 MHz	4.45 dB
Radiated Disturbance, 26000 to 40000 MHz	5.24 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT, model number A1671, A1821 is a tablet with multimedia functions (music, application support, and video), Cellular GSM/GPRS/EGPRS/CDMA2000 1xRTT/1x Advanced/EVDO Rev.A/WCDMA /HSPA+/DC- HSDPA/LTE FDD & Carrier Aggregation/TDD/TD-SCDMA radio, IEEE 802.11a/b/g/n/ac radio, and Bluetooth radio. The rechargeable battery is not user accessible.

5.2. DESCRIPTION OF MODELS DIFFERENCES

Both Model A1671 and A1821 have identical PCB layout, design and functionality, except that A1671 supports second electronic-UICC based SIM or “soft SIM” (called eSIM) beside the regular UICC based SIM and A1821 will come with eSIM removed. RF and electromagnetic characteristic are independent of the eSIM element. Both Models have exactly same technology and band support. Model A1671 is used for EMC/RSE Testing and that data will be used for both Models

5.3. MAXIMUM OUTPUT POWER

The transmitter has a maximum average 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	16.96	49.66
	802.11a 2TX CDD	Covered by 802.11n HT20 2TX CDD	
	802.11n HT20 2TX CDD	18.45	69.98
	802.11n HT20 2TX STBC	19.52	89.54
	802.11ac VHT20 2TX STBC	Covered by 802.11n HT20 2TX CDD	
	802.11n HT20 2TX SDM	Covered by 802.11n HT20 2TX CDD	
5190 - 5230	802.11ac VHT20 2TX SDM	Covered by 802.11n HT20 2TX CDD	
	802.11n HT40 SISO	16.92	49.20
	802.11n HT40 2TX CDD	19.46	88.31
	802.11n HT40 2TX STBC	Covered by 802.11n HT40 2TX CDD	
	802.11ac VHT40 2TX STBC	Covered by 802.11n HT40 2TX CDD	
	802.11n HT40 2TX SDM	Covered by 802.11n HT40 2TX CDD	
5210	802.11ac VHT40 2TX SDM	Covered by 802.11n HT40 2TX CDD	
	802.11ac VHT80 SISO	13.45	22.13
	802.11ac VHT80 2TX CDD	14.96	31.33
	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	15.98	39.63
	802.11a 2TX CDD	Covered by 802.11n HT20 2TX CDD	
	802.11n HT20 2TX CDD	17.97	62.66
	802.11n HT20 2TX STBC	18.99	79.25
	802.11ac VHT20 2TX STBC	Covered by 802.11n HT20 2TX STBC	
	802.11n HT20 2TX SDM	Covered by 802.11n HT20 2TX STBC	
	802.11ac VHT20 2TX SDM	Covered by 802.11n HT20 2TX STBC	
5270 - 5310	802.11n HT40 SISO	15.90	38.90
	802.11n HT40 2TX CDD	18.96	78.70
	802.11n HT40 2TX STBC	Covered by 802.11n HT40 2TX CDD	
	802.11ac VHT40 2TX STBC	Covered by 802.11n HT40 2TX CDD	
	802.11n HT40 2TX SDM	Covered by 802.11n HT40 2TX CDD	
	802.11ac VHT40 2TX SDM	Covered by 802.11n HT40 2TX CDD	
5290	802.11ac VHT80 SISO	13.48	22.28
	802.11ac VHT80 2TX CDD	14.49	28.12
	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	
5500 - 5700	802.11n HT20 SISO	14.98	31.48
5720	802.11ac VHT20 SISO (based on UNII-2C band output power)	12.46	17.62
5500 - 5700	802.11a 2TX CDD	Covered by 802.11n HT20 2TX CDD	
5500 - 5700	802.11n HT20 2TX CDD	16.98	49.89
5720	802.11ac VHT20 2TX CDD (based on UNII-2C band output power)	14.55	28.51
5500 - 5700	802.11n HT20 2TX STBC	18.00	63.10
5720	802.11ac VHT20 2TX STBC (based on UNII-2C band output power)	16.89	48.87
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 802.11n HT20 2TX STBC	
5510 - 5670	802.11n HT40 SISO	14.96	31.33
5710	802.11ac VHT40 SISO (based on UNII-2C band output power)	13.15	20.65
5510 - 5670	802.11n HT40 2TX CDD	17.98	62.81
5710	802.11ac VHT40 2TX CDD (based on UNII-2C band output power)	16.14	41.11
5510 - 5670	802.11n HT40 2TX STBC	Covered by 802.11n HT40 2TX CDD	
5710	802.11ac VHT40 2TX STBC (based on UNII-2C band output power)	Covered by 802.11n HT40 2TX CDD	
5510 - 5670	802.11n HT40 2TX SDM	Covered by 802.11n HT40 2TX CDD	
5710	802.11ac VHT40 2TX SDM (based on UNII-2C band output power)	Covered by 802.11n HT40 2TX CDD	
5530-5610	802.11ac VHT80 SISO	14.99	31.55
5690	802.11ac VHT80 SISO (based on UNII-2C band output power)	13.65	23.17
5530-5610	802.11ac VHT80 2TX CDD	17.97	62.66
5690	802.11ac VHT80 2TX CDD (based on UNII-2C band output power)	16.63	46.03
5530-5610	802.11ac VHT80 2TX STBC	Covered by 802.11ac VHT80 2TX CDD	
5690	802.11ac VHT80 2TX STBC(based on UNII-2C band output power)	Covered by 802.11ac VHT80 2TX CDD	
5530-5610	802.11ac VHT80 2TX SDM	Covered by 802.11ac VHT80 2TX CDD	

5.8GHz Band

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5745 - 5825	802.11a	Covered by 802.11n HT20 SISO	
	802.11n HT20 SISO	15.49	35.40
	802.11a 2TX CDD	Covered by 802.11n HT20 2TX CDD	
	802.11n HT20 2TX CDD	18.25	66.83
	802.11n HT20 2TX STBC	18.24	66.68
	802.11ac VHT20 2TX STBC	Covered by 802.11n HT20 2TX STBC	
	802.11n HT20 2TX SDM	Covered by 802.11n HT20 2TX STBC	
	802.11ac VHT20 2TX SDM	Covered by 802.11n HT20 2TX STBC	
5755 - 5795	802.11n HT40 SISO	15.49	35.40
	802.11n HT40 2TX CDD	18.23	66.53
	802.11n HT40 2TX STBC	Covered by 802.11n HT40 2TX CDD	
	802.11ac VHT40 2TX STBC	Covered by 802.11n HT40 2TX CDD	
	802.11n HT40 2TX SDM	Covered by 802.11n HT40 2TX CDD	
	802.11ac VHT40 2TX SDM	Covered by 802.11n HT40 2TX CDD	
5775	802.11ac VHT80 SISO	15.49	35.40
	802.11ac VHT80 2TX CDD	18.24	66.68
	802.11ac VHT80 2TX STBC	Covered by 802.11ac VHT80 2TX CDD	
	802.11ac VHT80 2TX SDM	Covered by 802.11ac VHT80 2TX CDD	

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Band (GHz)	Antenna Gain (dBi)	
	Antenna A (WF1)	Antenna B(WF2)
5.2	3.48	3.33
5.3	4.11	3.36
5.5	5.41	5.17
5.8	4.20	4.32

5.5. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 14E232.

5.6. WORST-CASE CONFIGURATION AND MODE

For radiated harmonics spurious below 1GHz, 18-40GHz and power line conducted emissions were performed with the EUT set at the CDD or STBC mode at highest power setting among the CDD/STBC/SDM modes as worst-case scenario.

The output power for PSD and spurious tests was set higher than maximum for the purposes of testing only.

For SISO modes, there are two transmission antennas. The antenna used in any given time can be either Antenna A, or Antenna B. All antenna ports have the same power; output power and PSD measurement for SISO modes on both antennas are reported. For 2TX MIMO modes, Antenna A/Antenna B, used at the same time.

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

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

802.11 ac VHT20 and VHT40 are covered by 802.11n HT20 and HT40 measurement data.

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 BT/BLE and WLAN 5 GHz bands. Baseline testing was performed on various configurations to determine the worst case on radiated emissions.

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Apple	A1286	730374GJAGW	N/A
Laptop AC/DC adapter	Apple	A1343	NA	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	2	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 (RADAITED BELOW 1 GHZ / 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	2	N/A

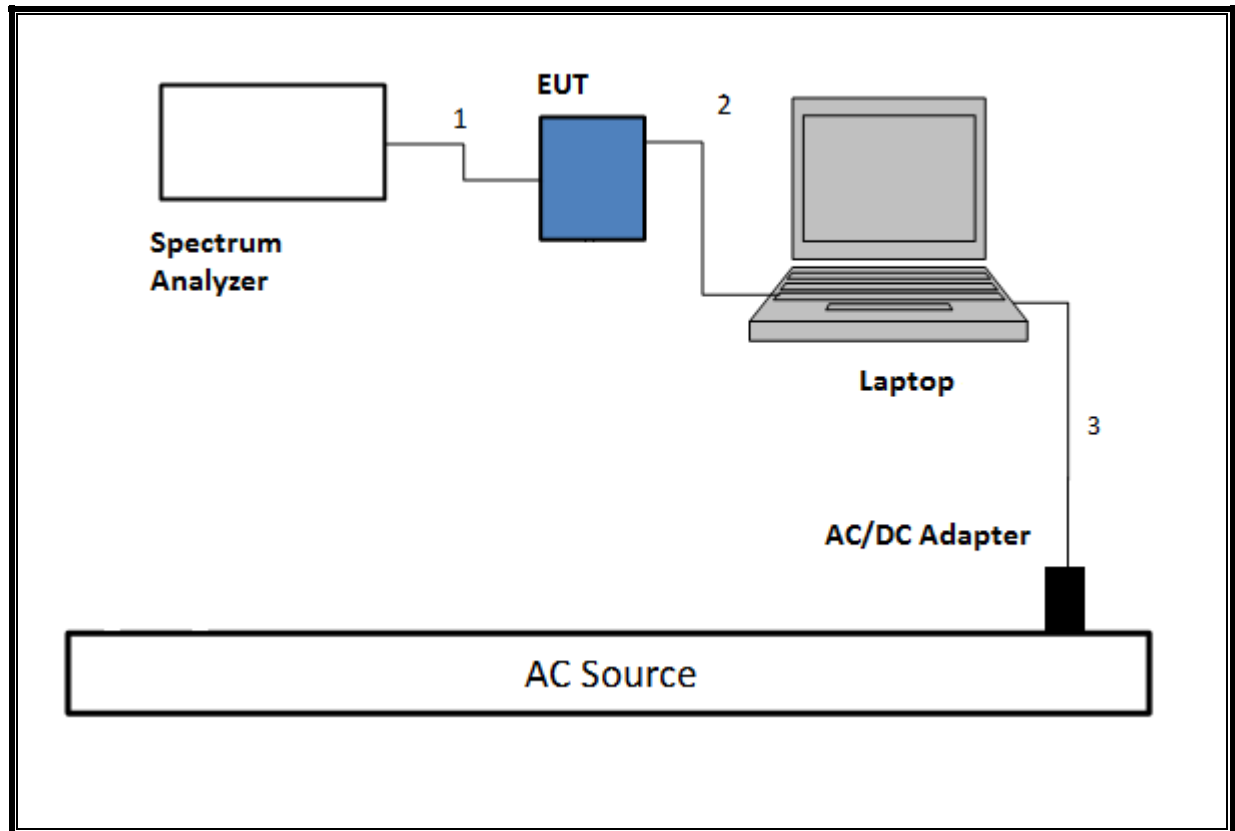
I/O CABLES (AC LINE CONDUCTED: LAPTOP CONFIGUARTION)

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	USB	1	USB	Shielded	1	N/A
3	AC	1	AC	Un-shielded	2	N/A

TEST SETUP - CONDUCTED TESTS

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

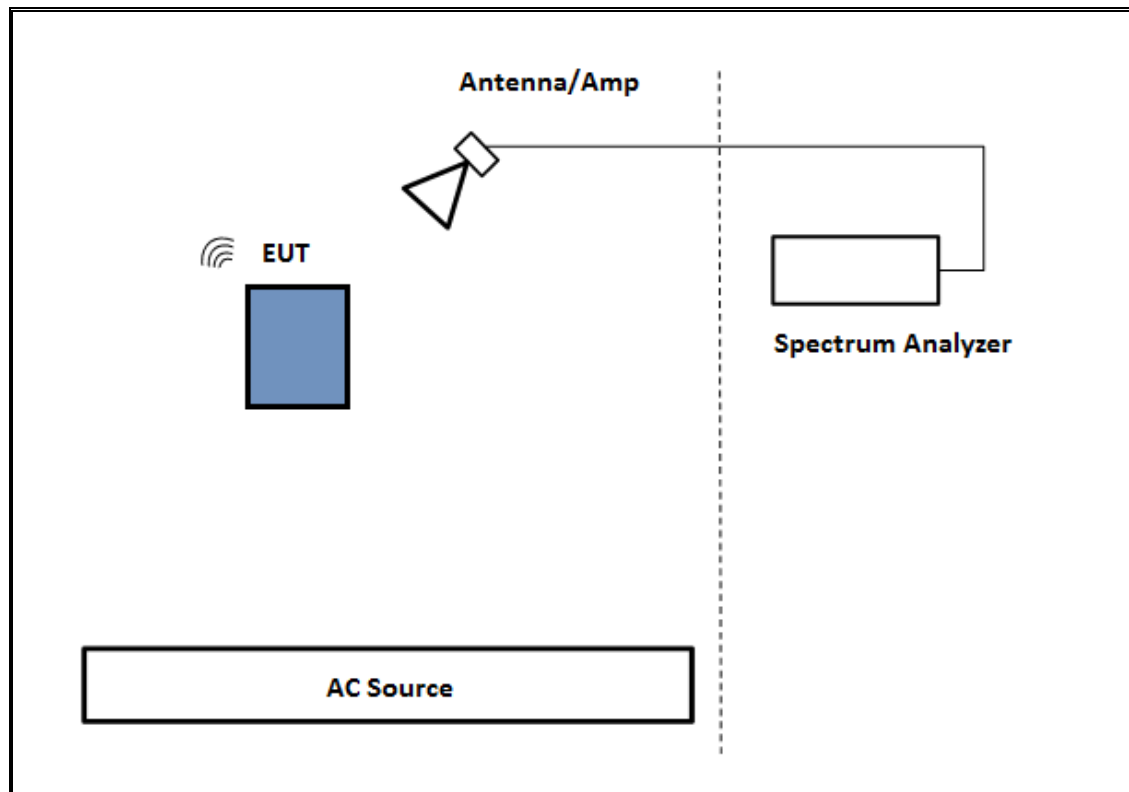
SETUP DIAGRAM



TEST SETUP- RADIATED-ABOVE 1 GHZ

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

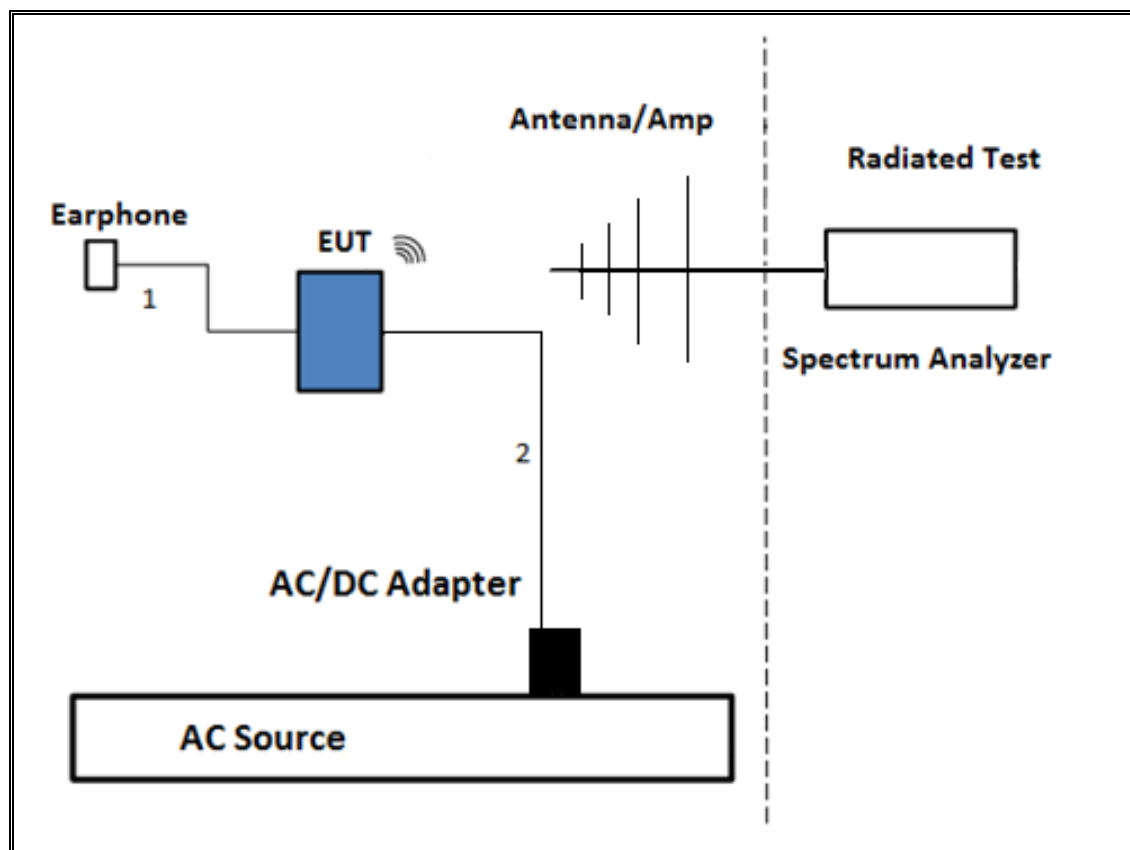
SETUP DIAGRAM



TEST SETUP- BELOW 1GHz

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

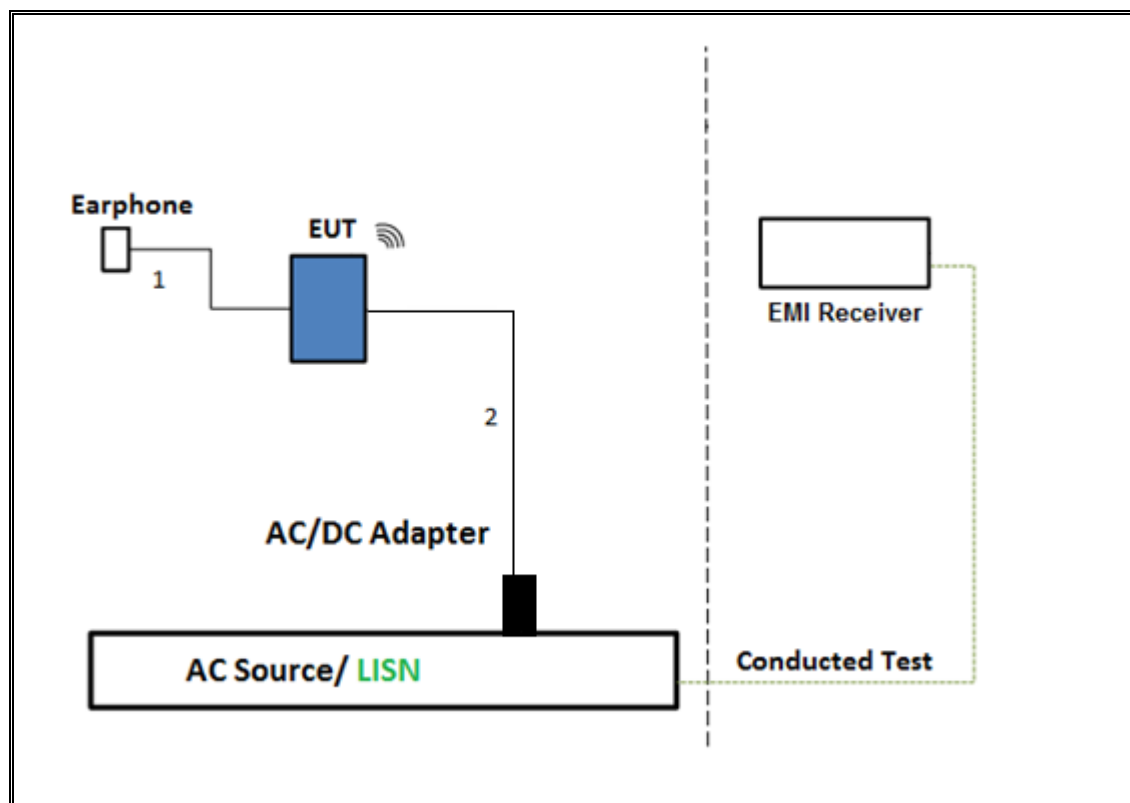
SETUP DIAGRAM



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.

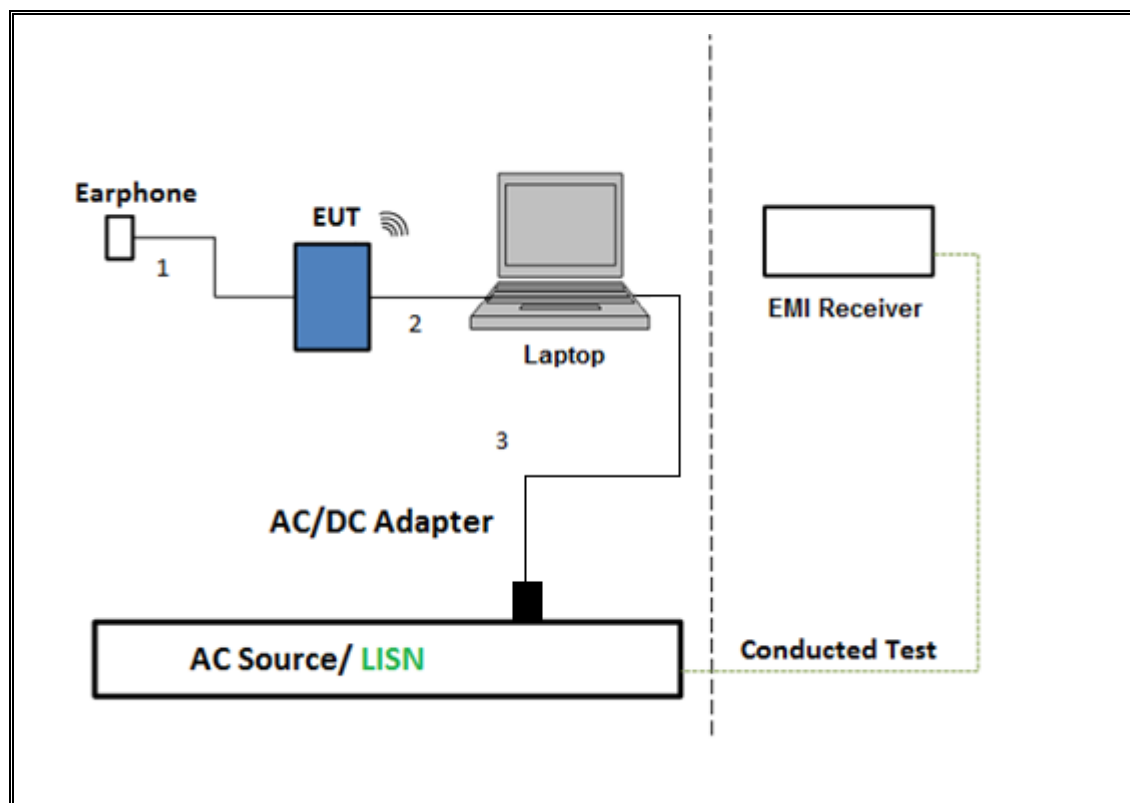
SETUP DIAGRAM



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
Power Meter, P-series single channel	Agilent	N1911A	T227	10/11/2017
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Agilent	N1921A	T1228	06/20/2017
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T344	02/22/2017
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB3	T407	04/04/2017
RF Amplifier, 1-18GHz	MITEQ	AFS42-00101800-25-S-42	T740	11/29/2017
Amplifier, 10KHz to 1GHz, 32dB	Sonoma Instrument	310	T286	05/04/2017
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T905	06/21/2017
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T346	02/22/2017
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB3	T408	11/10/2017
RF Amplifier, 1-18GHz	MITEQ	AFS42-00101800-25-S-42	T1131	09/23/2017
Amplifier, 10KHz to 1GHz, 32dB	Sonoma Instrument	310	T285	06/20/2017
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T459	06/13/2017
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1210	06/30/2017
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	T447	06/16/2017
Amplifier, 1 to 26.5GHz, 23.5dB Gain minimum	Keysight	8449B	T402	07/05/2017
Antenna, Horn 26.5GHz to 40GHz	ARA	MWH-2640/B	T446	05/25/2017
Amplifier, 26.5GHz to 40GHz	Miteq	NSP 4000 SP2	T88	04/07/2017
AC Line Conducted				
EMI Test Receiver 9KHz-7GHz	Rohde & Schwarz	ESCI7	T1436	12/19/2016
* LISN for Conducted Emissions CISPR-16	Fischer	50/250-25-2-01	T1310	06/08/2017
UL AUTOMATION SOFTWARE				
Radiated Software	UL	UL EMC	Ver 9.5, April 26, 2016	
Conducted Software	UL	UL EMC	Ver 5.4, October 13, 2016	
AC Line Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015	

