



CERTIFICATION TEST REPORT

Report Number. : 11708541-E4V4

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

Model : A1863, A1907

FCC ID : BCG-E3159A

EUT Description : SMARTPHONE

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

Date Of Issue:
August 25, 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	08/08/2017	Initial Issue	Chin Pang
V2	08/09/2017	Address TCB's Questions	Chin Pang
V3	08/11/2017	Address TCB's Questions	Chin Pang
V4	08/25/2017	Address TCB's Questions	Chin Pang

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.....	14
5.1. DESCRIPTION OF EUT	14
5.2. DIFFERENCE IN MODEL NUMBER	14
5.3. MAXIMUM OUTPUT POWER	14
5.4. DESCRIPTION OF AVAILABLE ANTENNAS.....	18
5.5. SOFTWARE AND FIRMWARE	18
5.6. WORST-CASE CONFIGURATION AND MODE.....	19
5.7. DESCRIPTION OF TEST SETUP	21
6. TEST AND MEASUREMENT EQUIPMENT	27
7. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS	28
7.1. ON TIME AND DUTY CYCLE.....	28
8. MEASUREMENT METHODS.....	32
ANTENNA PORT TEST RESULTS.....	33
8.1. 11n HT20 UAT 2 SISO MODE IN THE 5.2GHz BAND	33
8.1.1. 26 dB BANDWIDTH	33
8.1.2. 99% BANDWIDTH.....	36
8.1.3. AVERAGE POWER.....	39
8.1.4. OUTPUT POWER AND PPSD	40
8.2. 11n HT20 LAT 3 SISO MODE IN THE 5.2GHz BAND.....	44
8.2.1. 26 dB BANDWIDTH	44
8.2.2. 99% BANDWIDTH.....	47
8.2.3. AVERAGE POWER.....	50
8.2.4. OUTPUT POWER AND PPSD	51
8.3. 11n HT20 2TX CDD MIMO MODE IN THE 5.2GHz BAND	55
8.3.1. 26 dB BANDWIDTH	55
8.3.2. 99% BANDWIDTH.....	59
8.3.3. AVERAGE POWER.....	63
8.3.4. OUTPUT POWER AND PPSD	64

8.4.	11n HT40 UAT 2 SISO MODE IN THE 5.2GHz BAND	70
8.4.1.	26 dB BANDWIDTH	70
8.4.2.	99% BANDWIDTH.....	72
8.4.3.	AVERAGE POWER.....	74
8.4.4.	OUTPUT POWER AND PPSD	75
8.5.	11n HT40 LAT 3 SISO MODE IN THE 5.2GHz BAND.....	78
8.5.1.	26 dB BANDWIDTH	78
8.5.2.	99% BANDWIDTH.....	80
8.5.3.	AVERAGE POWER.....	82
8.5.4.	OUTPUT POWER AND PPSD	83
8.6.	11n HT40 2TX CDD MIMO MODE IN THE 5.2GHz BAND	86
8.6.1.	26 dB BANDWIDTH	86
8.6.2.	99% BANDWIDTH.....	89
8.6.3.	AVERAGE POWER.....	92
8.6.4.	OUTPUT POWER AND PPSD	93
8.7.	11ac HT80 UAT 2 SISO MODE IN THE 5.2GHz BAND	98
8.7.1.	26 dB BANDWIDTH	98
8.7.2.	99% BANDWIDTH.....	100
8.7.3.	AVERAGE POWER.....	102
8.7.4.	OUTPUT POWER AND PPSD	103
8.8.	11ac HT80 LAT 3 SISO MODE IN THE 5.2GHz BAND	106
8.8.1.	26 dB BANDWIDTH	106
8.8.2.	99% BANDWIDTH.....	108
8.8.3.	AVERAGE POWER.....	110
8.8.4.	OUTPUT POWER AND PPSD	111
8.9.	11ac HT80 2TX CDD MIMO MODE IN THE 5.2GHz BAND	114
8.9.1.	26 dB BANDWIDTH	114
8.9.2.	99% BANDWIDTH.....	116
8.9.3.	AVERAGE POWER.....	118
8.9.4.	OUTPUT POWER AND PPSD	119
8.10.	11n HT20 UAT 2 SISO MODE IN THE 5.3GHz BAND.....	123
8.10.1.	26 dB BANDWIDTH.....	123
8.10.2.	99% BANDWIDTH.....	126
8.10.3.	AVERAGE POWER.....	129
8.10.4.	OUTPUT POWER AND PPSD.....	130
8.11.	11n HT20 LAT 3 SISO MODE IN THE 5.3GHz BAND	134
8.11.1.	26 dB BANDWIDTH.....	134
8.11.2.	99% BANDWIDTH.....	137
8.11.3.	AVERAGE POWER	140
8.11.4.	OUTPUT POWER AND PPSD.....	141
8.12.	11n HT20 2TX CDD MIMO MODE IN THE 5.3GHz BAND.....	145
8.12.1.	26 dB BANDWIDTH.....	145
8.12.2.	99% BANDWIDTH.....	149
8.12.3.	AVERAGE POWER.....	153
8.12.4.	OUTPUT POWER AND PPSD.....	154
8.13.	11n HT40 UAT 2 SISO MODE IN THE 5.3GHz BAND.....	159
8.13.1.	26 dB BANDWIDTH.....	159
8.13.2.	99% BANDWIDTH	161
8.13.3.	AVERAGE POWER	163