Note: * indicates automation software version used in the compliance certification testing

7. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

7.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

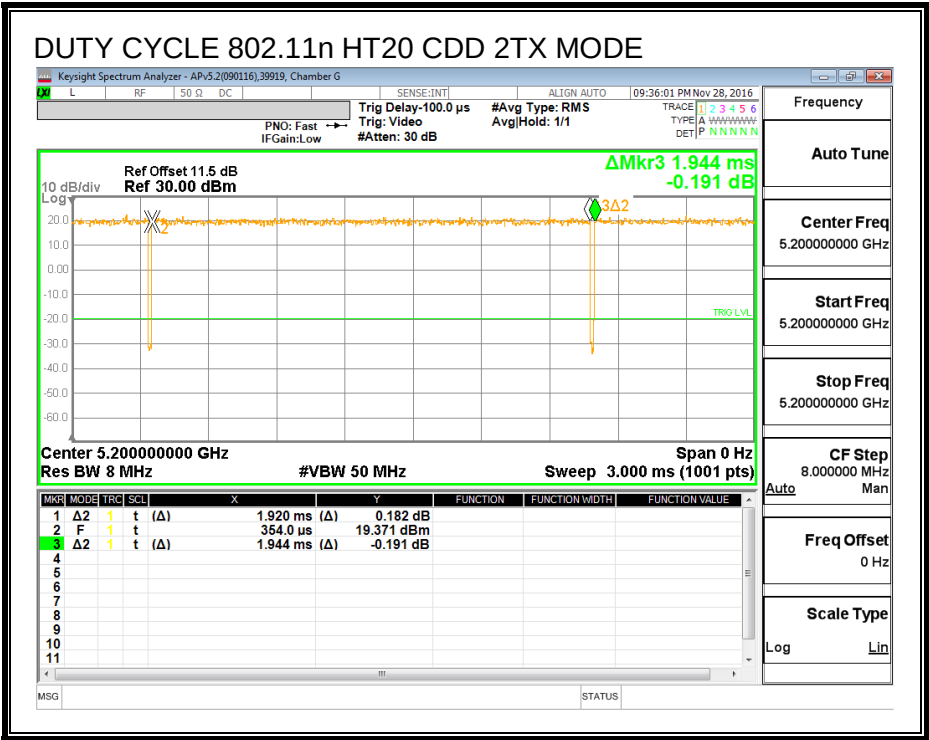
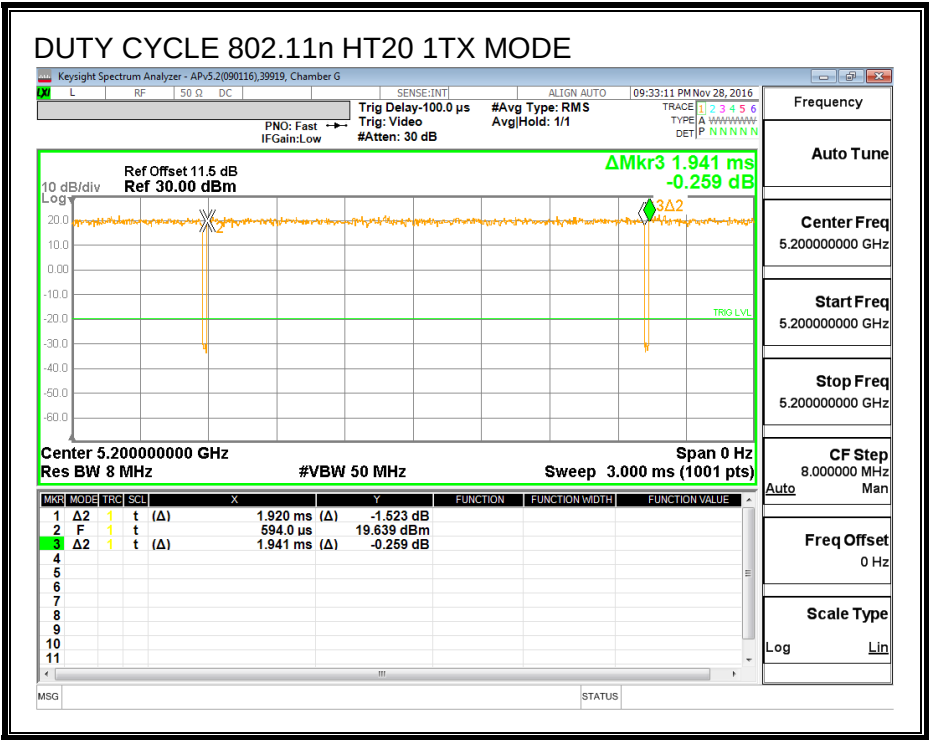
PROCEDURE

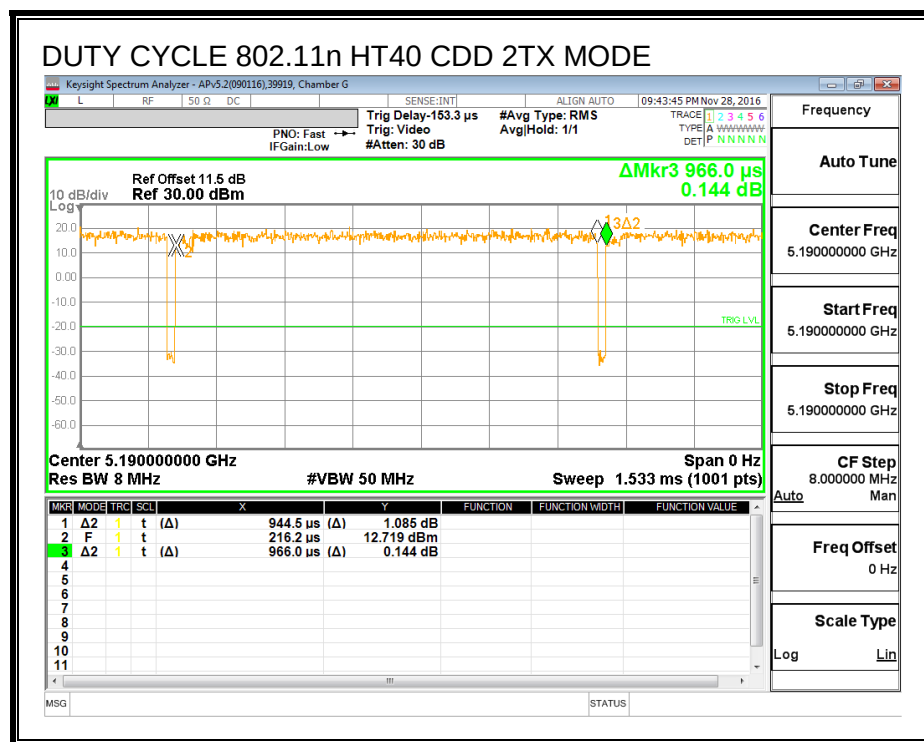
KDB 789033 Zero-Span Spectrum Analyzer Method.

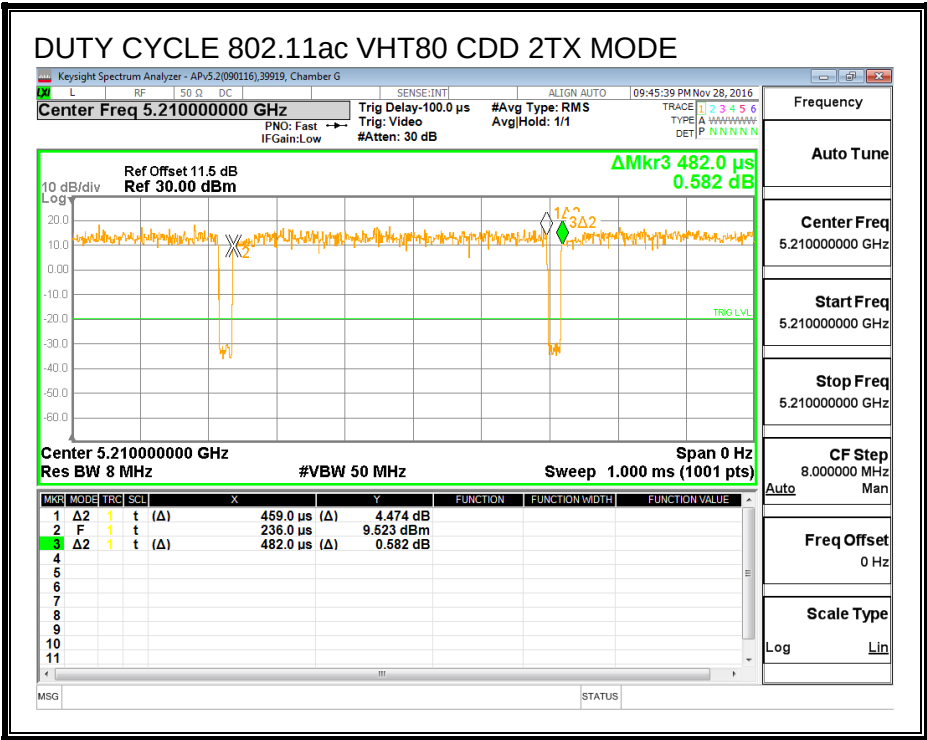
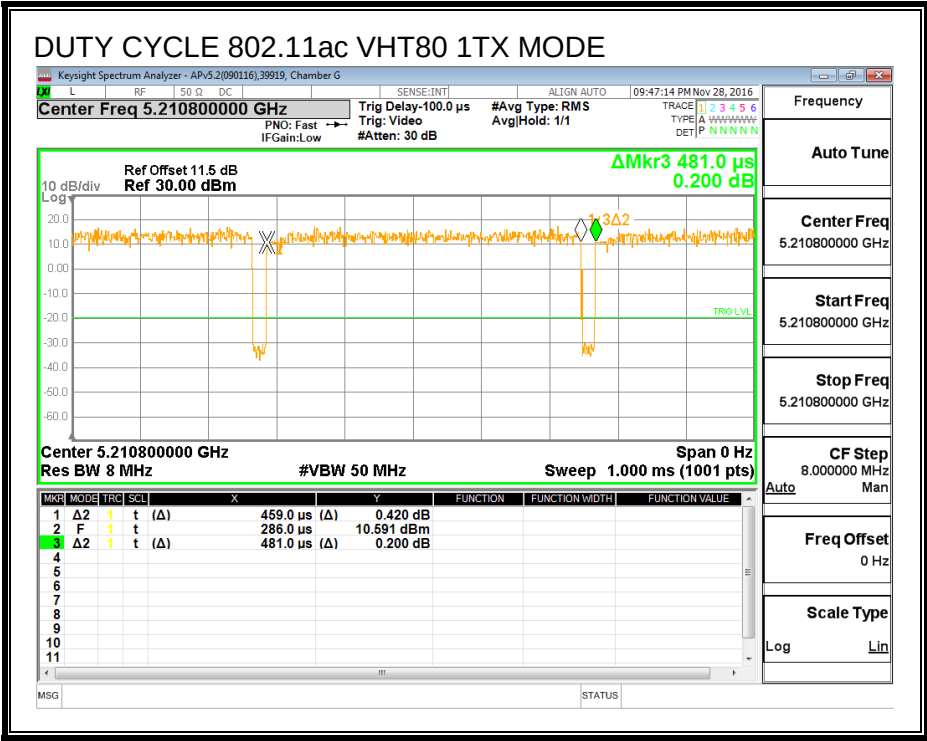
RESULTS

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 2TX	1.920	1.944	0.988	98.77%	0.00	0.010
802.11n HT40 1TX	0.942	0.966	0.975	97.52%	0.11	1.062
802.11n HT40 CDD 2TX	0.945	0.966	0.978	97.77%	0.10	1.059
802.11ac VHT80 1TX	0.459	0.481	0.954	95.43%	0.20	2.179
802.11ac VHT80 CDD 2TX	0.459	0.482	0.952	95.23%	0.21	2.179

DUTY CYCLE PLOTS







7.2. MEASUREMENT METHODS

6 dB Emission BW: KDB 789033 D02 v01r03, Section C.

26 dB Emission BW: KDB 789033 D02 v01r03, Section C.

99% Occupied BW: KDB 789033 D02 v01r03, Section D.

Conducted Output Power: KDB 789033 D02 v01r03, Section E.3.b (Method PM-G).

Power Spectral Density: KDB 789033 D02 v01r03, Section F (Method SA-2).

Unwanted emissions in restricted bands: KDB 789033 D02 v01r03, Sections G.3, G.4, G.5, and G.6.

Unwanted emissions in non-restricted bands: KDB 789033 D02 v01r03, Sections G.3, G.4, and G.5.

8. ANTENNA PORT TEST RESULTS

8.1. 802.11n HT20 Antenna A MODE IN THE 5.2 GHz BAND

8.1.1. 26 dB BANDWIDTH

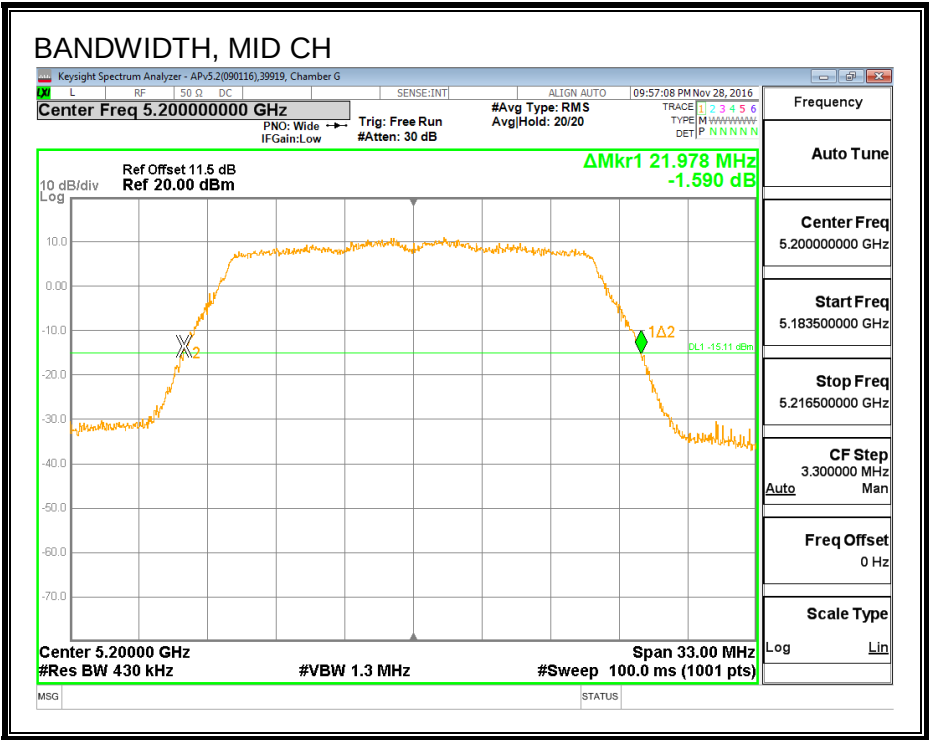
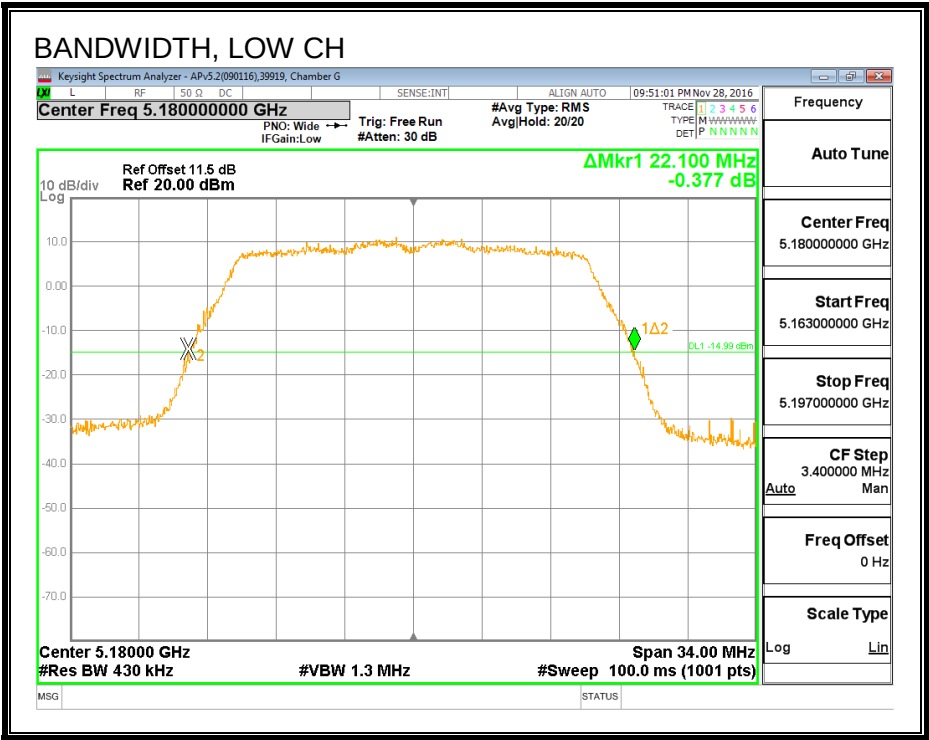
LIMITS

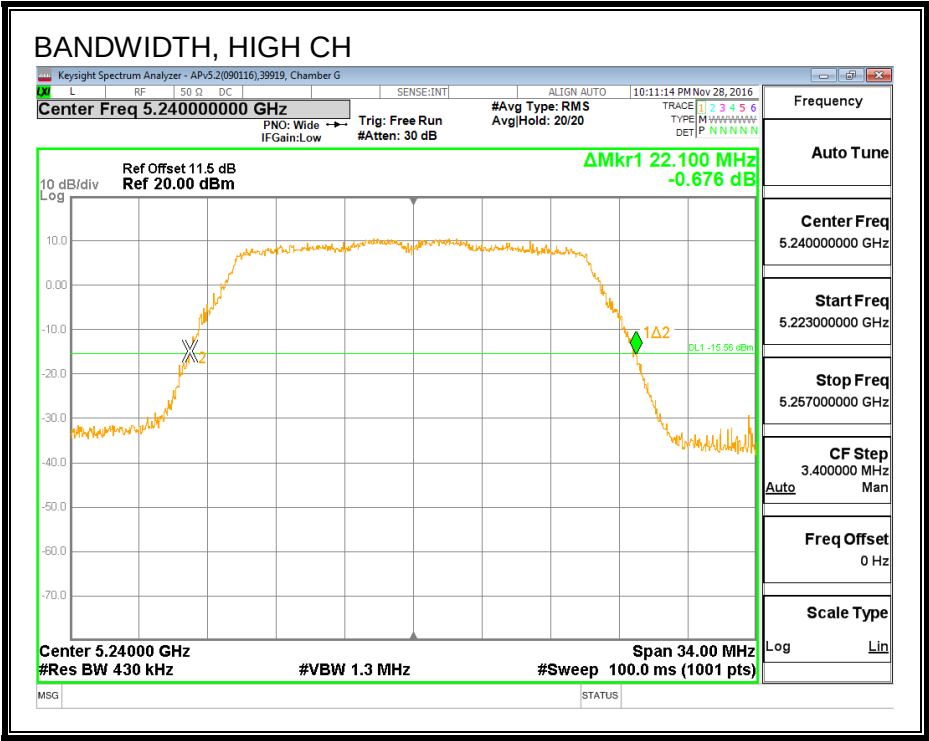
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5180	22.100
Mid	5200	21.978
High	5240	22.100

26 dB BANDWIDTH





8.1.2. 99% BANDWIDTH

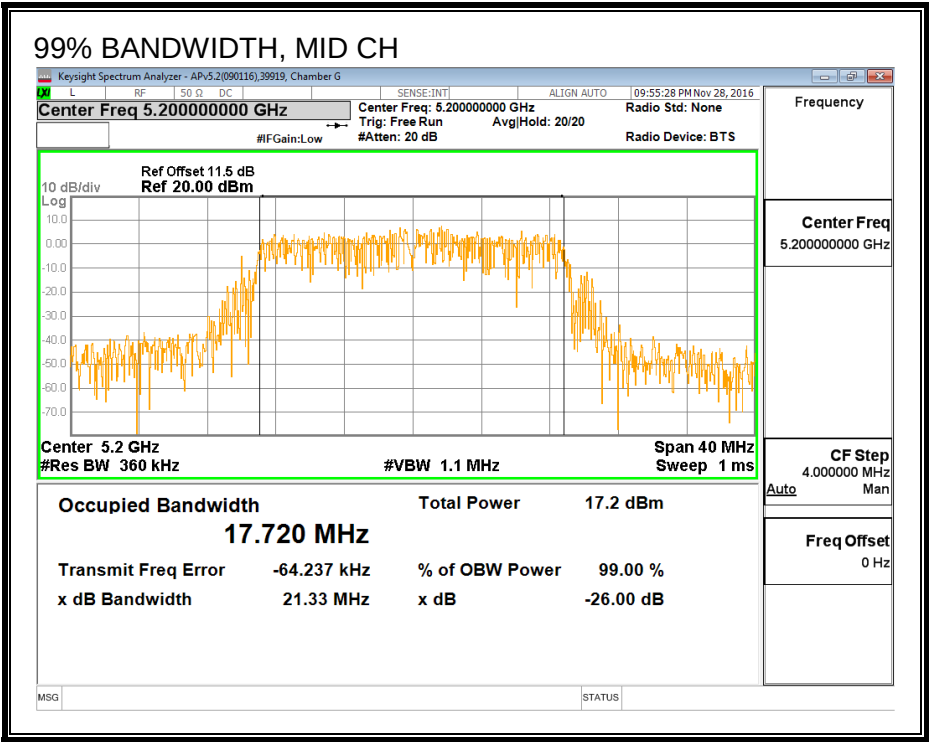
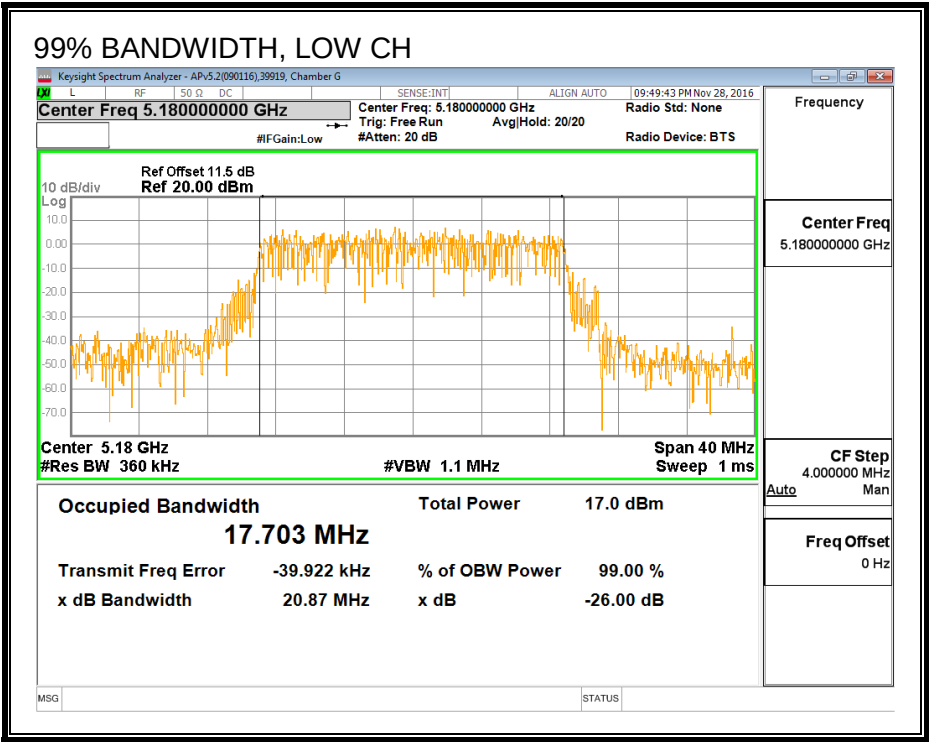
LIMITS