8.13.4.	OUTPUT POWER AND PPSD.....	164
8.14.	<i>11n HT40 LAT 3 SISO MODE IN THE 5.3GHz BAND</i>	<i>167</i>
8.14.1.	26 dB BANDWIDTH.....	167
8.14.2.	99% BANDWIDTH.....	169
8.14.3.	AVERAGE POWER.....	171
8.14.4.	OUTPUT POWER AND PPSD.....	172
8.15.	<i>11n HT40 2TX CDD MIMO MODE IN THE 5.3GHz BAND.....</i>	<i>175</i>
8.15.1.	26 dB BANDWIDTH.....	175
8.15.2.	99% BANDWIDTH.....	178
8.15.3.	AVERAGE POWER.....	181
8.15.4.	OUTPUT POWER AND PPSD.....	182
8.16.	<i>11ac HT80 UAT 2 SISO MODE IN THE 5.3GHz BAND</i>	<i>186</i>
8.16.1.	26 dB BANDWIDTH.....	186
8.16.2.	99% BANDWIDTH.....	188
8.16.3.	AVERAGE POWER.....	190
8.16.4.	OUTPUT POWER AND PPSD.....	191
8.17.	<i>11ac HT80 LAT 3 SISO MODE IN THE 5.3GHz BAND.....</i>	<i>194</i>
8.17.1.	26 dB BANDWIDTH.....	194
8.17.2.	99% BANDWIDTH.....	196
8.17.3.	AVERAGE POWER.....	198
8.17.4.	OUTPUT POWER AND PPSD.....	199
8.18.	<i>11ac HT80 2TX CDD MIMO MODE IN THE 5.3GHz BAND.....</i>	<i>202</i>
8.18.1.	26 dB BANDWIDTH.....	202
8.18.2.	99% BANDWIDTH.....	204
8.18.3.	AVERAGE POWER.....	206
8.18.4.	OUTPUT POWER AND PPSD.....	207
8.19.	<i>11n HT20 UAT 2 SISO MODE IN THE 5.6GHz BAND.....</i>	<i>210</i>
8.19.1.	26 dB BANDWIDTH.....	210
8.19.2.	99% BANDWIDTH.....	213
8.19.3.	AVERAGE POWER.....	216
8.19.4.	OUTPUT POWER AND PPSD.....	217
8.19.5.	11ac HT20 UAT 2 SISO STRADDLE CHANNEL 144	221
8.19.6.	6 dB BANDWIDTH.....	225
8.20.	<i>11n HT20 LAT 3 SISO MODE IN THE 5.6GHz BAND</i>	<i>226</i>
8.20.1.	26 dB BANDWIDTH.....	226
8.20.2.	99% BANDWIDTH.....	229
8.20.3.	AVERAGE POWER.....	232
8.20.4.	OUTPUT POWER AND PPSD.....	233
8.20.5.	11ac HT20 LAT 3 SISO STRADDLE CHANNEL 144	237
8.20.6.	6 dB BANDWIDTH.....	241
8.21.	<i>11n HT20 2TX CDD MIMO MODE IN THE 5.6GHz BAND.....</i>	<i>242</i>
8.21.1.	26 dB BANDWIDTH.....	242
8.21.2.	99% BANDWIDTH.....	247
8.21.3.	AVERAGE POWER.....	252
8.21.4.	OUTPUT POWER AND PPSD.....	253
8.21.5.	11ac HT20 2TX CDD MIMO STRADDLE CHANNEL 144	258
8.21.6.	6 dB BANDWIDTH.....	264
8.22.	<i>11n HT40 UAT 2 SISO MODE IN THE 5.6GHz BAND.....</i>	<i>266</i>
8.22.1.	26 dB BANDWIDTH.....	266