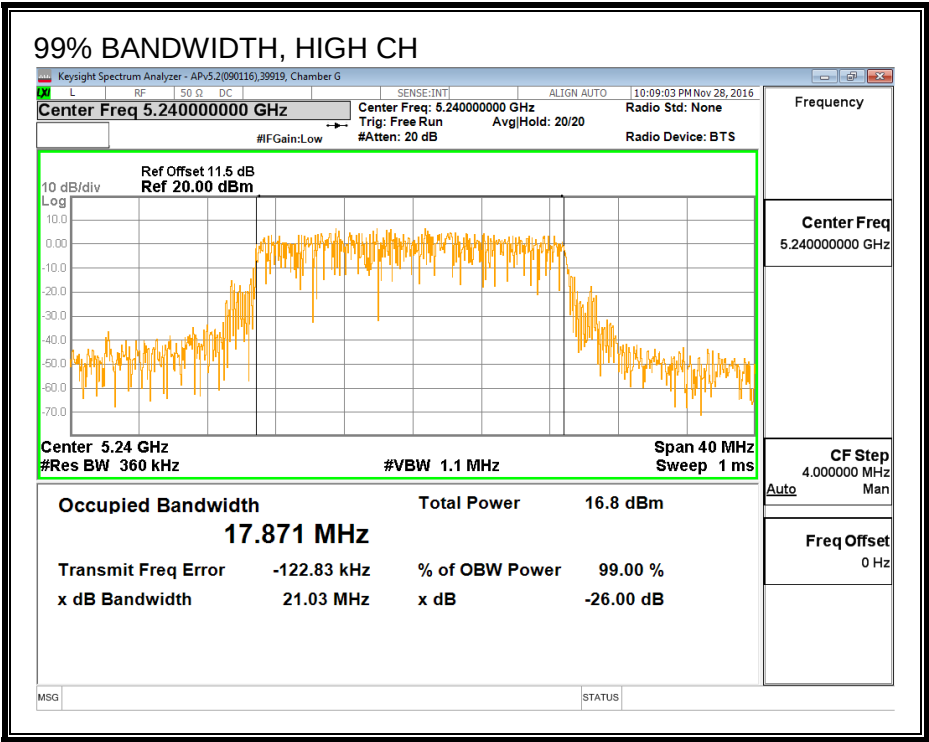
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% BW (MHz)
Low	5180	17.703
Mid	5200	17.720
High	5240	17.871

99% BANDWIDTH





8.1.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

RESULTS

ID:	45256	Date:	1/31/17
------------	-------	--------------	---------

Channel	Frequency (MHz)	Power (dBm)
Low	5180	15.92
Mid	5200	16.96
High	5240	16.95

8.1.4. 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 colocated 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

ID:	45256	Date:	1/31/17
------------	-------	--------------	---------

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	3.48	3.48	24.00	11.00
Mid	5200	3.48	3.48	24.00	11.00
High	5240	3.48	3.48	24.00	11.00

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

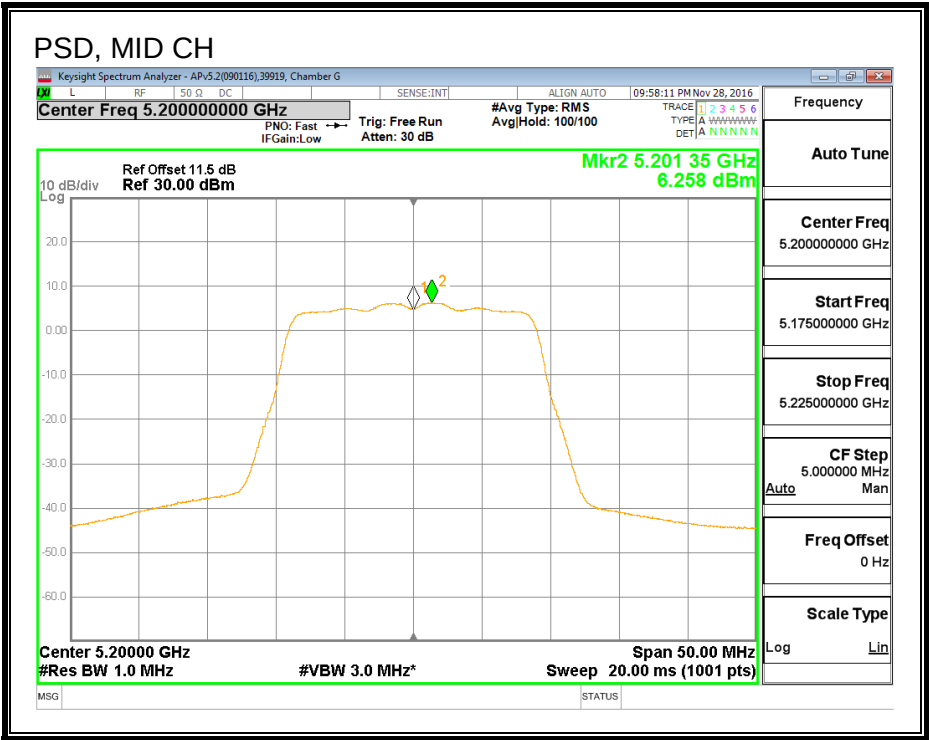
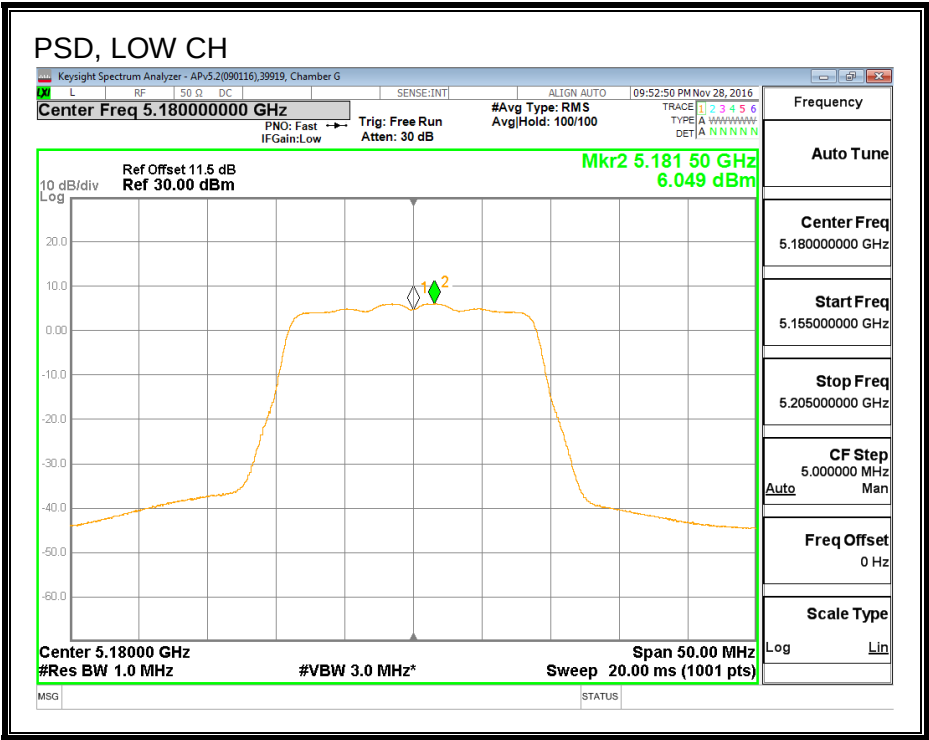
Output Power Results

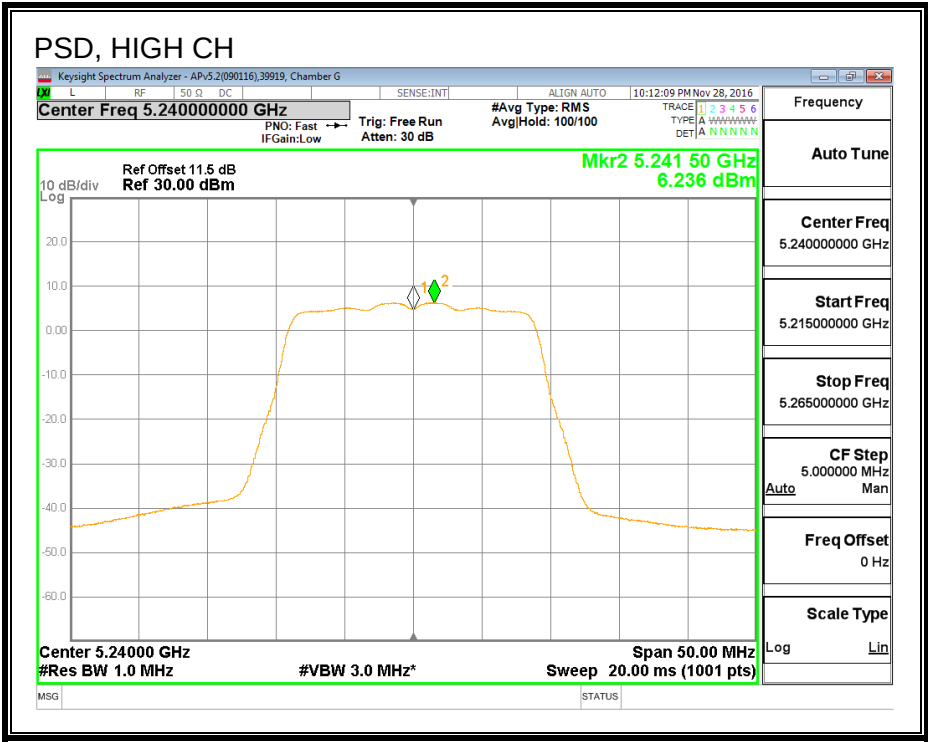
Channel	Frequency (MHz)	Antenna A Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	15.92	15.92	24.00	-8.08
Mid	5200	16.96	16.96	24.00	-7.04
High	5240	16.95	16.95	24.00	-7.05

PSD Results

Channel	Frequency (MHz)	Antenna A Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5180	6.05	6.05	11.00	-4.95
Mid	5200	6.26	6.26	11.00	-4.74
High	5240	6.24	6.24	11.00	-4.76

PSD





8.2. 802.11n HT20 Antenna B MODE IN THE 5.2 GHz BAND

8.2.1. 26 dB BANDWIDTH

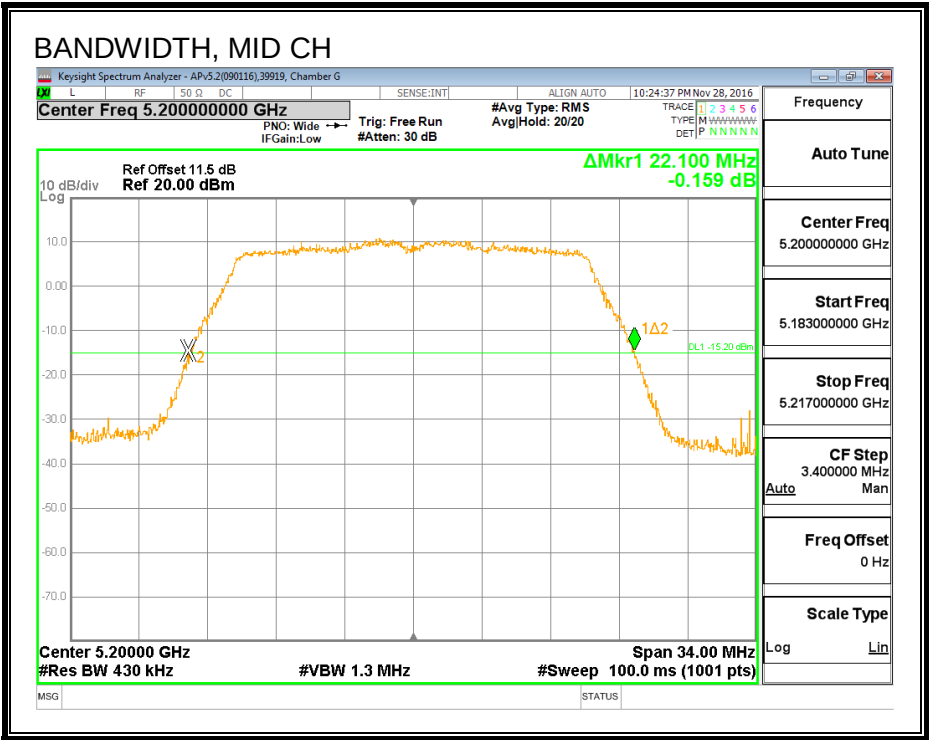
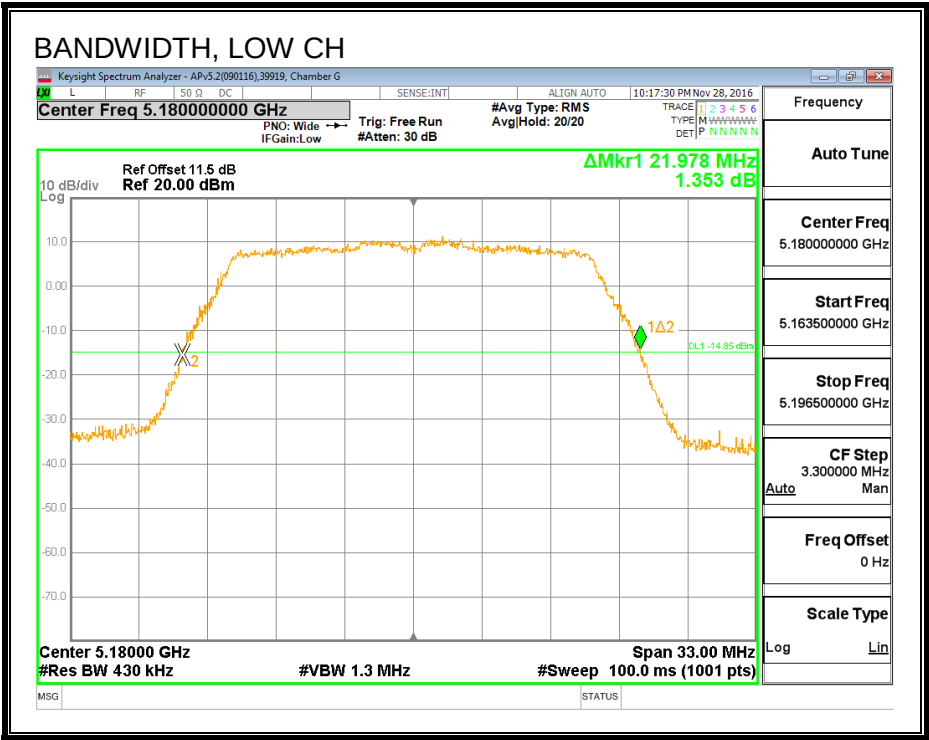
LIMITS

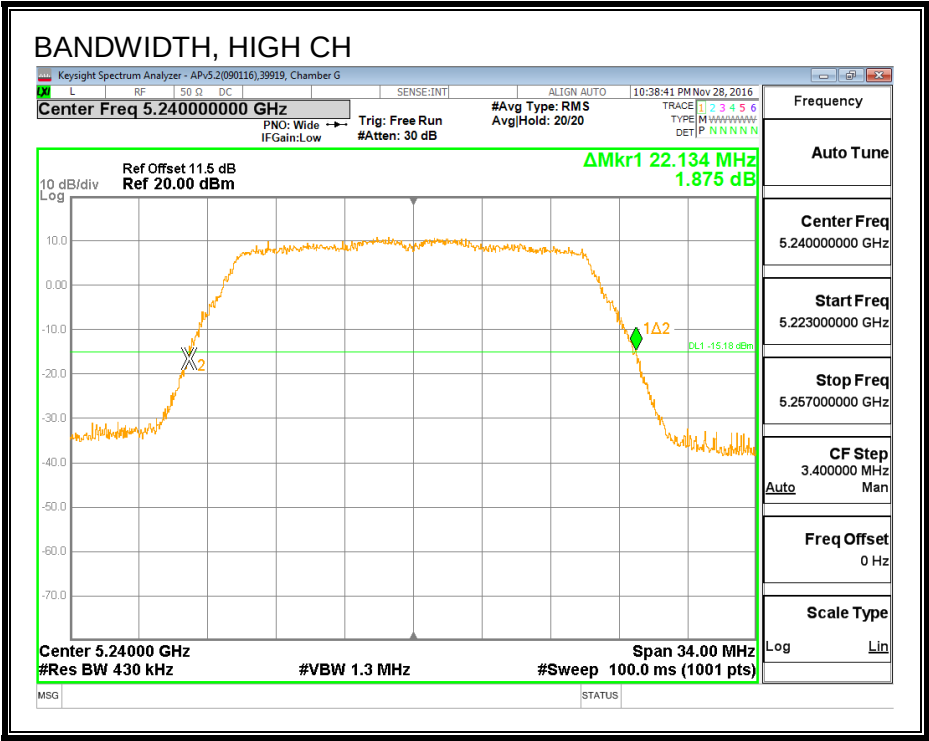
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5180	21.978
Mid	5200	22.100
High	5240	22.134

26 dB BANDWIDTH





8.2.2. 99% BANDWIDTH

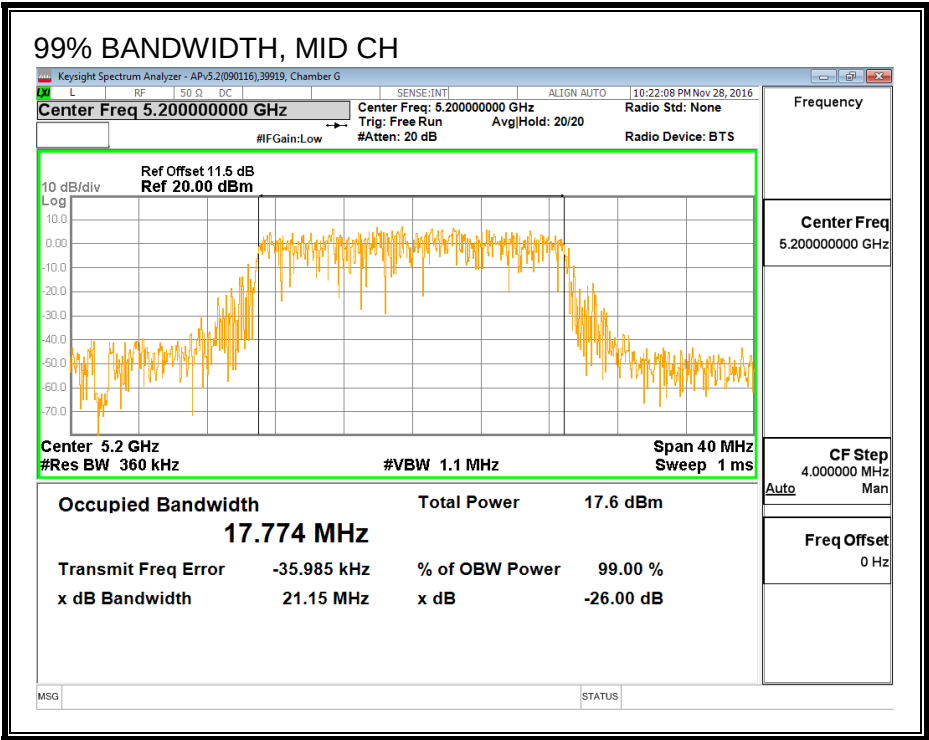
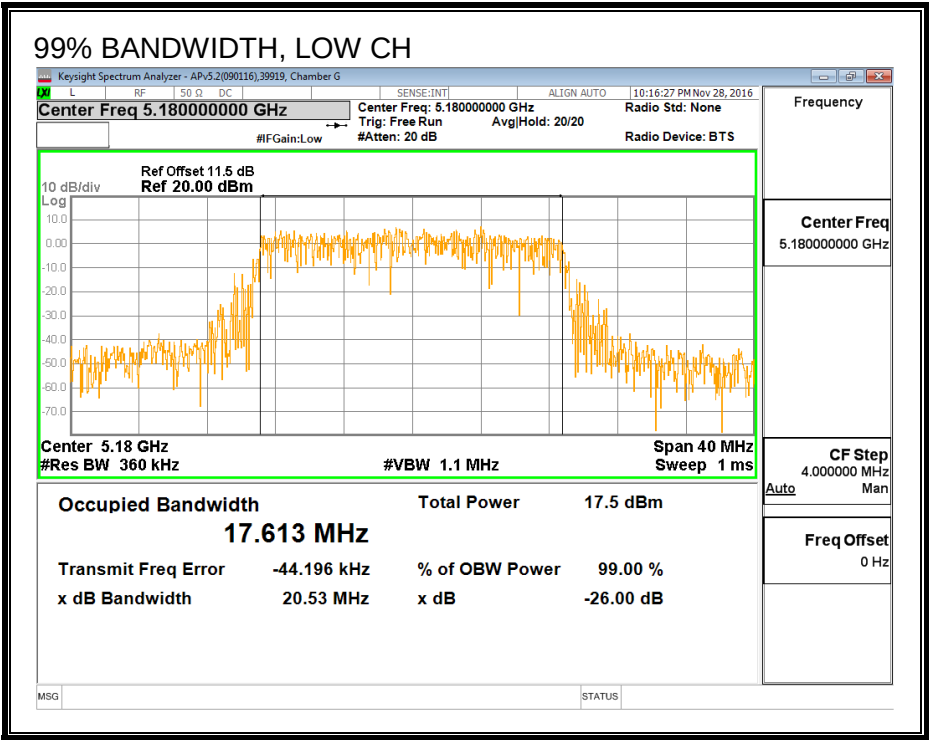
LIMITS

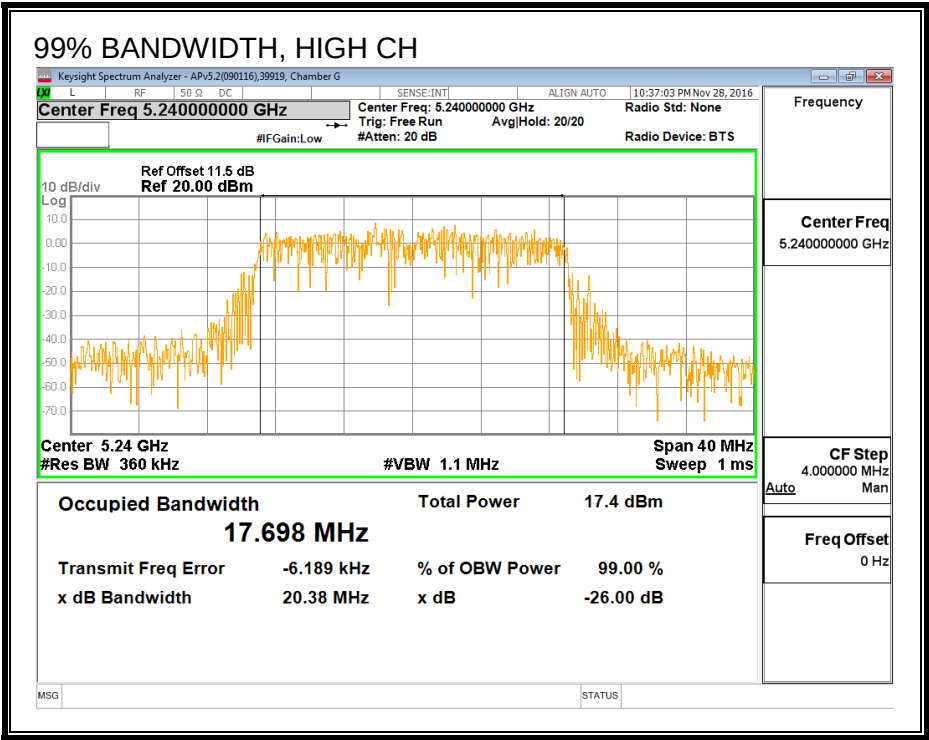
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% BW (MHz)
Low	5180	17.613
Mid	5200	17.774
High	5240	17.698

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

ID:	45256	Date:	1/31/17
------------	-------	--------------	---------

Channel	Frequency (MHz)	Power (dBm)
Low	5180	15.89
Mid	5200	15.91
High	5240	15.92

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

ID:	45256	Date:	1/31/17
------------	-------	--------------	---------

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	3.33	3.33	24.00	11.00
Mid	5200	3.33	3.33	24.00	11.00
High	5240	3.33	3.33	24.00	11.00