8.22.2.	99% BANDWIDTH	269
8.22.3.	AVERAGE POWER	272
8.22.4.	OUTPUT POWER AND PPSD.....	273
8.22.5.	11ac HT40 UAT 2 SISO STRADDLE CHANNEL 142	277
8.22.6.	6 dB BANDWIDTH.....	281
8.23.	<i>11n HT40 LAT 3 SISO MODE IN THE 5.6GHz BAND</i>	<i>282</i>
8.23.1.	26 dB BANDWIDTH.....	282
8.23.2.	99% BANDWIDTH	285
8.23.3.	AVERAGE POWER	288
8.23.4.	OUTPUT POWER AND PPSD.....	289
8.23.5.	11ac HT40 LAT 3 SISO STRADDLE CHANNEL 142	293
8.23.6.	6 dB BANDWIDTH.....	297
8.24.	<i>11n HT40 2TX CDD MIMO MODE IN THE 5.6GHz BAND.....</i>	<i>298</i>
8.24.1.	26 dB BANDWIDTH.....	298
8.24.2.	99% BANDWIDTH	303
8.24.3.	AVERAGE POWER	308
8.24.4.	OUTPUT POWER AND PPSD.....	309
8.24.5.	11ac HT40 2TX CDD MIMO STRADDLE CHANNEL 142	314
8.24.6.	6 dB BANDWIDTH.....	320
8.25.	<i>11ac HT80 UAT 2 SISO MODE IN THE 5.6GHz BAND</i>	<i>322</i>
8.25.1.	26 dB BANDWIDTH.....	322
8.25.2.	99% BANDWIDTH	325
8.25.3.	AVERAGE POWER	328
8.25.4.	OUTPUT POWER AND PPSD.....	329
8.25.5.	11ac HT80 UAT 2 SISO STRADDLE CHANNEL 138	332
8.25.6.	6 dB BANDWIDTH.....	336
8.26.	<i>11ac HT80 LAT 3 SISO MODE IN THE 5.6GHz BAND.....</i>	<i>337</i>
8.26.1.	26 dB BANDWIDTH.....	337
8.26.2.	99% BANDWIDTH	340
8.26.3.	AVERAGE POWER	343
8.26.4.	OUTPUT POWER AND PPSD.....	344
8.26.5.	11ac HT80 LAT 3 SISO STRADDLE CHANNEL 138.....	347
8.26.6.	6 dB BANDWIDTH.....	351
8.27.	<i>11ac HT80 2TX CDD MIMO MODE IN THE 5.6GHz BAND.....</i>	<i>352</i>
8.27.1.	26 dB BANDWIDTH.....	352
8.27.2.	99% BANDWIDTH	356
8.27.3.	AVERAGE POWER	360
8.27.4.	OUTPUT POWER AND PPSD.....	361
8.27.5.	11ac HT80 2TX CDD MIMO STRADDLE CHANNEL 138	365
8.27.6.	6 dB BANDWIDTH.....	371
8.28.	<i>11n HT20 UAT 2 SISO MODE IN THE 5.8GHz BAND.....</i>	<i>373</i>
8.28.1.	6 dB BANDWIDTH.....	373
8.28.2.	26 dB BANDWIDTH.....	376
8.28.3.	99% BANDWIDTH	379
8.28.4.	AVERAGE POWER	382
8.28.5.	OUTPUT POWER.....	383
8.28.6.	POWER SPECTRAL DENSITY	385
8.29.	<i>11n HT20 LAT 3 SISO MODE IN THE 5.8GHz BAND</i>	<i>389</i>
8.29.1.	6 dB BANDWIDTH.....	389
8.29.2.	26 dB BANDWIDTH.....	392