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

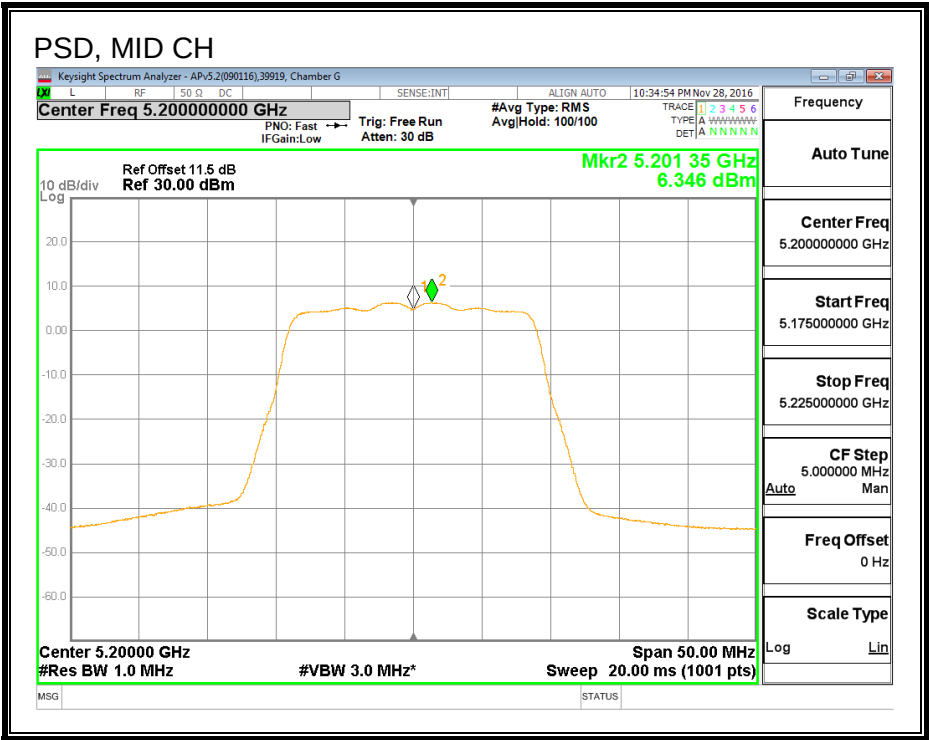
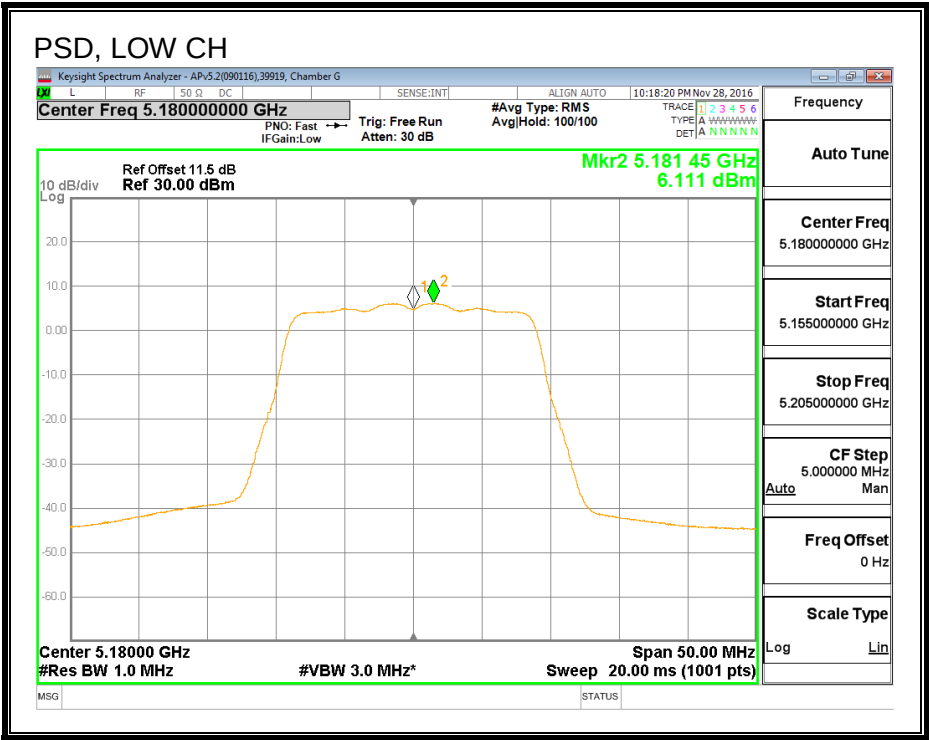
Output Power Results

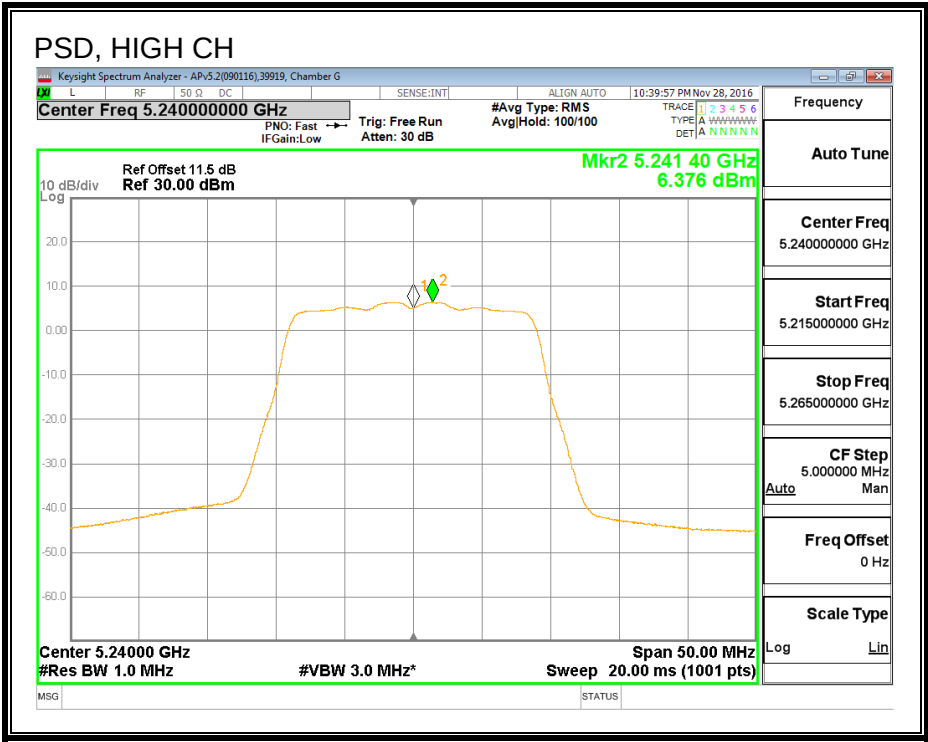
Channel	Frequency (MHz)	Antenna B Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	15.89	15.89	24.00	-8.11
Mid	5200	15.91	15.91	24.00	-8.09
High	5240	15.92	15.92	24.00	-8.08

PSD Results

Channel	Frequency (MHz)	Antenna B Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5180	6.11	6.11	11.00	-4.89
Mid	5200	6.35	6.35	11.00	-4.65
High	5240	6.38	6.38	11.00	-4.62

PSD





8.3. 802.11n HT20 2Tx (Antenna A + Antenna B) CDD MODE IN THE 5.2 GHz BAND

8.3.1. 26 dB BANDWIDTH

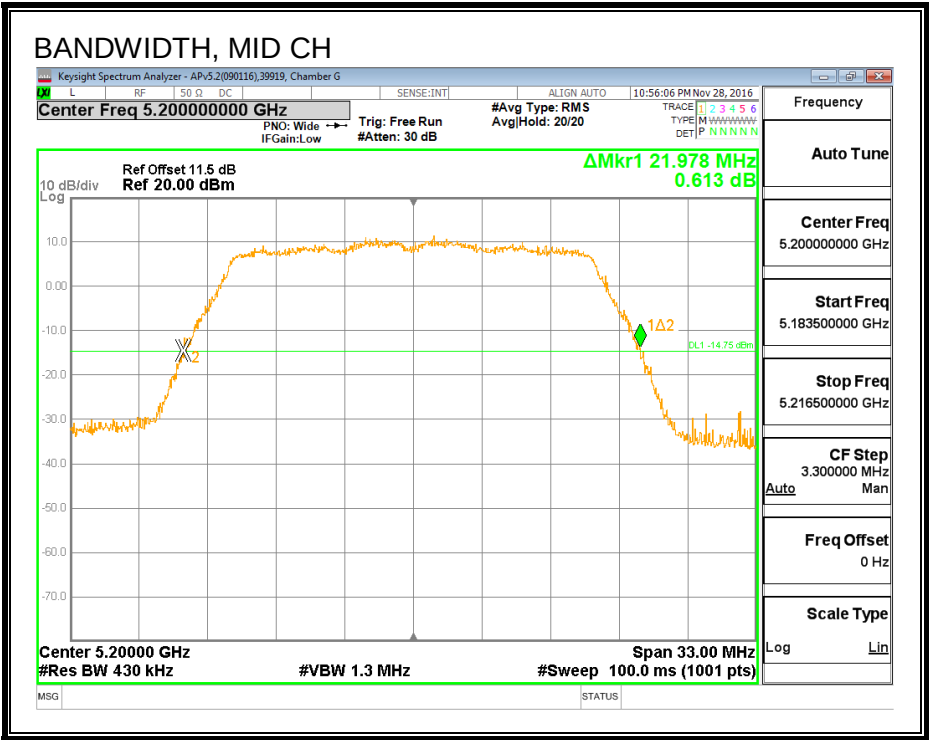
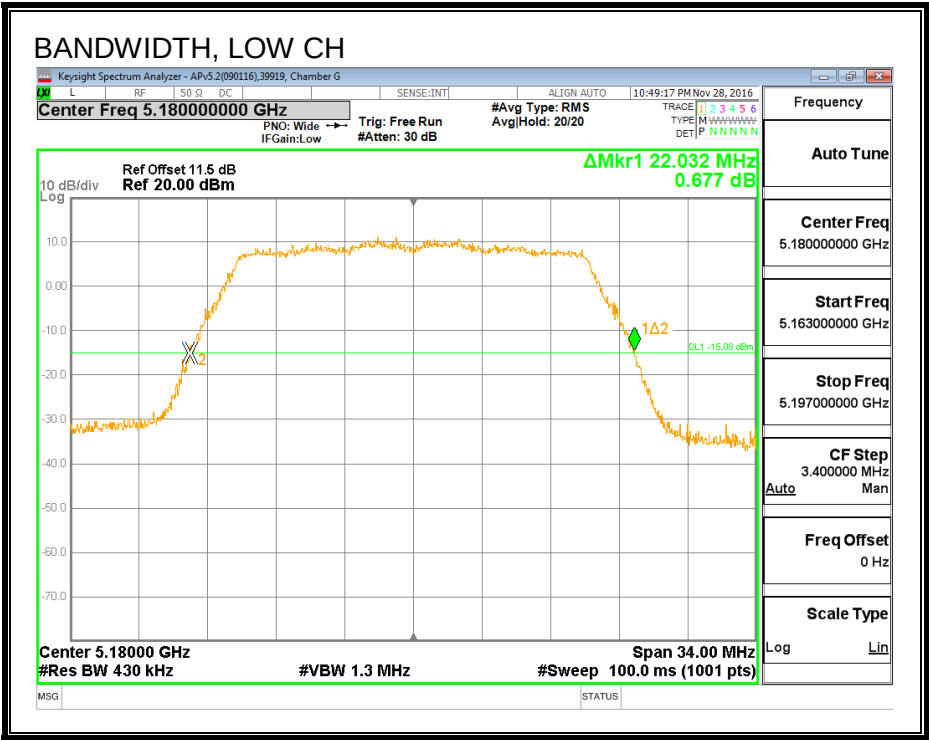
LIMITS

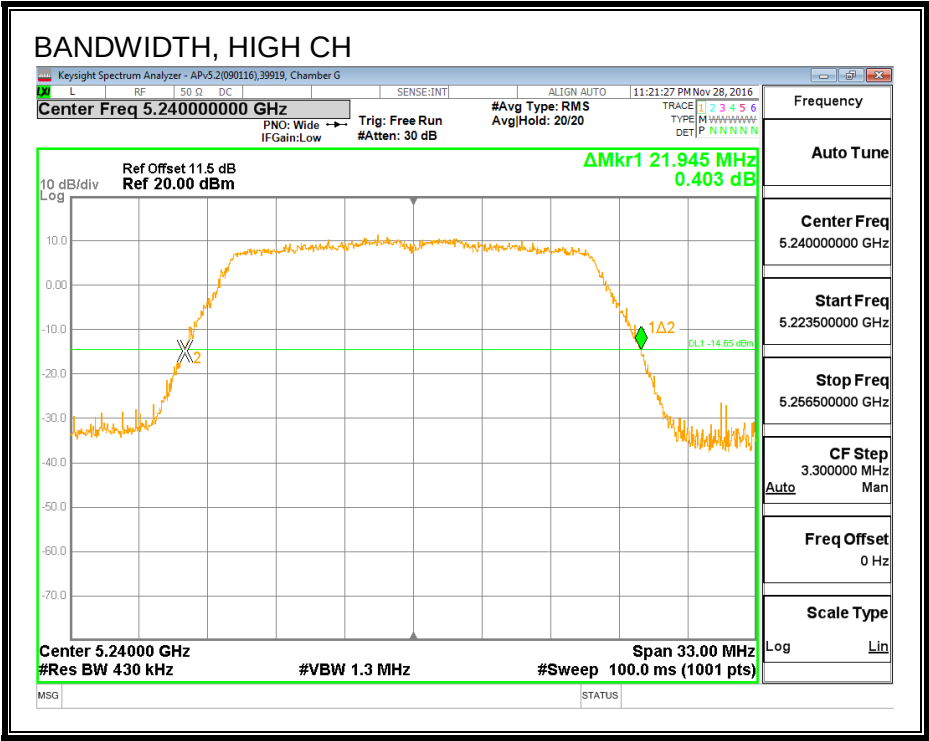
None; for reporting purposes only.

RESULTS

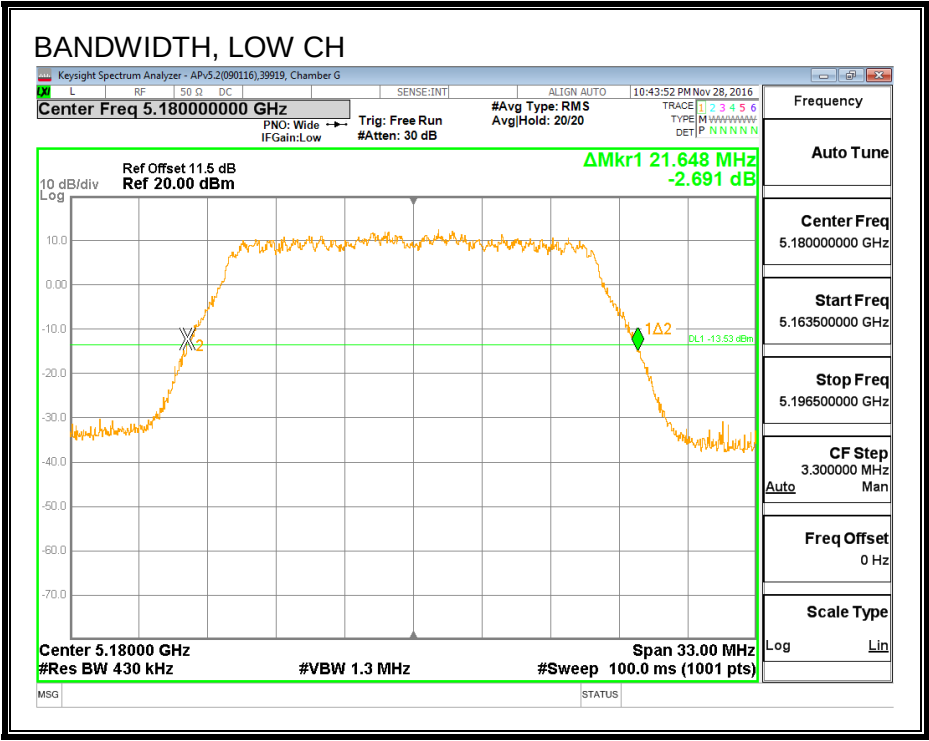
Channel	Frequency (MHz)	26 dB BW Antenna A (MHz)	26 dB BW Antenna B (MHz)
Low	5180	22.032	21.648
Mid	5200	21.978	21.648
High	5240	21.945	21.582

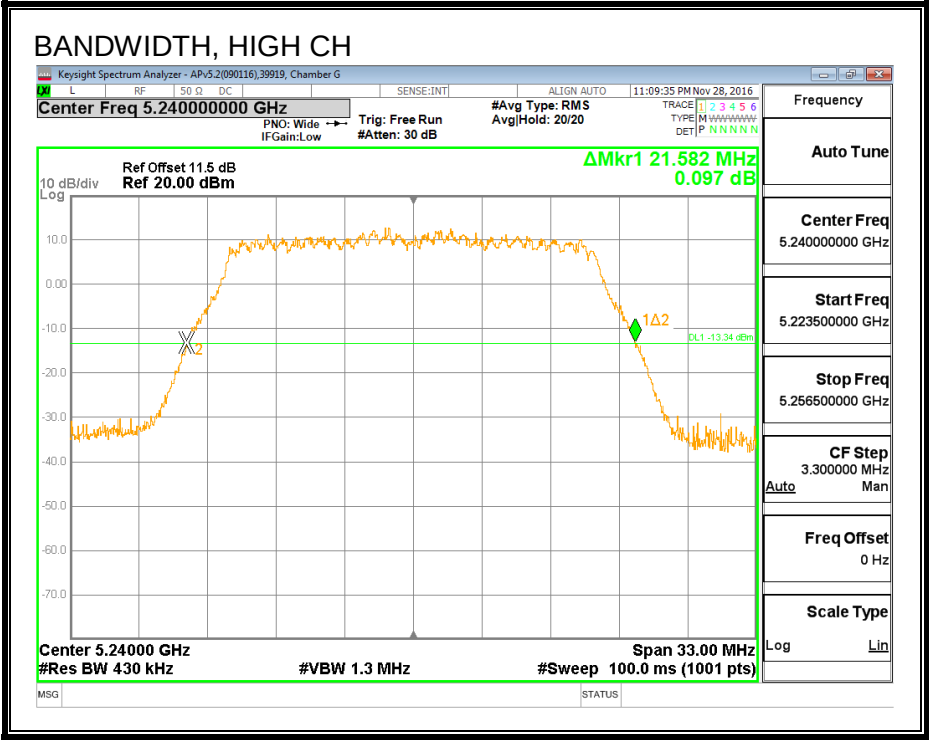
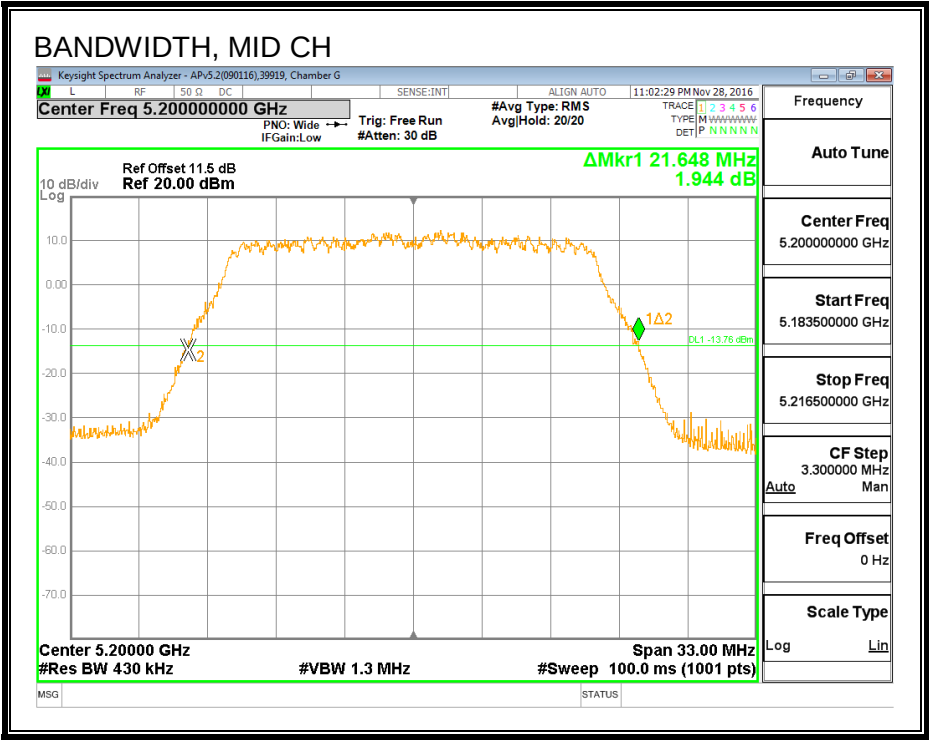
26 DB BANDWIDTH, ANTENNA A





26 DB BANDWIDTH, ANTENNA B





8.3.2. 99% BANDWIDTH

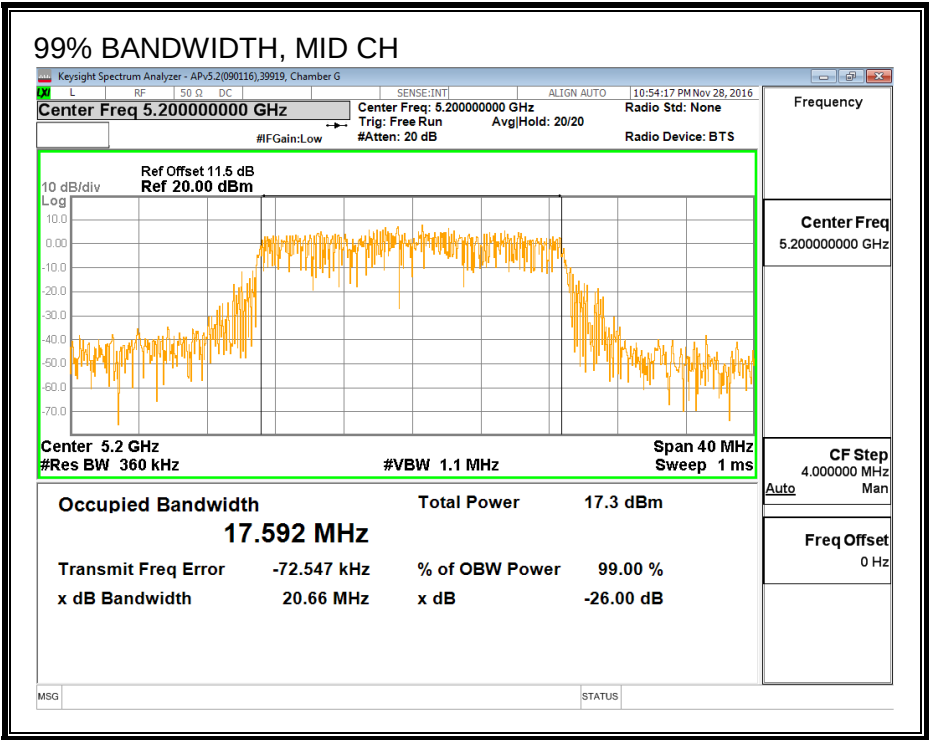
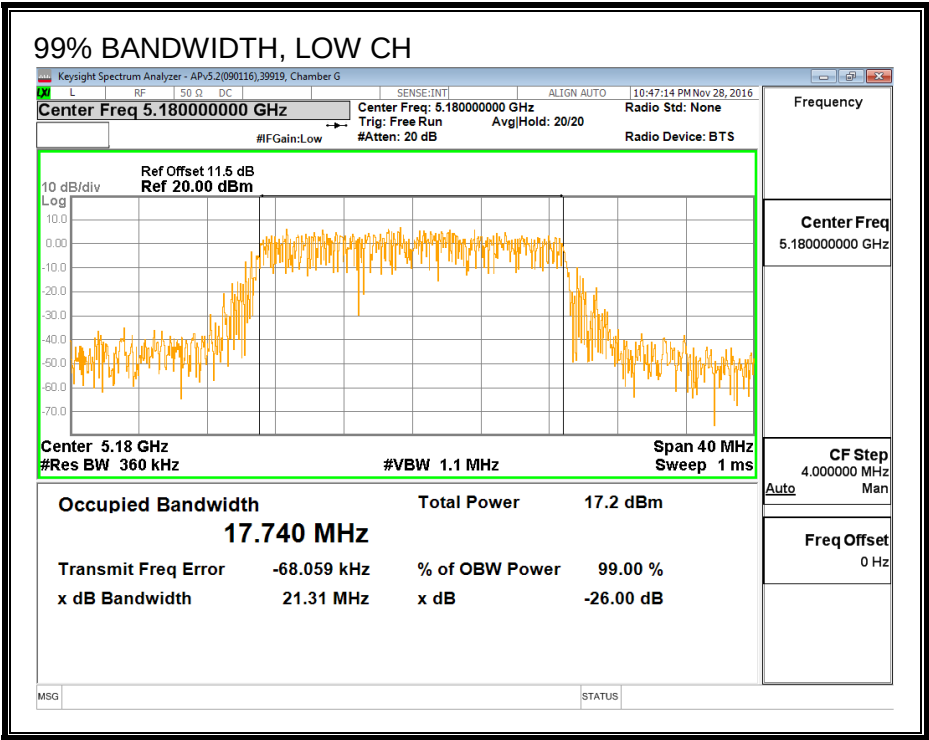
LIMITS

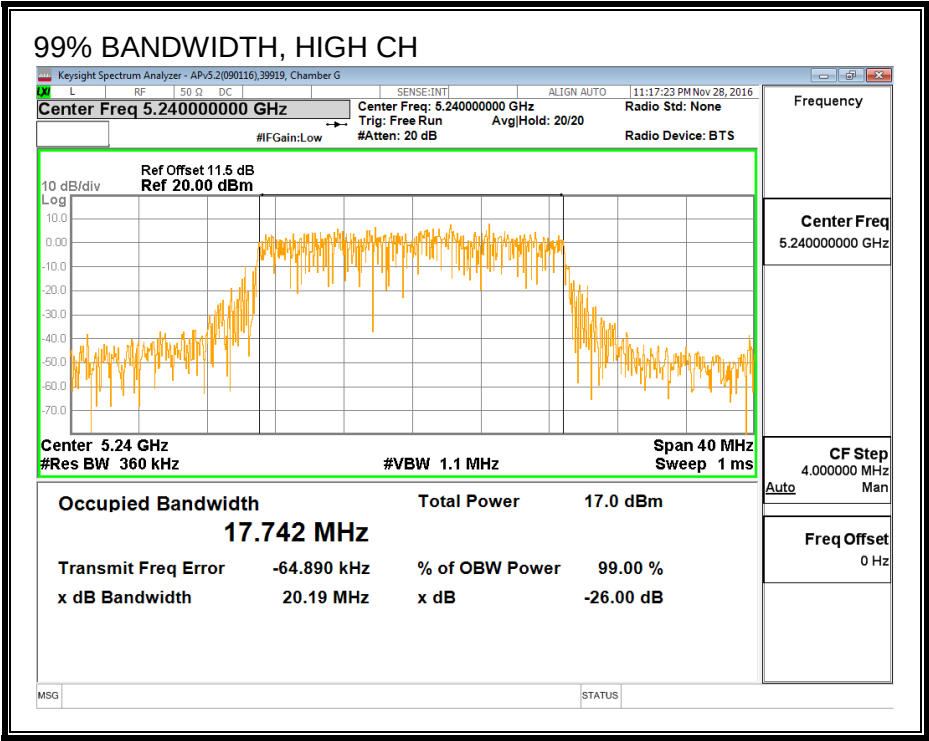
None; for reporting purposes only.

RESULTS

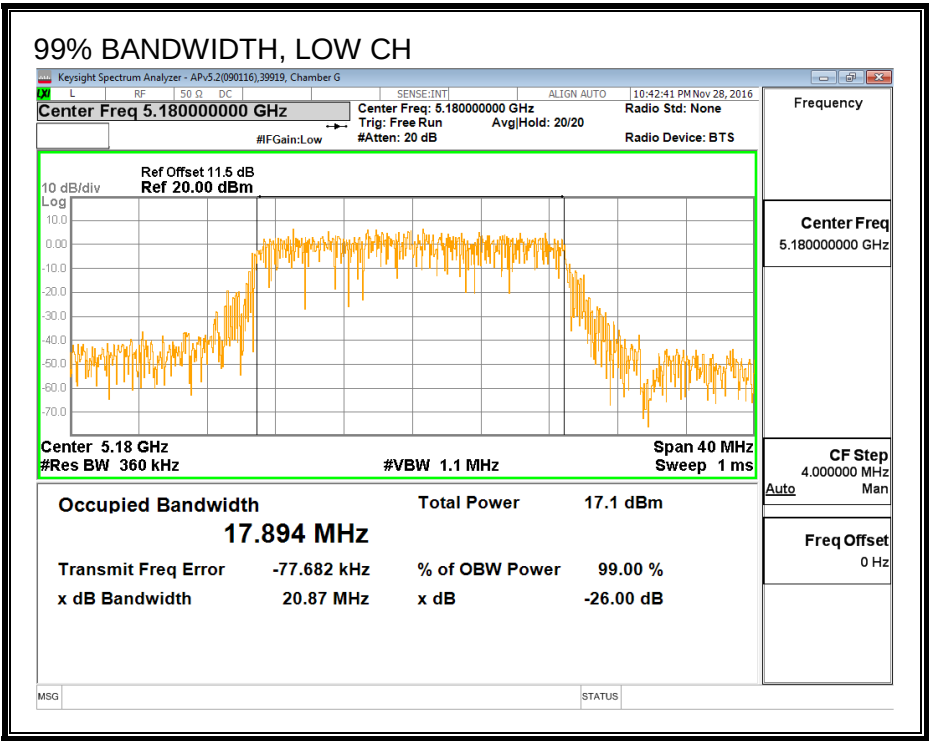
Channel	Frequency (MHz)	99% BW Antenna A (MHz)	99% BW Antenna B (MHz)
Low	5180	17.740	17.894
Mid	5200	17.592	17.760
High	5240	17.742	17.689

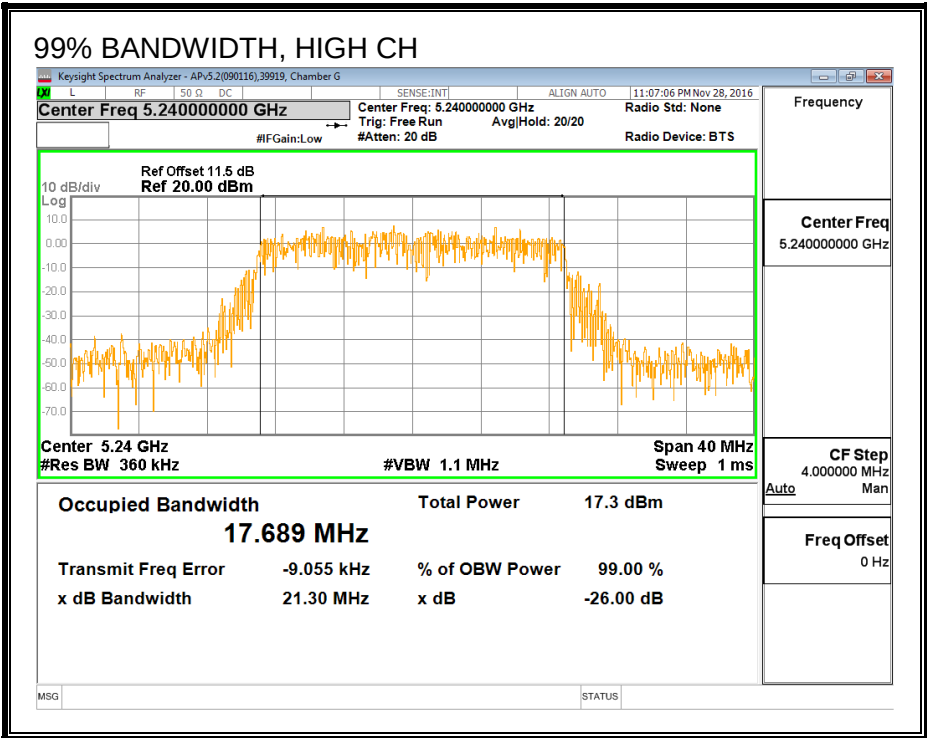
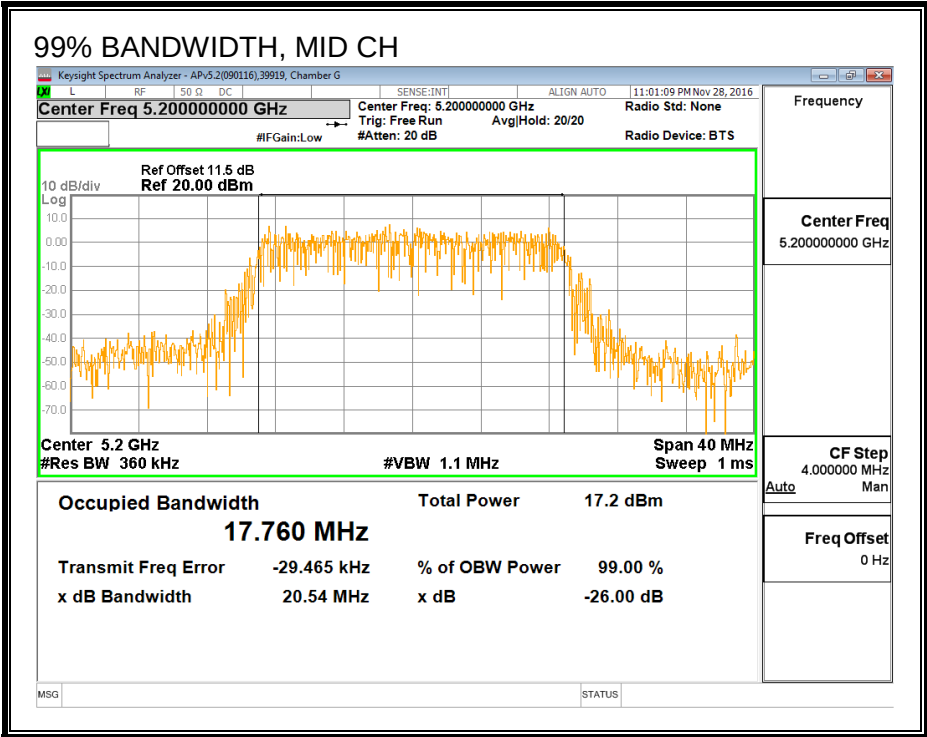
99% BANDWIDTH, ANTENNA A





99% BANDWIDTH, ANTENNA B





8.3.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

RESULTS

ID:	45256	Date:	1/31/17
------------	-------	--------------	---------

Average Power Results

Channel	Frequency (MHz)	Antenna A Power (dBm)	Antenna B Power (dBm)	Total Power (dBm)
Low	5180	14.95	14.97	17.97
Mid	5200	15.41	15.45	18.44
High	5240	15.48	15.39	18.45

8.3.4. 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 colocated 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:

Antenna A	Anteena B	Uncorrelated Chains
Gain (dBi)	Gain (dBi)	Directional Gain (dBi)
3.48	3.33	3.41

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

Antenna A	Antenna B	Correlated Chains
Gain (dBi)	Gain (dBi)	Directional Gain (dBi)
3.48	3.33	6.42

RESULTS

ID:	45256	Date:	1/31/17
------------	-------	--------------	---------

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	3.41	6.42	24.00	10.58
Mid	5200	3.41	6.42	24.00	10.58
High	5240	3.41	6.42	24.00	10.58

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

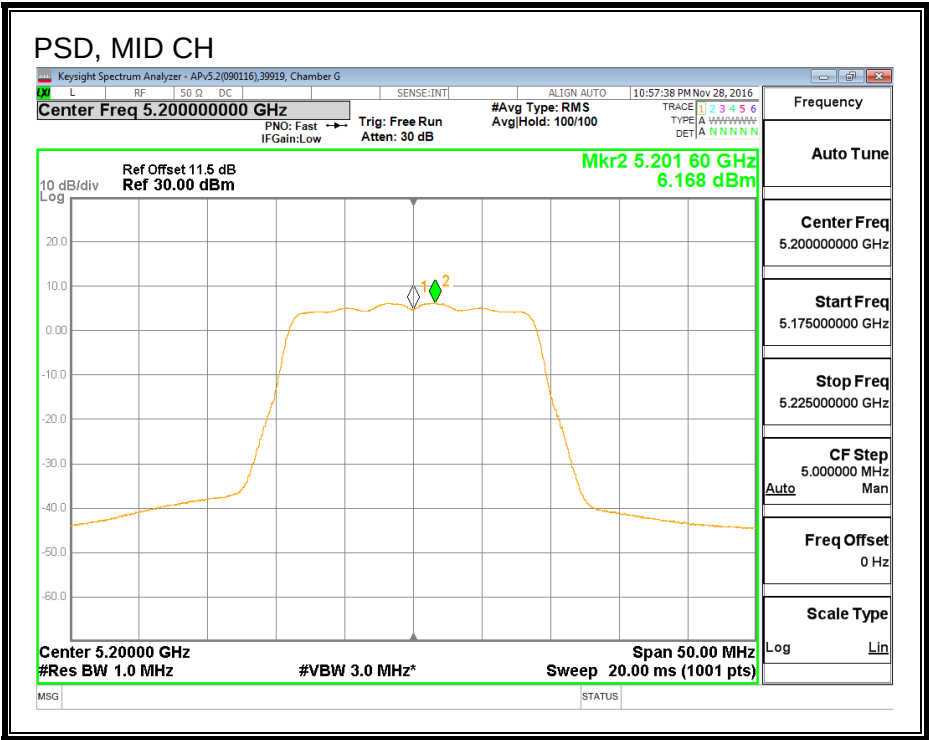
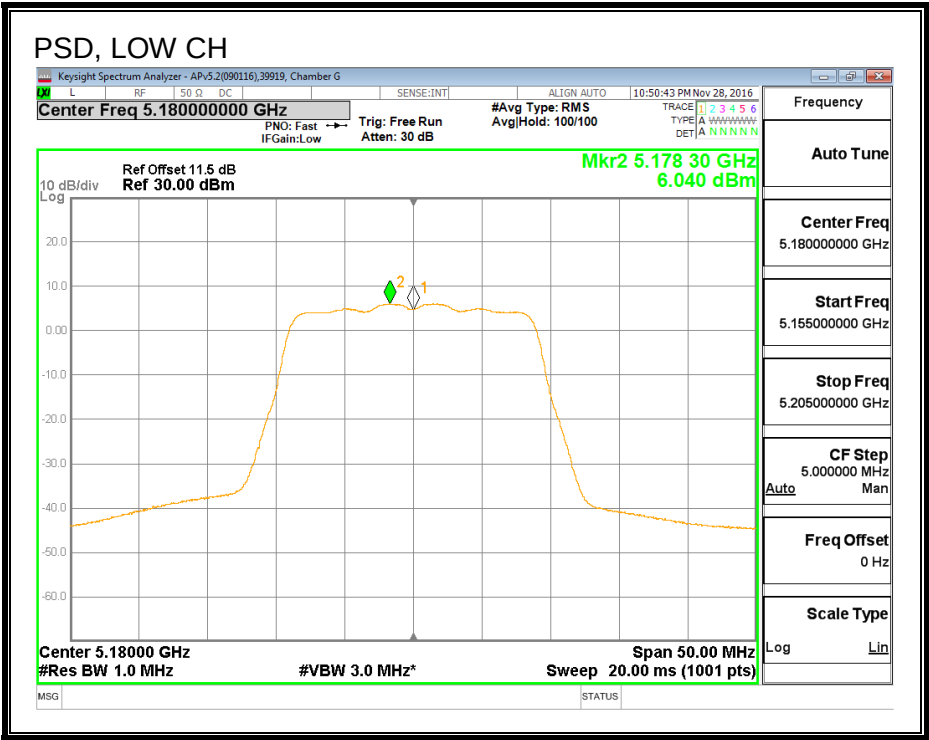
Output Power Results

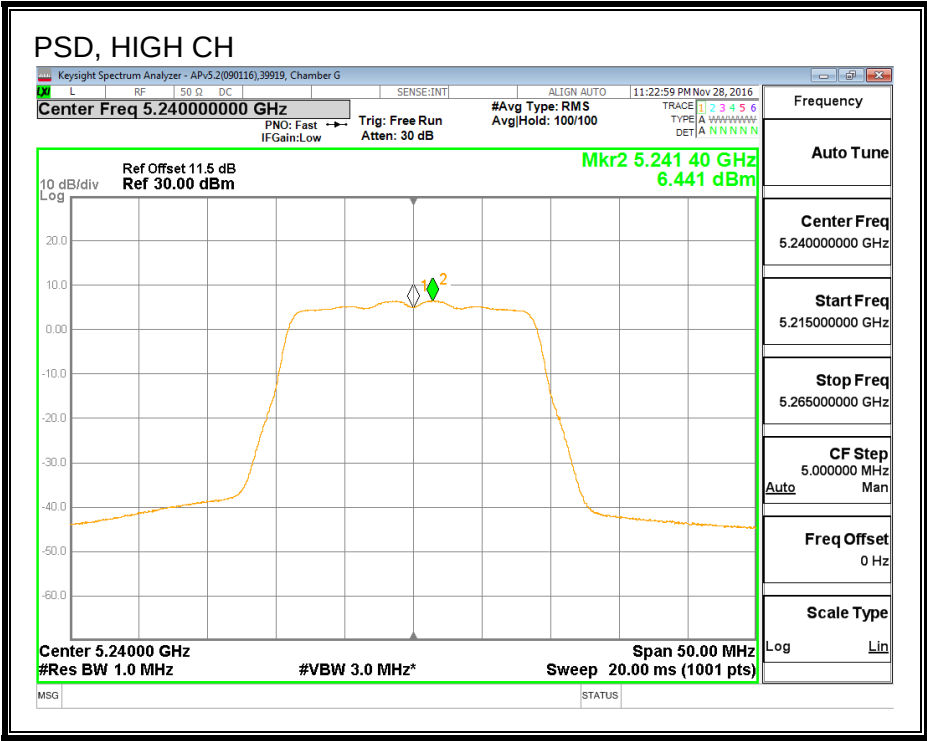
Channel	Frequency (MHz)	Antenna A Meas Power (dBm)	Antenna B Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	14.95	14.97	17.97	24.00	-6.03
Mid	5200	15.41	15.45	18.44	24.00	-5.56
High	5240	15.48	15.39	18.45	24.00	-5.55

PSD Results

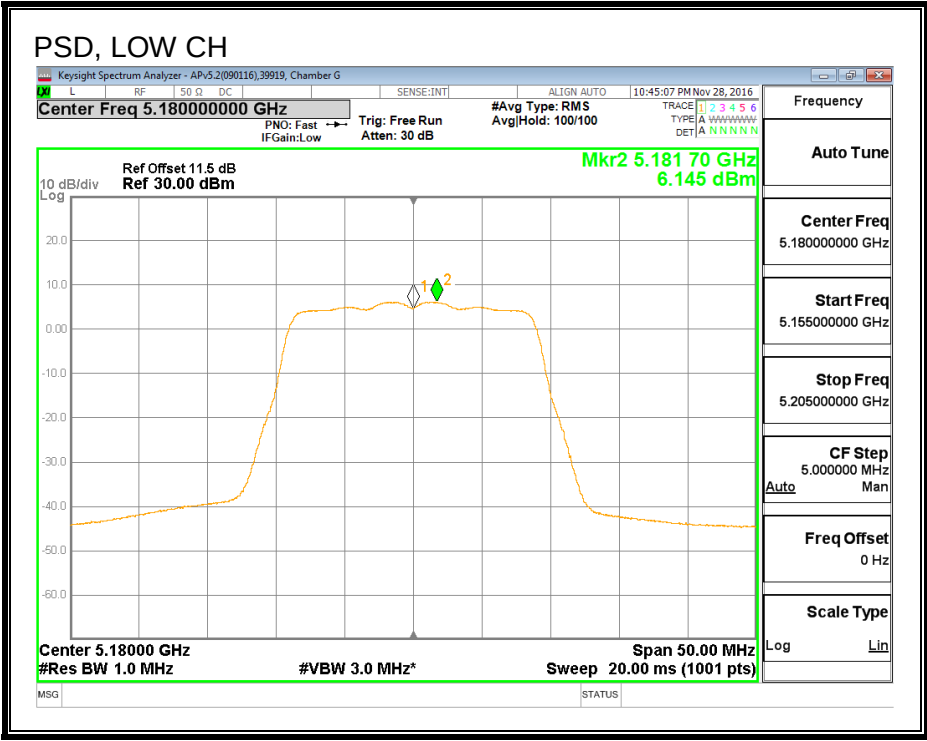
Channel	Frequency (MHz)	Antenna A Meas PSD (dBm)	Antenna B Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5180	6.04	6.15	9.10	10.58	-1.48
Mid	5200	6.17	6.32	9.26	10.58	-1.32
High	5240	6.44	6.41	9.44	10.58	-1.14

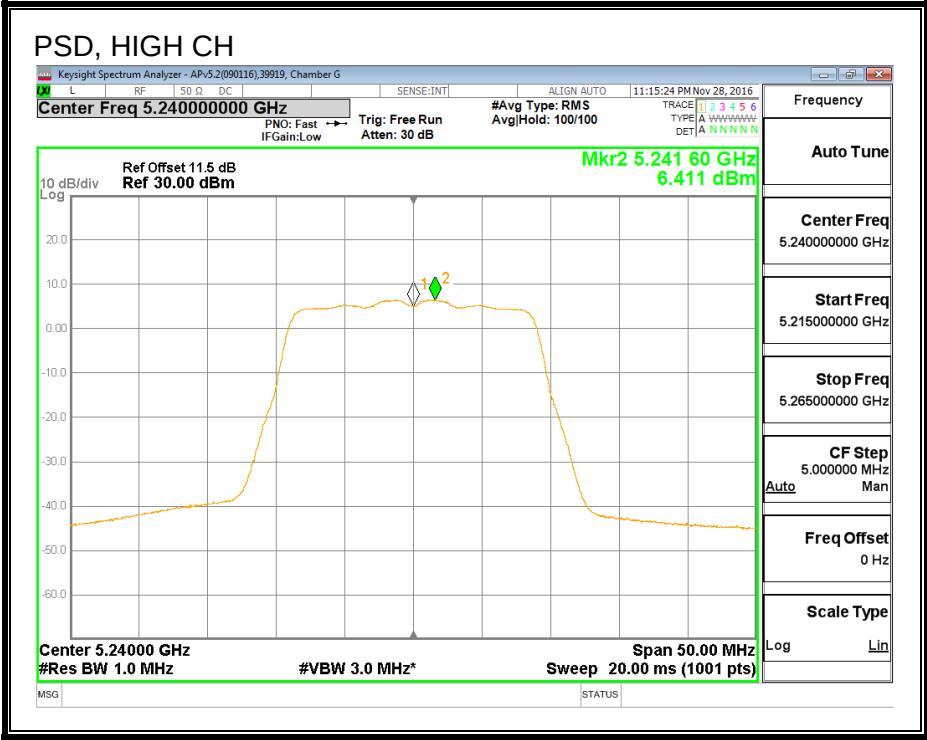
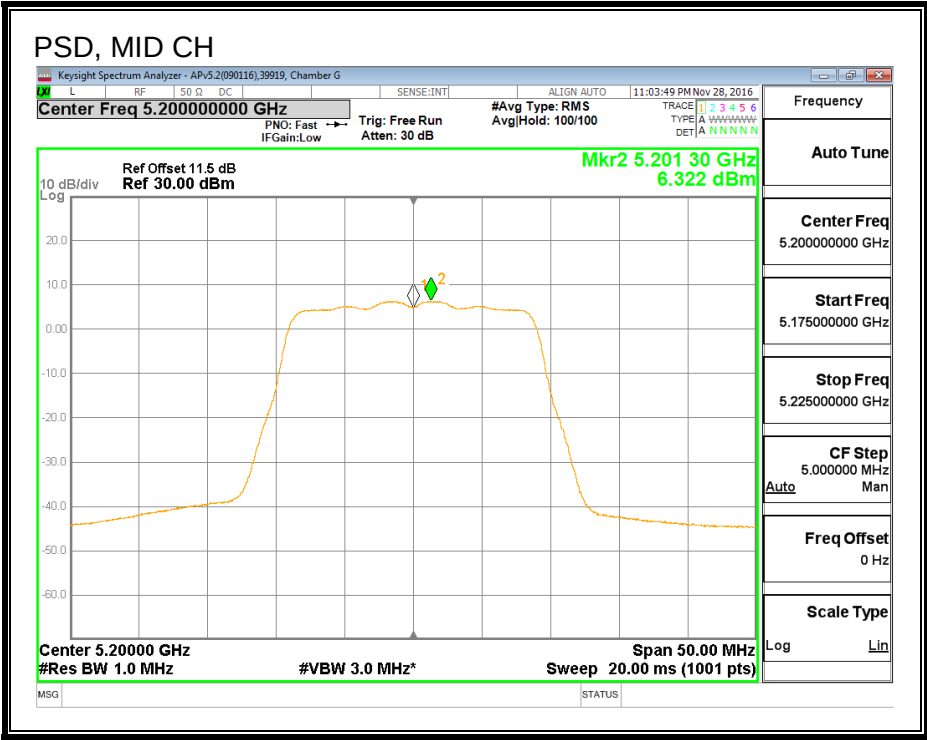
PSD, Antenna A