8.29.3.	99% BANDWIDTH	395
8.29.4.	AVERAGE POWER	398
8.29.5.	OUTPUT POWER.....	399
8.29.6.	POWER SPECTRAL DENSITY	401
8.30.	<i>11n HT20 2TX CDD MIMO MODE IN THE 5.8GHz BAND.....</i>	<i>405</i>
8.30.1.	6 dB BANDWIDTH.....	405
8.30.2.	26 dB BANDWIDTH.....	409
8.30.3.	99% BANDWIDTH	413
8.30.4.	AVERAGE POWER	417
8.30.5.	OUTPUT POWER.....	418
8.30.6.	POWER SPECTRAL DENSITY	420
8.31.	<i>11n HT40 UAT 2 SISO MODE IN THE 5.8GHz BAND.....</i>	<i>425</i>
8.31.1.	6 dB BANDWIDTH.....	425
8.31.2.	26 dB BANDWIDTH.....	427
8.31.3.	99% BANDWIDTH	429
8.31.4.	AVERAGE POWER	431
8.31.5.	OUTPUT POWER.....	432
8.31.6.	POWER SPECTRAL DENSITY	434
8.32.	<i>11n HT40 LAT 3 SISO MODE IN THE 5.8GHz BAND</i>	<i>437</i>
8.32.1.	6 dB BANDWIDTH.....	437
8.32.2.	26 dB BANDWIDTH.....	439
8.32.3.	99% BANDWIDTH	441
8.32.4.	AVERAGE POWER	443
8.32.5.	OUTPUT POWER.....	444
8.32.6.	POWER SPECTRAL DENSITY	446
8.33.	<i>11n HT40 2TX CDD MIMO MODE IN THE 5.8GHz BAND.....</i>	<i>449</i>
8.33.1.	6 dB BANDWIDTH.....	449
8.33.2.	26 dB BANDWIDTH.....	452
8.33.3.	99% BANDWIDTH	455
8.33.4.	AVERAGE POWER	458
8.33.5.	OUTPUT POWER.....	459
8.33.6.	POWER SPECTRAL DENSITY	461
8.34.	<i>11ac HT80 UAT 2 SISO MODE IN THE 5.8GHz BAND</i>	<i>465</i>
8.34.1.	6 dB BANDWIDTH.....	465
8.34.2.	26 dB BANDWIDTH.....	467
8.34.3.	99% BANDWIDTH	469
8.34.4.	AVERAGE POWER	471
8.34.5.	OUTPUT POWER.....	472
8.34.6.	POWER SPECTRAL DENSITY	474
8.35.	<i>11ac HT80 LAT 3 SISO MODE IN THE 5.8GHz BAND.....</i>	<i>477</i>
8.35.1.	6 dB BANDWIDTH.....	477
8.35.2.	26 dB BANDWIDTH.....	479
8.35.3.	99% BANDWIDTH	481
8.35.4.	AVERAGE POWER	483
8.35.5.	OUTPUT POWER.....	484
8.35.6.	POWER SPECTRAL DENSITY	486
8.36.	<i>11ac HT80 2TX CDD MIMO MODE IN THE 5.8GHz BAND.....</i>	<i>489</i>
8.36.1.	6 dB BANDWIDTH.....	489
8.36.2.	26 dB BANDWIDTH.....	491
8.36.3.	99% BANDWIDTH	493