PSD, Antenna B





8.4. 802.11n HT20 2Tx (Ant A + Ant B) STBC MODE IN THE 5.2 GHz BAND

8.4.1. 26 dB BANDWIDTH

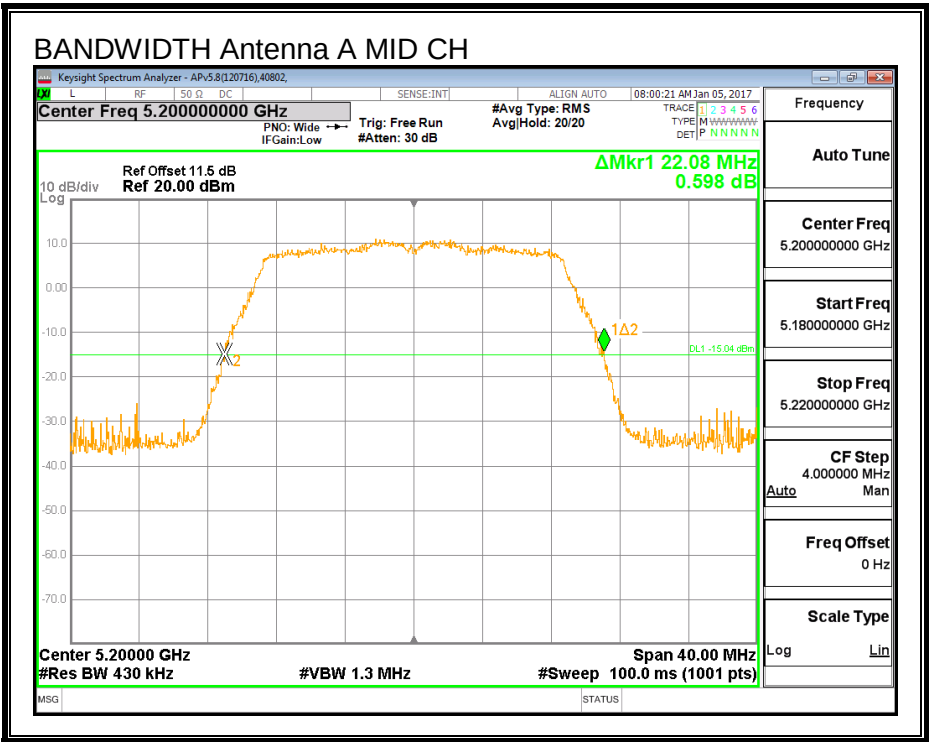
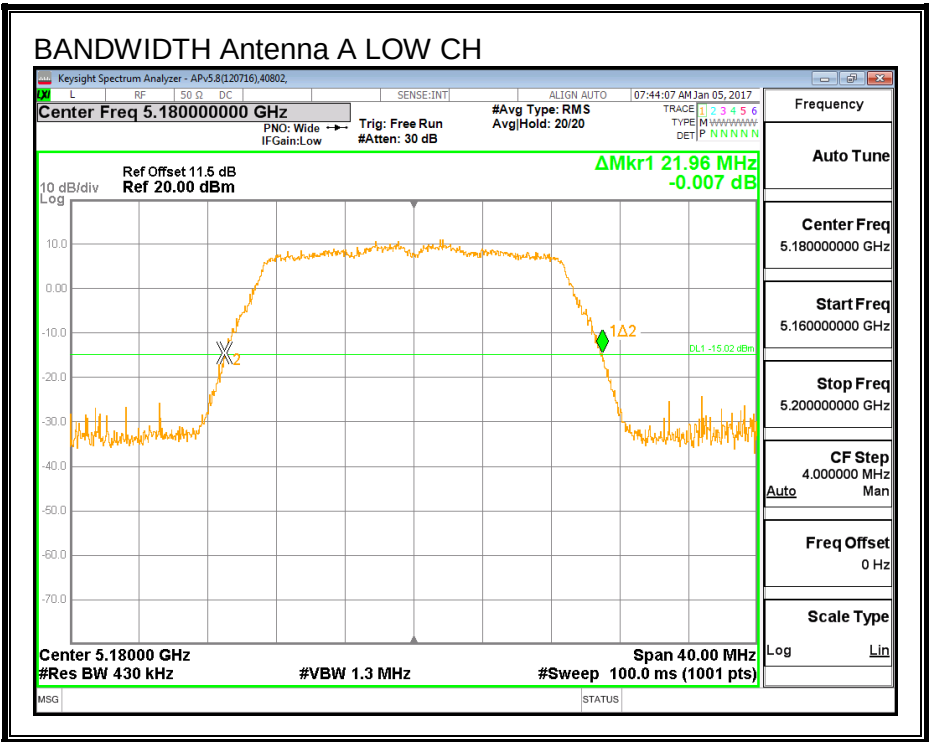
LIMITS

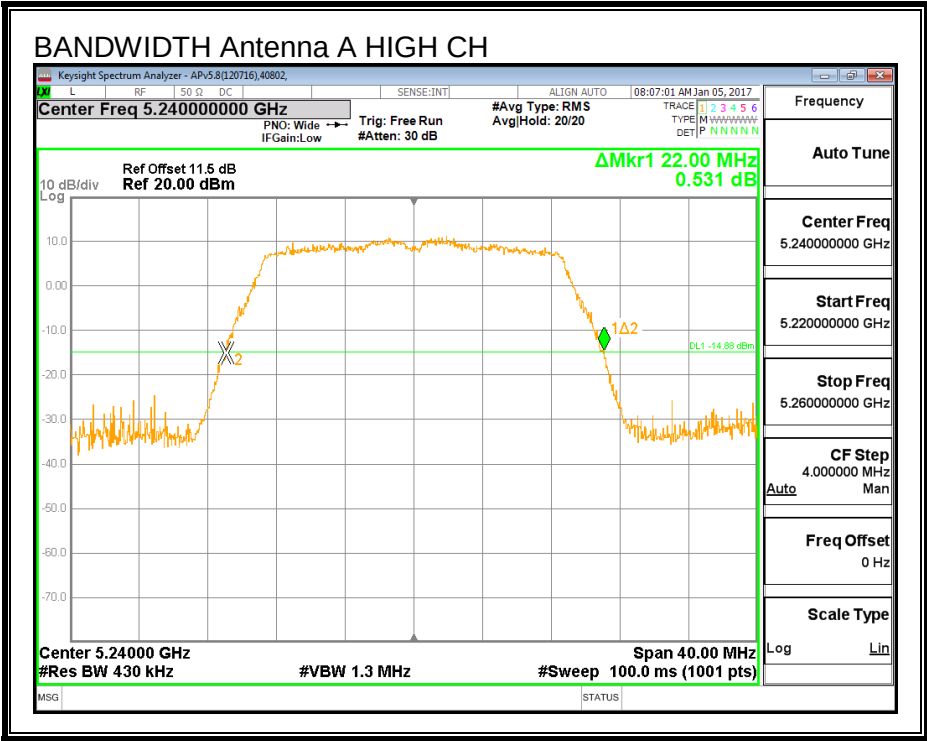
None; for reporting purposes only.

RESULTS

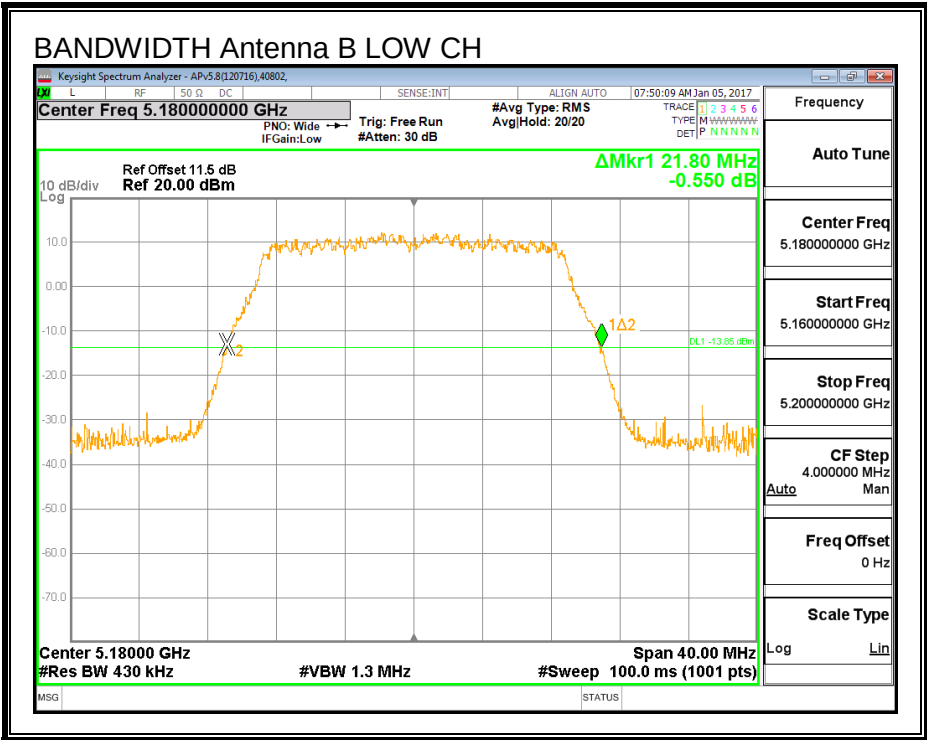
Channel	Frequency (MHz)	26 dB BW Antenna A (MHz)	26 dB BW Antenna B (MHz)
Low	5180	21.960	21.800
Mid	5200	22.080	21.640
High	5240	22.000	21.680

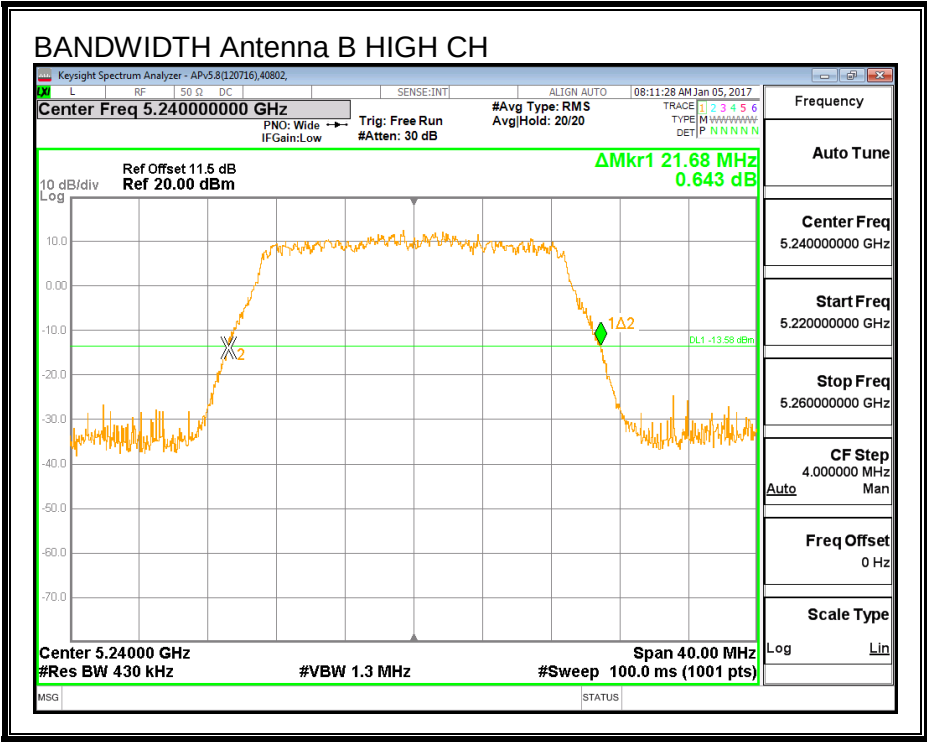
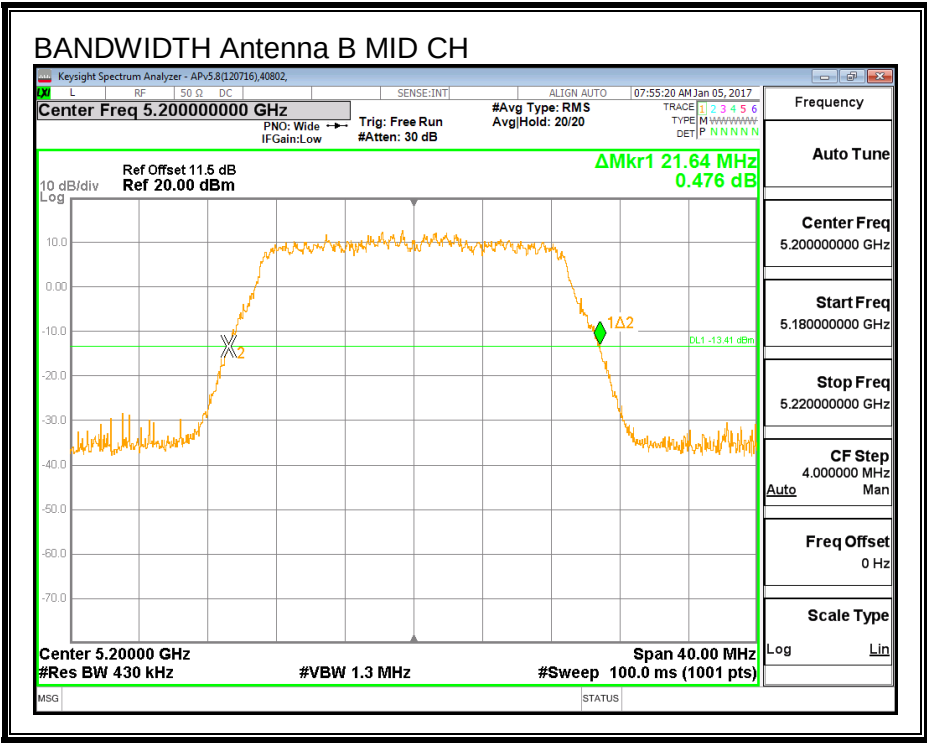
26 dB BANDWIDTH, Antenna A





26 dB BANDWIDTH, Antenna B





8.4.2. 99% BANDWIDTH

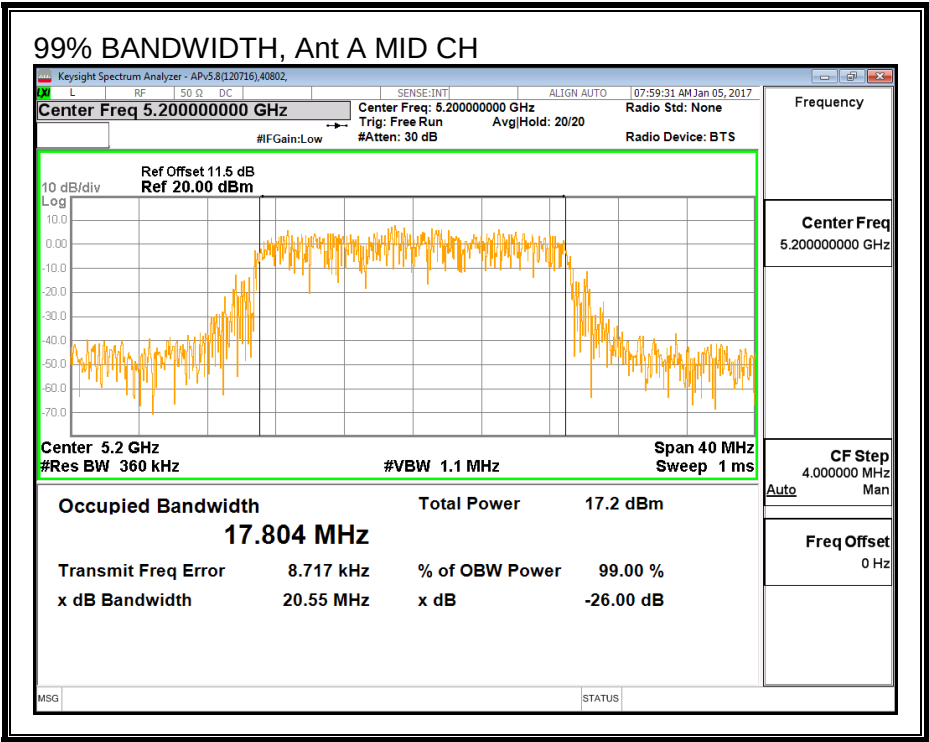
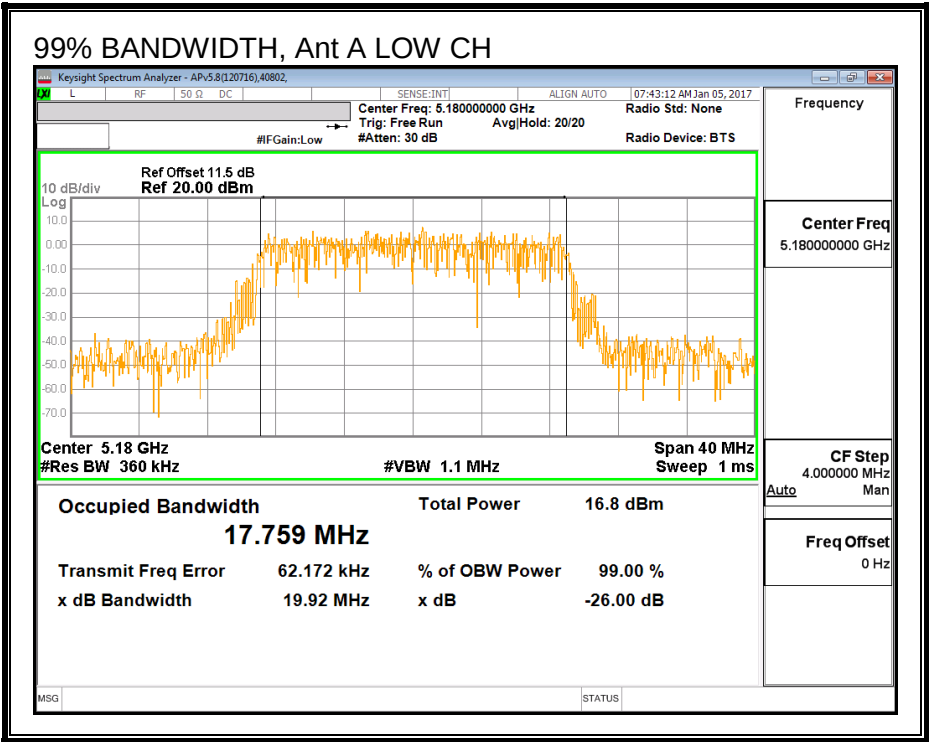
LIMITS

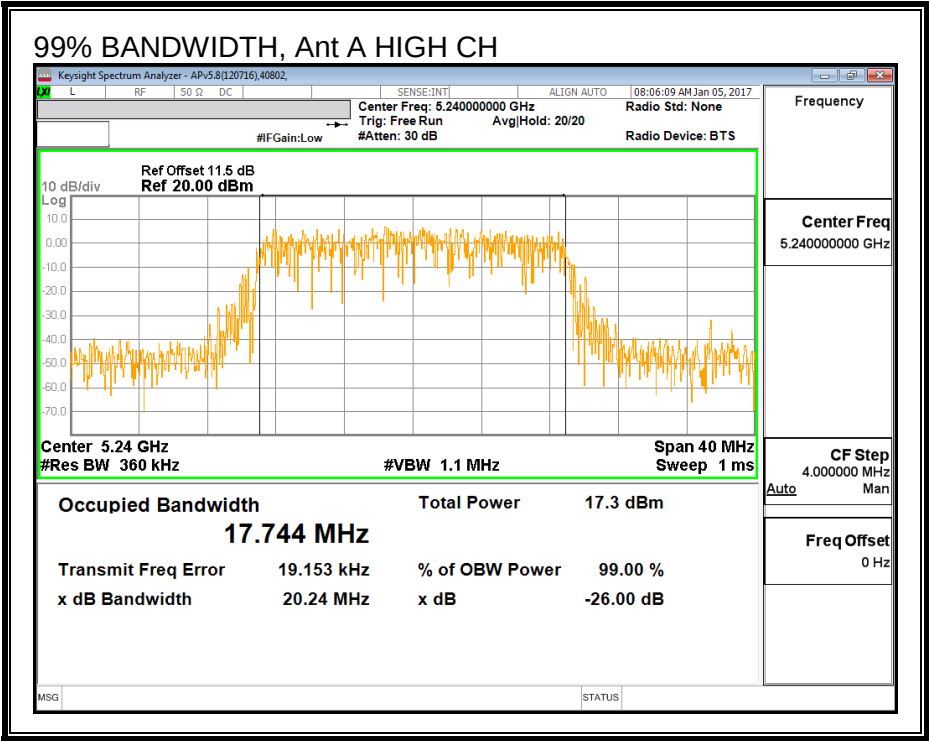
None; for reporting purposes only.

RESULTS

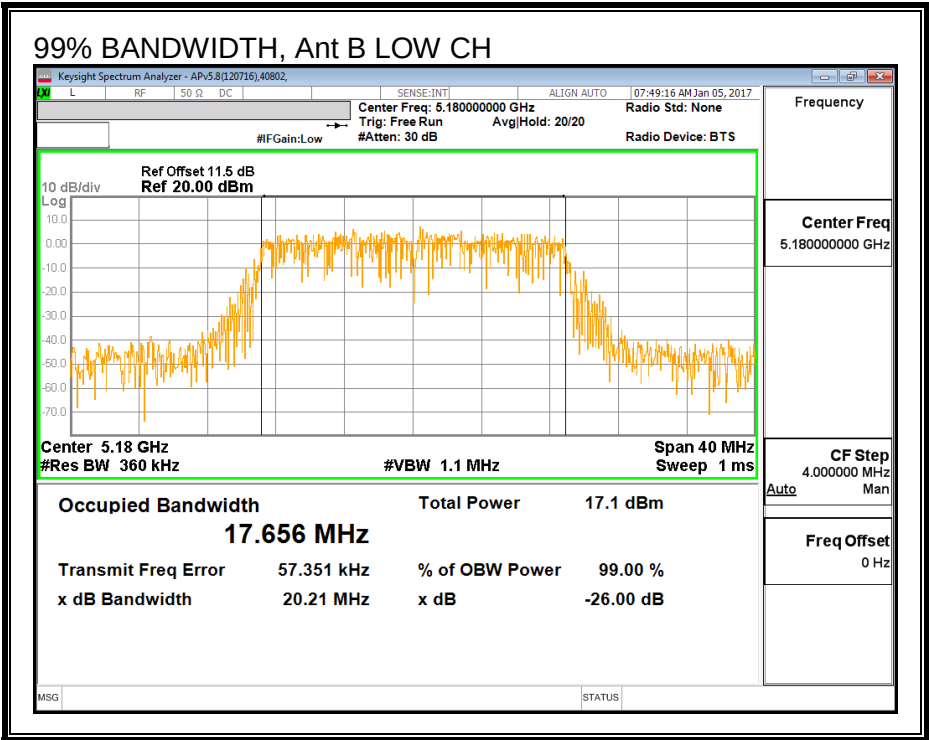
Channel	Frequency (MHz)	99% BW Antenna A (MHz)	99% BW Antenna B (MHz)
Low	5180	17.759	17.656
Mid	5200	17.804	17.836
High	5240	17.744	17.772

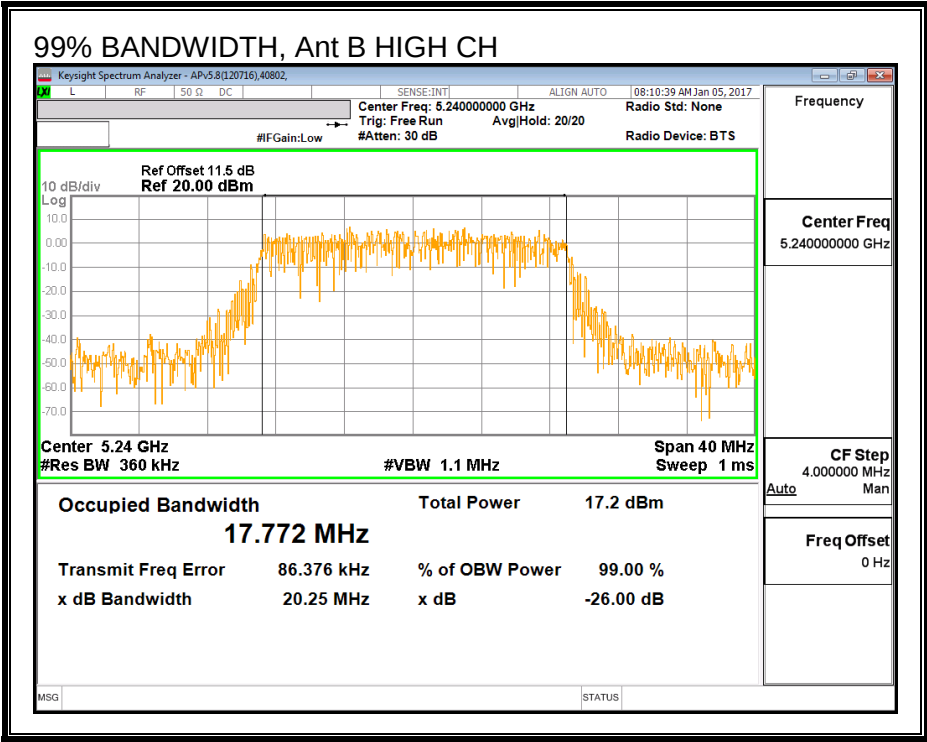
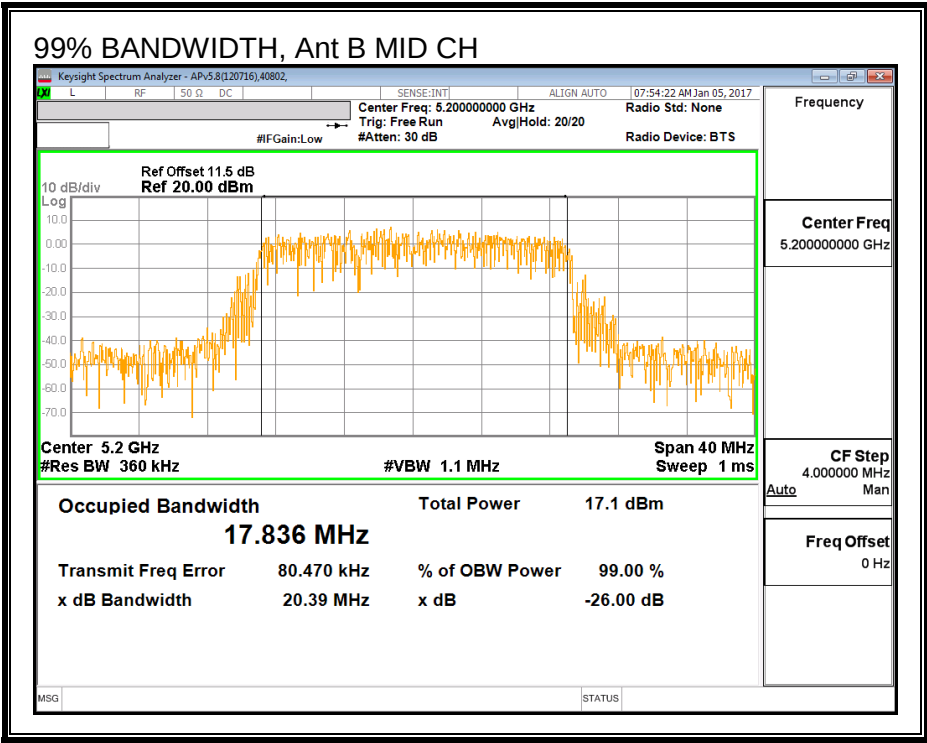
99% BANDWIDTH, Antenna A





99% BANDWIDTH, Antenna B





8.4.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

RESULTS

ID:	45256	Date:	1/31/17
------------	-------	--------------	---------

Average Power Results

Channel	Frequency (MHz)	Antenna A Power (dBm)	Antenna B Power (dBm)	Total Power (dBm)
Low	5180	15.00	14.90	17.96
Mid	5200	16.96	16.00	19.52
High	5240	17.00	15.90	19.50

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.

DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is the same for each chain. The directional gain is equal to the antenna gain.

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

Use this table for uncorrelated chains and unequal antenna gain

Antenna A	Antenna B	Uncorrelated Chains
Gain (dBi)	Gain (dBi)	Directional Gain (dBi)
3.48	3.33	3.41

Antenna A	Antenna B	Correlated Chains
Gain (dBi)	Gain (dBi)	Directional Gain (dBi)
3.48	3.33	6.42

RESULTS

ID:	45256	Date:	1/31/17
------------	-------	--------------	---------

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	3.41	6.42	24.00	10.58
Mid	5200	3.41	6.42	24.00	10.58
High	5240	3.41	6.42	24.00	10.58

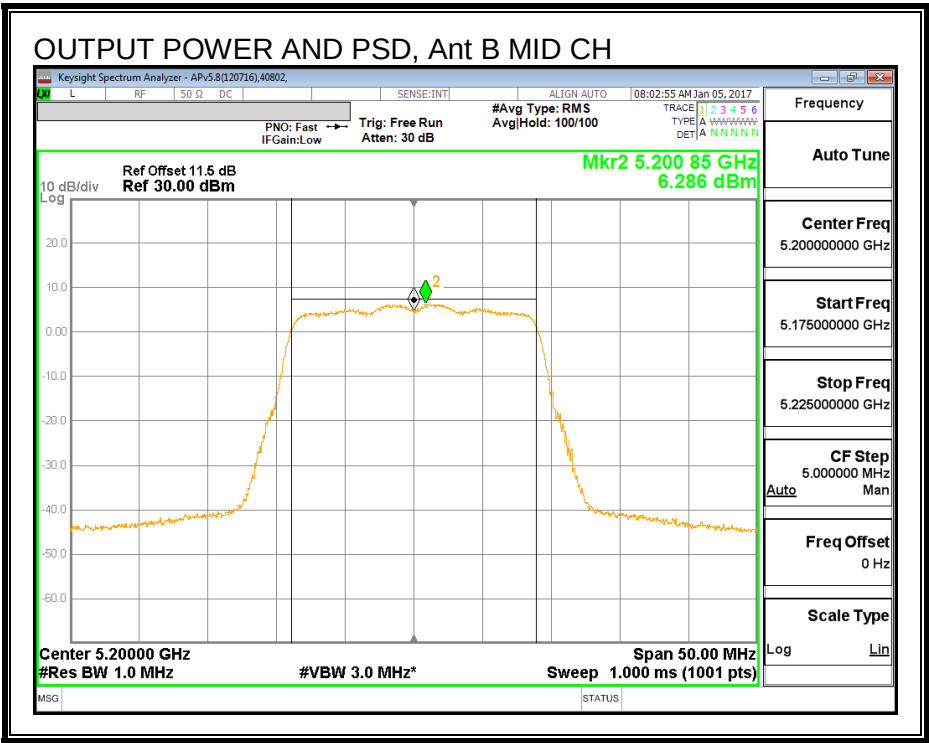
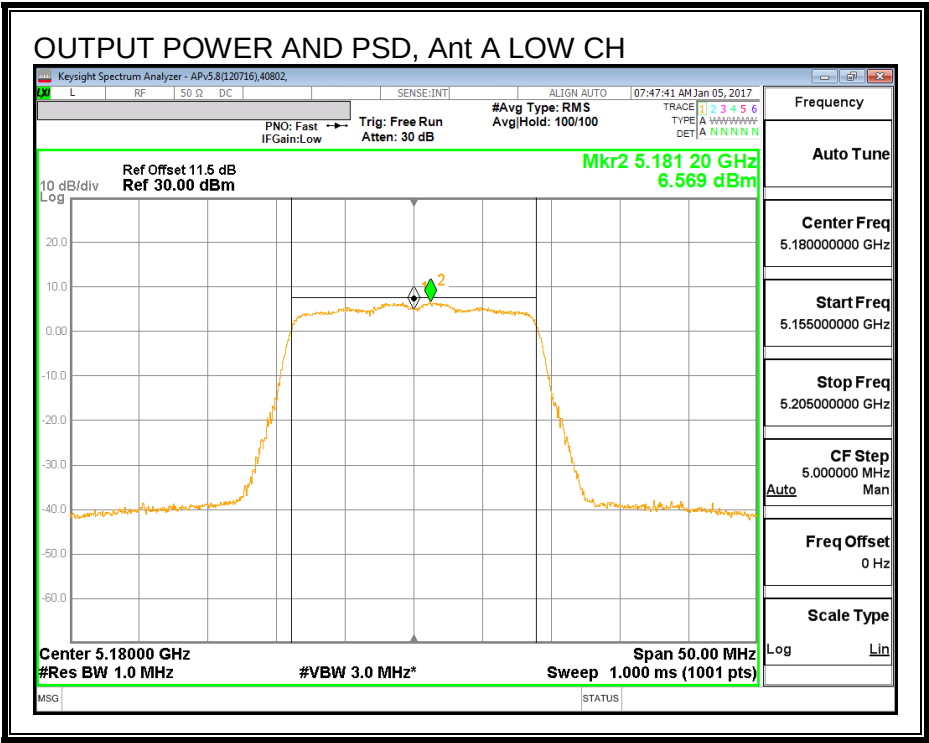
Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power & PSD
---------------------------	------	---

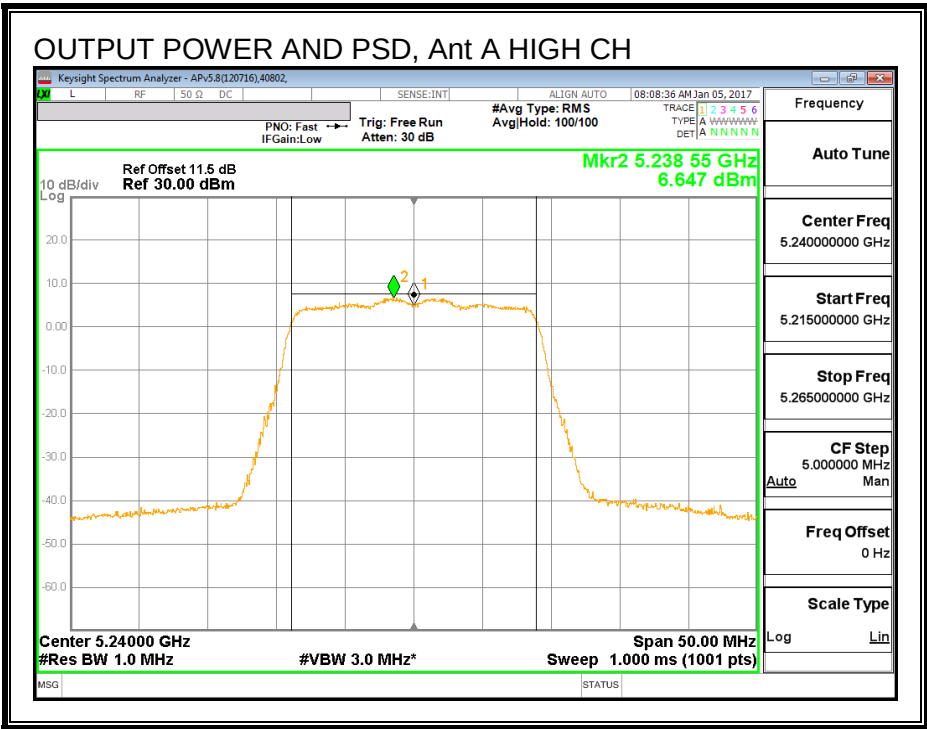
Output Power Results

Channel	Frequency (MHz)	Antenna A Meas Power (dBm)	Antenna B Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	15.00	14.90	17.96	24.00	-6.04
Mid	5200	16.96	16.00	19.52	24.00	-4.48
High	5240	17.00	15.90	19.50	24.00	-4.50

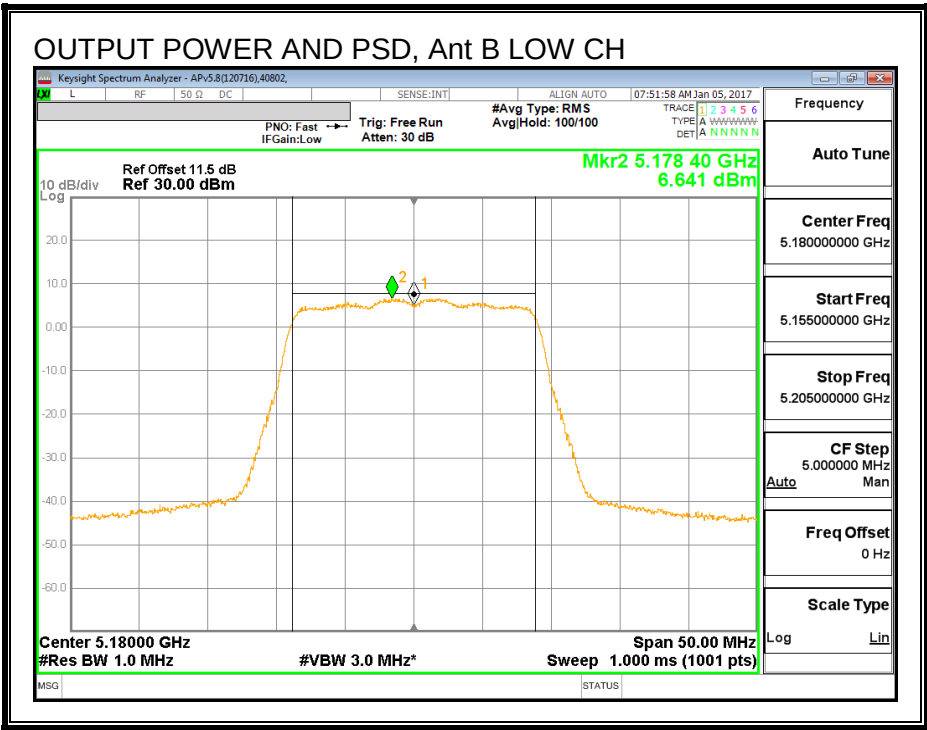
PSD Results

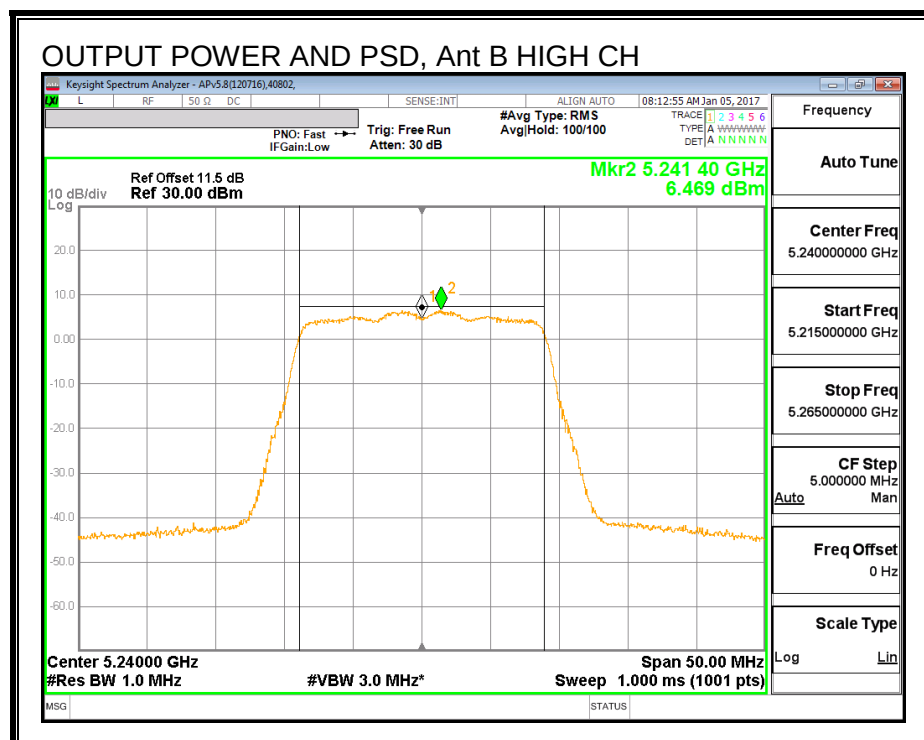
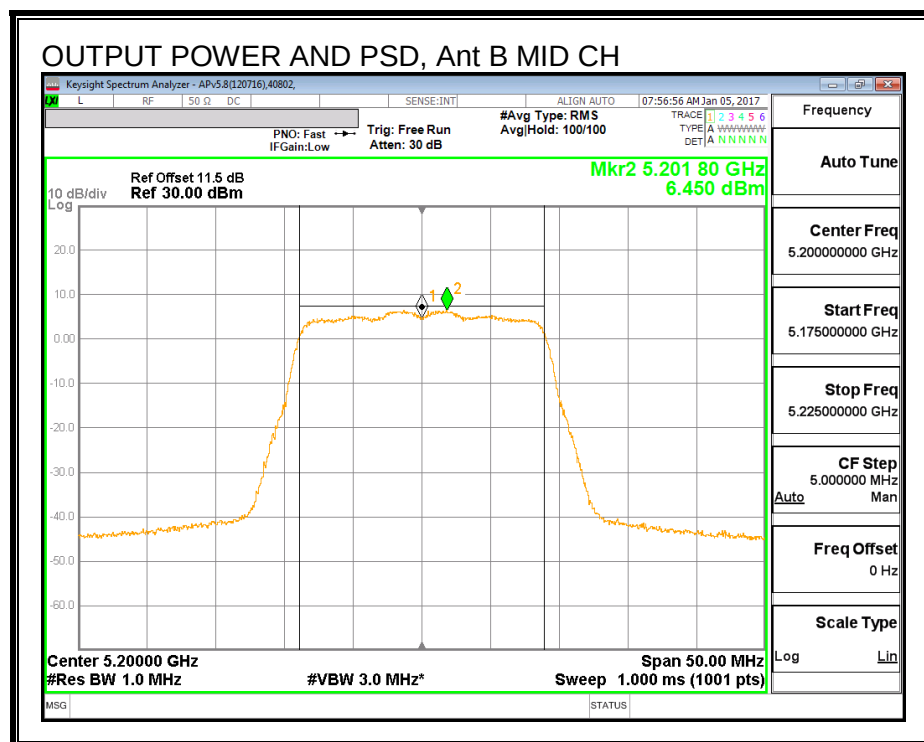
Channel	Frequency (MHz)	Antenna A Meas PSD (dBm)	Antenna B Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5180	6.57	6.64	9.62	10.58	-0.96
Mid	5200	6.29	6.45	9.38	10.58	-1.20
High	5240	6.65	6.47	9.57	10.58	-1.01





OUTPUT POWER AND PSD, Antenna B





8.5. 802.11n HT40 Antenna A MODE IN THE 5.2 GHz BAND

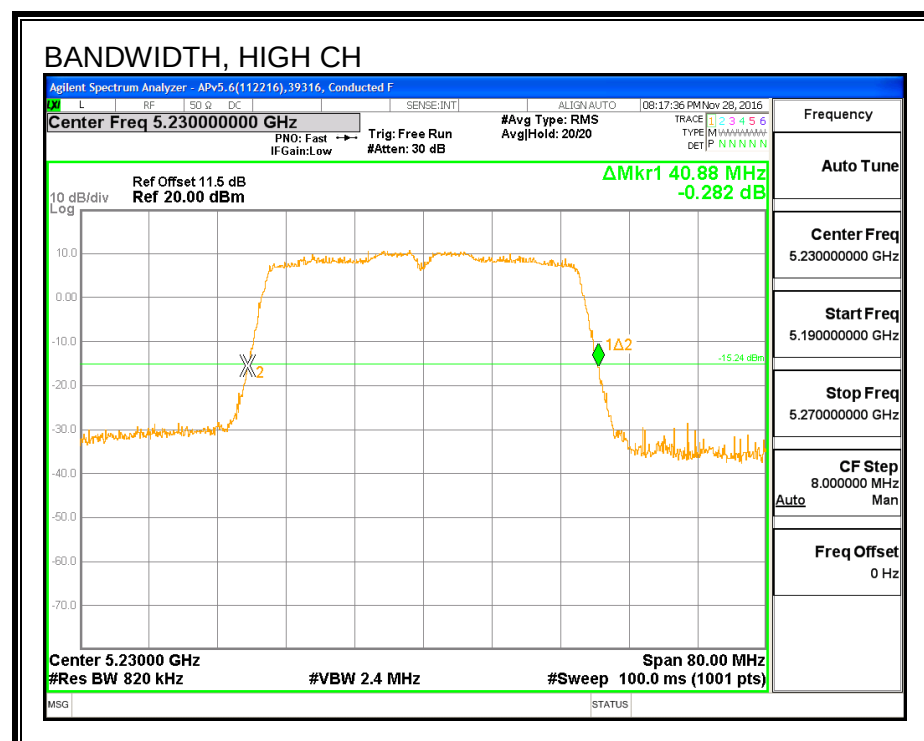
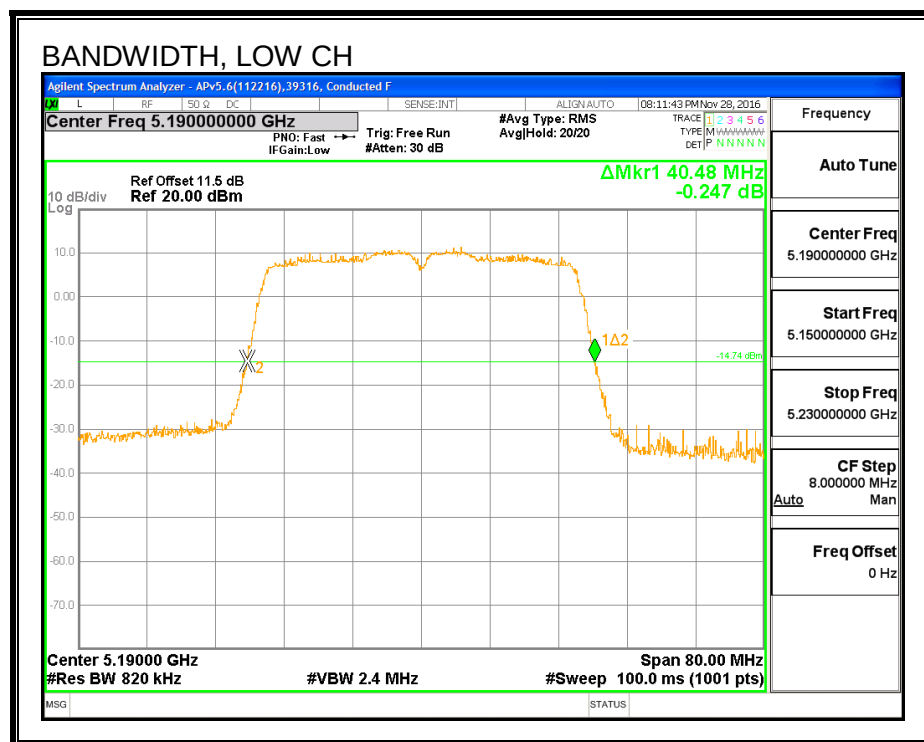
8.5.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5190	40.480
High	5230	40.880



8.5.2. 99% BANDWIDTH

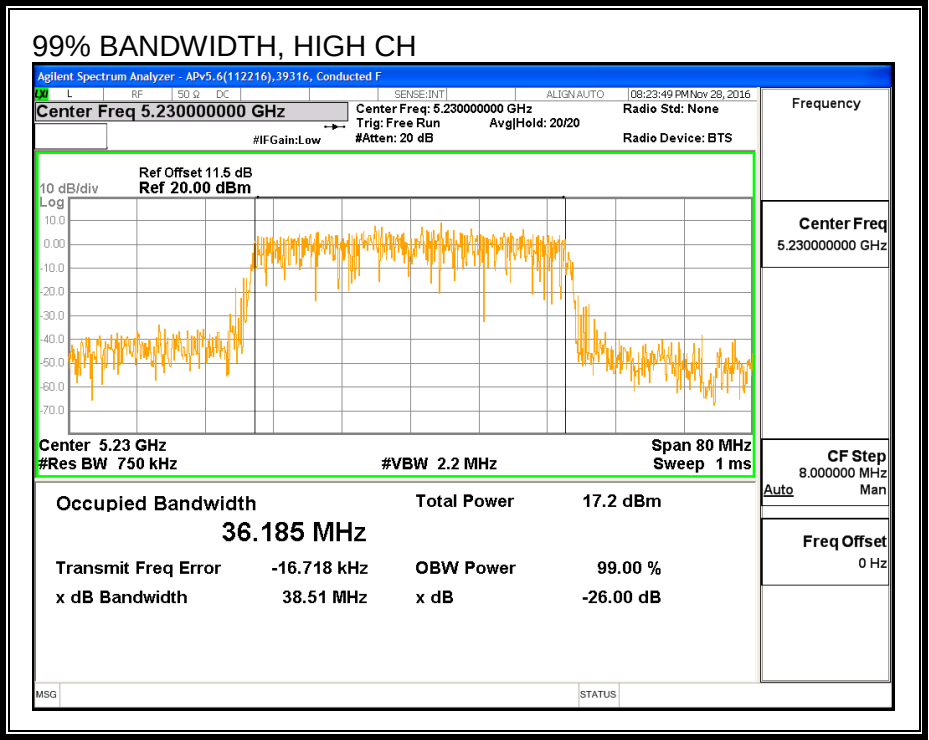
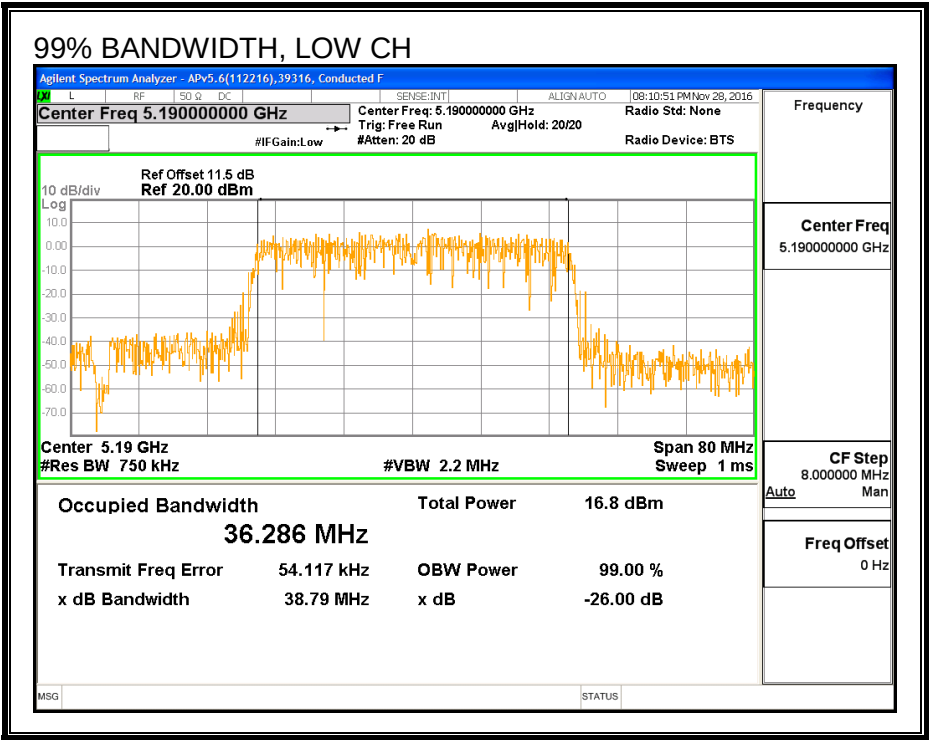
LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5190	36.286
High	5230	36.185

99% BANDWIDTH



8.5.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

RESULTS

ID:	45256	Date:	1/31/17
------------	-------	--------------	---------

Channel	Frequency (MHz)	Power (dBm)
Low	5190	13.94
High	5230	16.92

8.5.4. 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 colocated 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

ID:	45256	Date:	1/31/17
------------	-------	--------------	---------

Antenna Gain and Limits

Channel	Frequency (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
Low	5190	3.48	3.48	24.00	11.00
High	5230	3.48	3.48	24.00	11.00

Duty Cycle CF (dB)	0.11	Included in Calculations of Corr'PSD
---------------------------	------	---

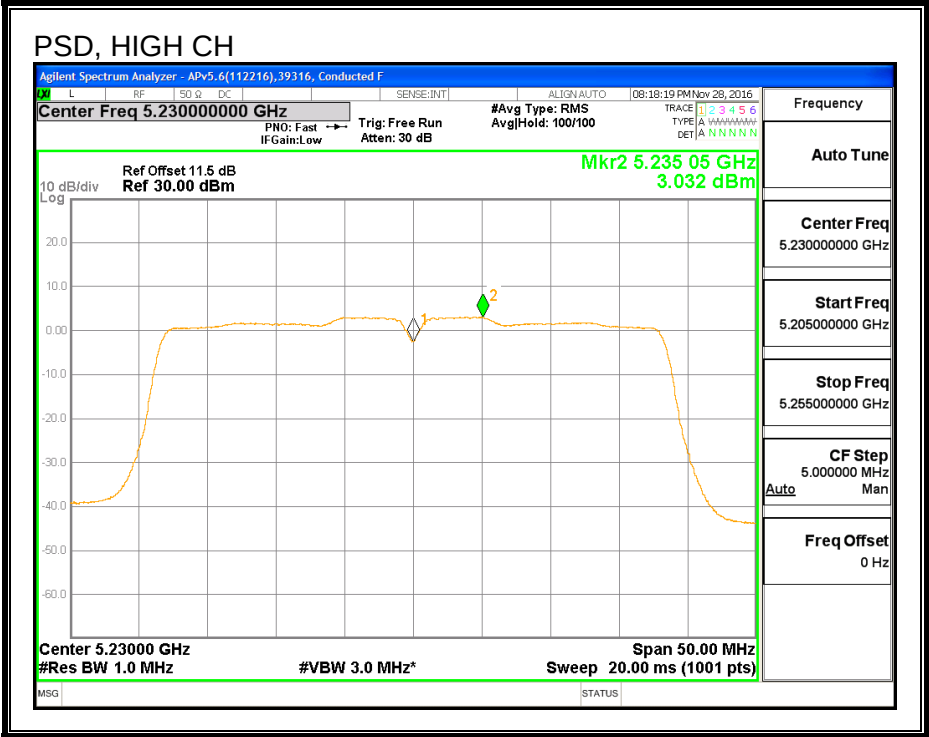
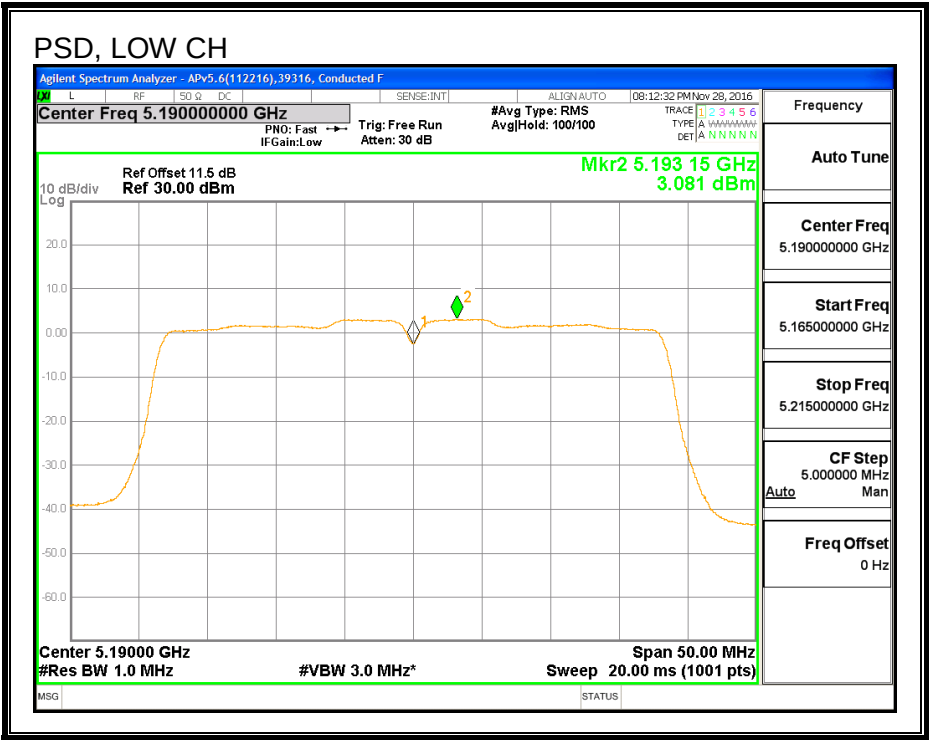
Output Power Results

Channel	Frequency (MHz)	Antenna A Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5190	13.94	13.94	24.00	-10.06
High	5230	16.92	16.92	24.00	-7.08

PSD Results

Channel	Frequency (MHz)	Antenna A Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5190	3.08	3.19	11.00	-7.81
High	5230	3.03	3.14	11.00	-7.86

PSD



8.6. 802.11n HT40 Antenna B MODE IN THE 5.2 GHz BAND

8.6.1. 26 dB BANDWIDTH

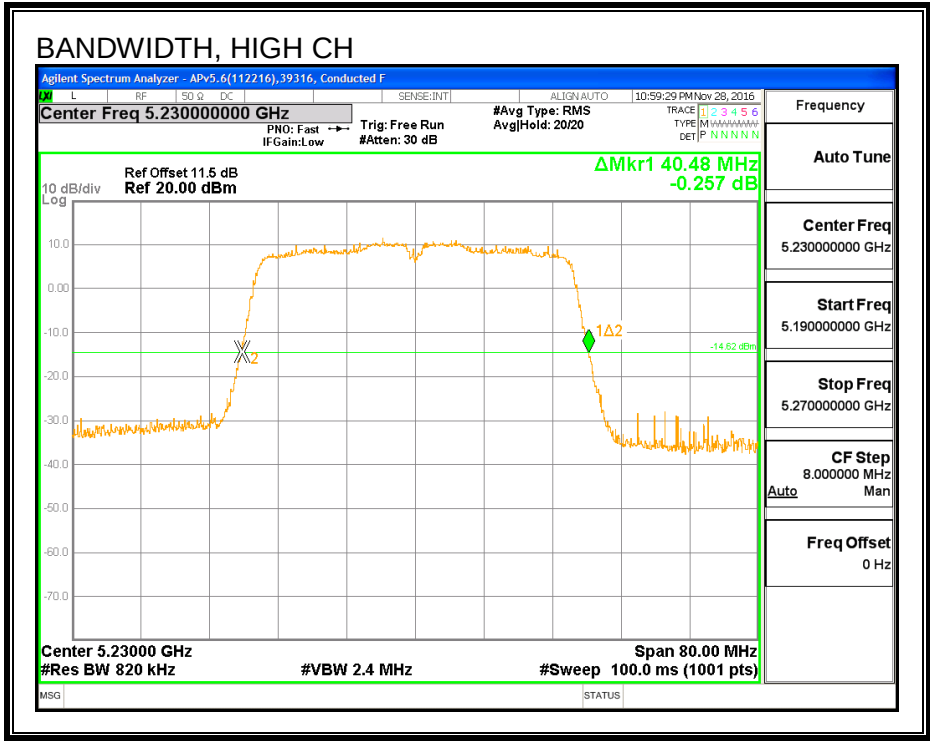
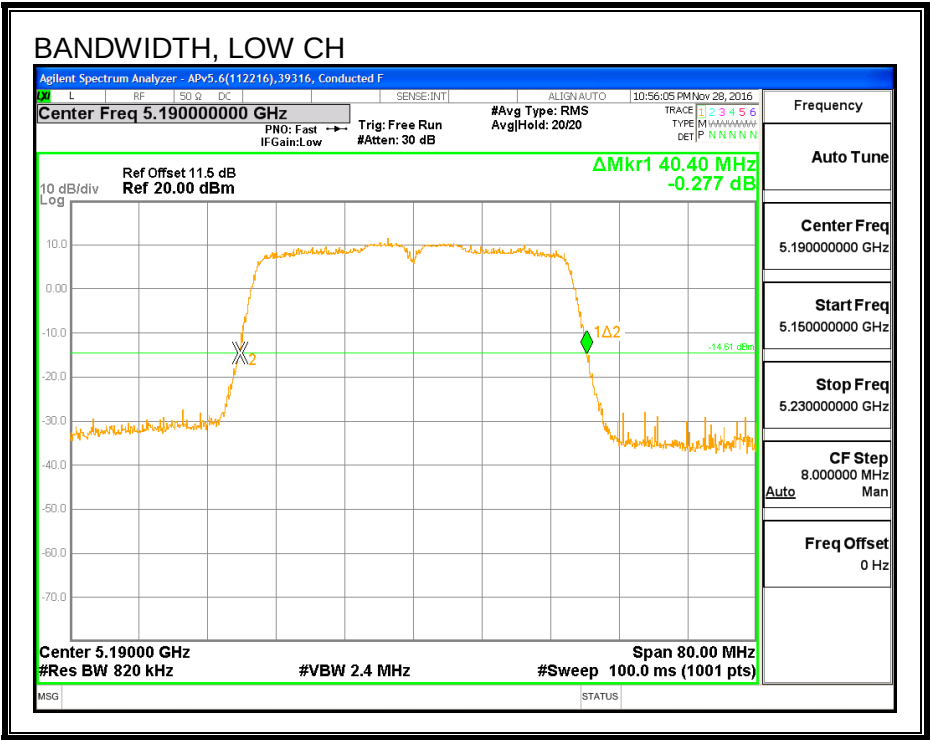
LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5190	40.400
High	5230	40.480

26 dB BANDWIDTH



8.6.2. 99% BANDWIDTH

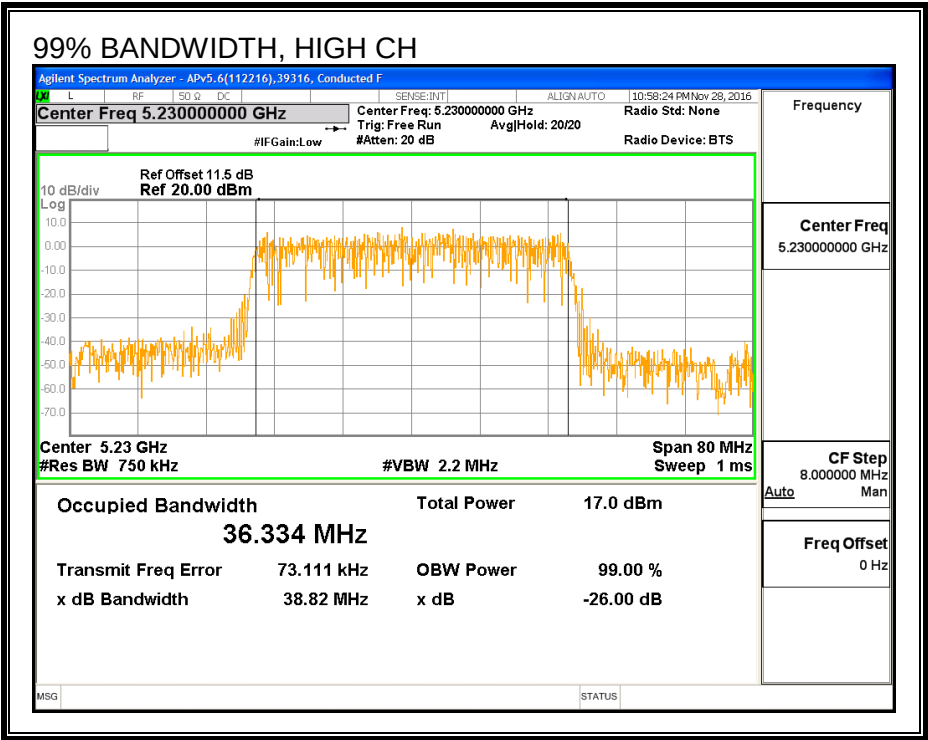
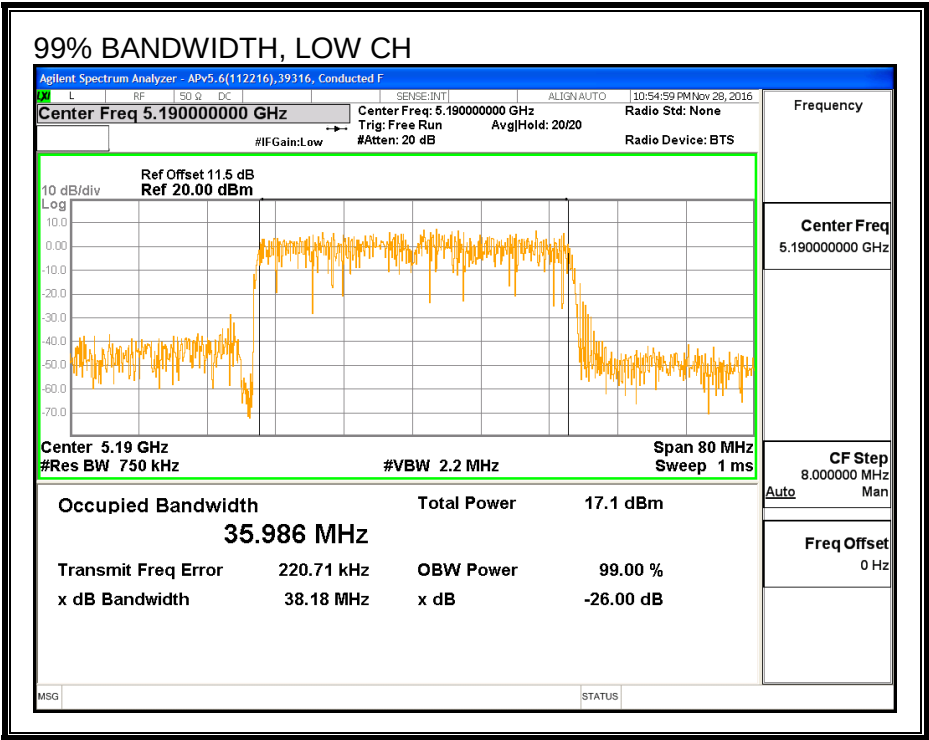
LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5190	35.986
High	5230	36.334

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

ID:	45256	Date:	1/31/17
------------	-------	--------------	---------

Channel	Frequency (MHz)	Power (dBm)
Low	5190	13.98
High	5230	15.96

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 colocated 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

ID:	45256	Date:	1/31/17
------------	-------	--------------	---------

Antenna Gain and Limits

Channel	Frequency (MHz)	Directional Gain for Power (dBi)	Directional Gain for PSD (dBi)	Power Limit (dBm)	PSD Limit (dBm)
Low	5190	3.33	3.33	24.00	11.00
High	5230	3.33	3.33	24.00	11.00

Duty Cycle CF (dB)	0.11	Included in Calculations of Corr'd PSD
---------------------------	------	---

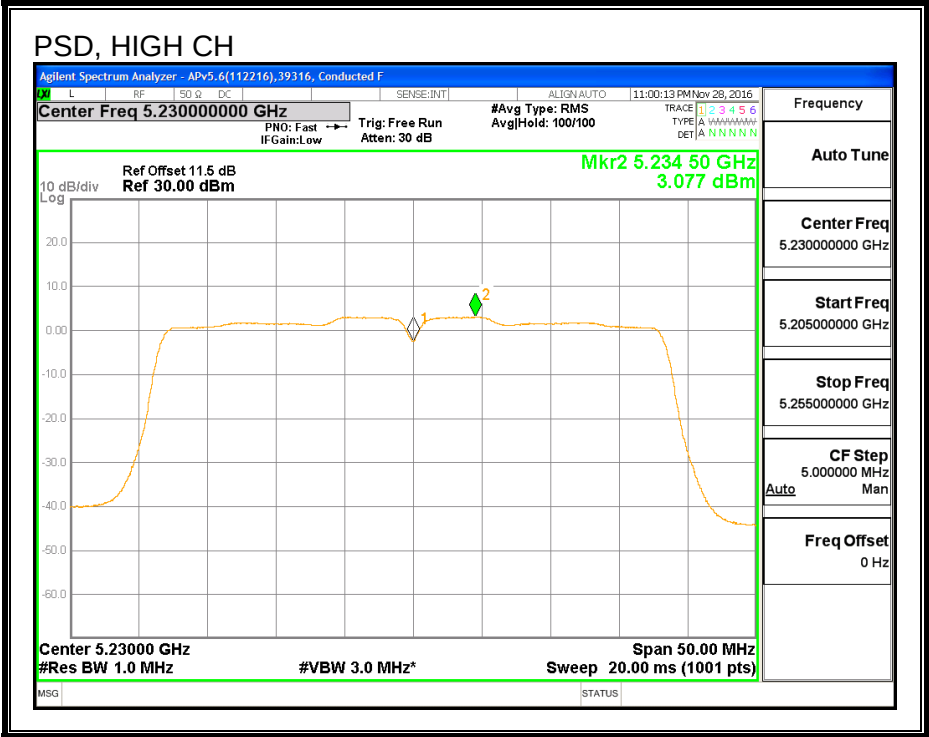
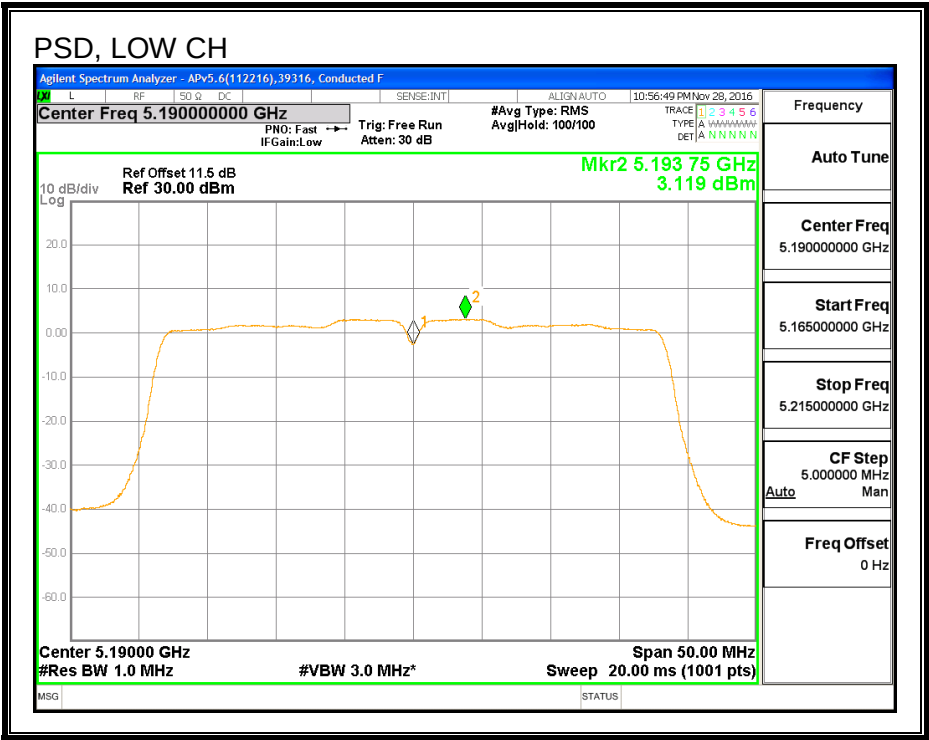
Output Power Results

Channel	Frequency (MHz)	Antenna B Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5190	13.98	13.98	24.00	-10.02
High	5230	15.96	15.96	24.00	-8.04

PSD Results

Channel	Frequency (MHz)	Antenna B Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5190	3.12	3.23	11.00	-7.77
High	5230	3.08	3.19	11.00	-7.81

PSD



8.7. 802.11n HT40 2Tx (Antenna A + Antenna B) CDD MODE IN THE 5.2 GHz BAND

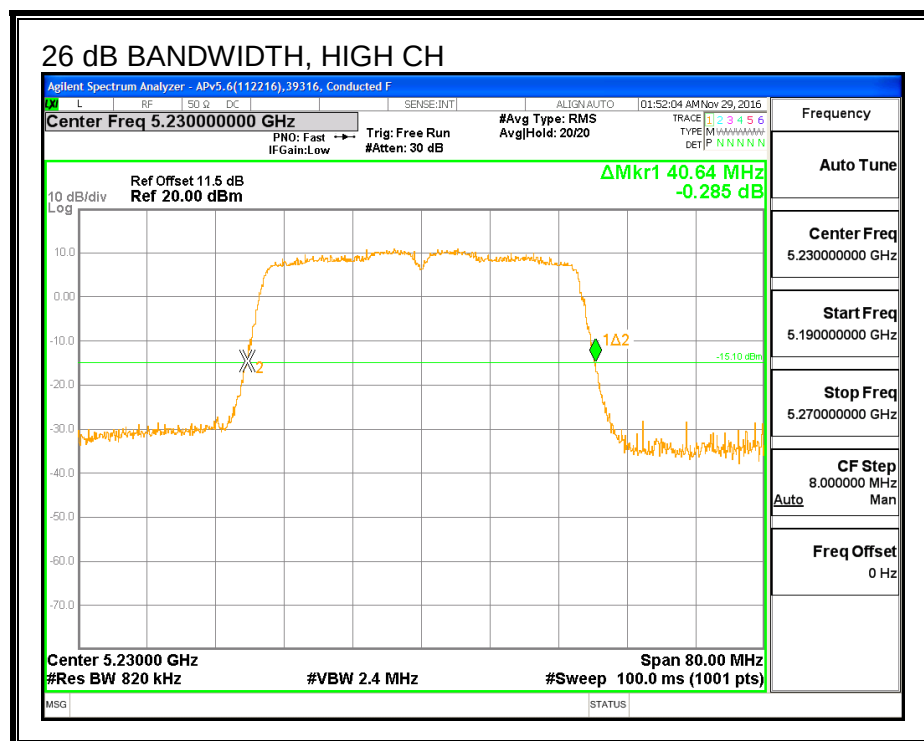
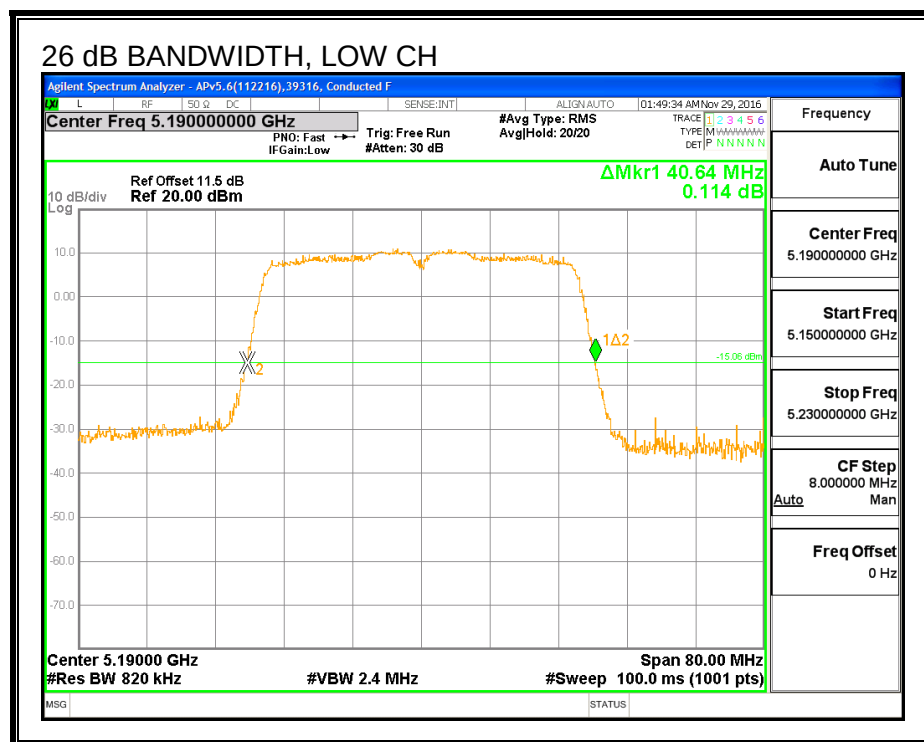
8.7.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB BW Antenna A (MHz)	26 dB BW Antenna B (MHz)
Low	5190	40.640	40.240
High	5230	40.640	40.160



26 DB BANDWIDTH, Antenna B