8.36.4.	AVERAGE POWER	495
8.36.5.	OUTPUT POWER.....	496
8.36.6.	POWER SPECTRAL DENSITY	498
9.	RADIATED TEST RESULTS	501
9.1.	LIMITS AND PROCEDURE.....	501
9.1.1.	11n HT20 UAT 2 SISO MODE IN THE 5.2GHz BAND	502
9.1.2.	11n HT20 LAT 3 SISO MODE IN THE 5.2GHz BAND.....	504
9.1.3.	11n HT20 2TX CDD MIMO MODE IN THE 5.2GHz BAND	506
9.1.4.	11n HT40 UAT 2 SISO MODE IN THE 5.2GHz BAND	514
9.1.5.	11n HT40 LAT 3 SISO MODE IN THE 5.2GHz BAND.....	516
9.1.6.	11n HT40 2TX CDD MIMO MODE IN THE 5.2GHz BAND	518
9.1.7.	11ac HT80 UAT 2 SISO MODE IN THE 5.2GHz BAND	524
9.1.8.	11ac HT80 LAT 3 SISO MODE IN THE 5.2GHz BAND	526
9.1.9.	11ac HT80 2TX CDD MIMO MODE IN THE 5.2GHz BAND	528
9.1.10.	11n HT20 UAT 2 SISO MODE IN THE 5.3GHz BAND.....	532
9.1.11.	11n HT20 LAT 3 SISO MODE IN THE 5.3GHz BAND	534
9.1.12.	11n HT20 2TX CDD MIMO MODE IN THE 5.3GHz BAND	536
9.1.13.	11n HT40 UAT 2 SISO MODE IN THE 5.3GHz BAND.....	544
9.1.14.	11n HT40 LAT 3 SISO MODE IN THE 5.3GHz BAND	546
9.1.15.	11n HT40 2TX CDD MIMO MODE IN THE 5.3GHz BAND	548
9.1.16.	11ac HT80 UAT 2 SISO MODE IN THE 5.3GHz BAND	554
9.1.17.	11ac HT80 LAT 3 SISO MODE IN THE 5.3GHz BAND.....	556
9.1.18.	11ac HT80 2TX CDD MIMO MODE IN THE 5.3GHz BAND.....	558
9.1.19.	11n HT20 UAT 2 SISO MODE IN THE 5.6GHz BAND.....	562
9.1.20.	11n HT20 LAT 3 SISO MODE IN THE 5.6GHz BAND	566
9.1.21.	11n HT20 2TX CDD MIMO MODE IN THE 5.6GHz BAND	570
9.1.22.	11n HT20 2TX CDD MIMO STRADDLE CHANNEL 144.....	574
9.1.23.	11n HT40 UAT 2 SISO MODE IN THE 5.6GHz BAND.....	576
9.1.24.	11n HT40 LAT 3 SISO MODE IN THE 5.6GHz BAND	580
9.1.25.	11n HT40 2TX CDD MIMO MODE IN THE 5.6GHz BAND	584
9.1.26.	11n HT40 2TX CDD MIMO STRADDLE CHANNEL 142.....	594
9.1.27.	11ac HT80 UAT 2 SISO MODE IN THE 5.6GHz BAND	596
9.1.28.	11ac HT80 LAT 3 SISO MODE IN THE 5.6GHz BAND.....	598
9.1.29.	11ac HT80 2TX CDD MIMO MODE IN THE 5.6GHz BAND.....	600
9.1.30.	11ac HT80 2TX CDD MIMO STRADDLE CHANNEL 138.....	606
9.1.31.	11n HT20 UAT 2 SISO MODE IN THE 5.8GHz BAND.....	608
9.1.32.	11n HT20 LAT 3 SISO MODE IN THE 5.8GHz BAND	612
9.1.33.	11n HT20 2TX CDD MIMO MODE IN THE 5.8GHz BAND	616
9.1.34.	11n HT40 UAT 2 SISO MODE IN THE 5.8GHz BAND.....	626
9.1.35.	11n HT40 LAT 3 SISO MODE IN THE 5.8GHz BAND	630
9.1.36.	11n HT40 2TX CDD MIMO MODE IN THE 5.8GHz BAND	634
9.1.37.	11ac HT80 UAT 2 SISO MODE IN THE 5.8GHz BAND	642
9.1.38.	11ac HT80 LAT 3 SISO MODE IN THE 5.8GHz BAND.....	646
9.1.39.	11ac HT80 2TX CDD MIMO MODE IN THE 5.8GHz BAND.....	650
9.2.	WORST-CASE BELOW 1 GHz	656
9.3.	WORST-CASE 18 to 26 GHz	658
9.4.	WORST-CASE 26 to 40 GHz	660
10.	AC POWER LINE CONDUCTED EMISSIONS	662
10.1.	EUT POWERED BY AC/DC ADAPTER VIA USB CABLE	663

10.2.	EUT POWERED BY HOST PC VIA USB CABLE	665
11.	DYNAMIC FREQUENCY SELECTION.....	667
11.1.	OVERVIEW	667
11.1.1.	LIMITS.....	667
11.1.2.	TEST AND MEASUREMENT SYSTEM.....	671
11.1.3.	TEST ROOM ENVIRONMENT	673
11.1.4.	TEST AND MEASUREMENT SOFTWARE.....	673
11.1.5.	SETUP OF EUT (CLIENT MODE)	674
11.1.6.	SETUP OF EUT (CLIENT-TO-CLIENT COMMUNICATIONS MODE).....	675
11.1.7.	SETUP OF EUT (PEER TO PEER MODE).....	676
11.1.8.	DESCRIPTION OF EUT	678
11.2.	CLIENT MODE RESULTS FOR 20 MHz BANDWIDTH	680
11.2.1.	TEST CHANNEL.....	680
11.2.2.	RADAR WAVEFORM AND TRAFFIC	680
11.2.3.	OVERLAPPING CHANNEL TESTS.....	683
11.2.4.	MOVE AND CLOSING TIME	683
11.3.	CLIENT MODE RESULTS FOR 40 MHz BANDWIDTH	687
11.3.1.	TEST CHANNEL.....	687
11.3.2.	RADAR WAVEFORM AND TRAFFIC	687
11.3.3.	OVERLAPPING CHANNEL TESTS.....	690
11.3.4.	MOVE AND CLOSING TIME	690
11.4.	CLIENT MODE RESULTS FOR 80 MHz BANDWIDTH	694
11.4.1.	TEST CHANNEL.....	694
11.4.2.	RADAR WAVEFORM AND TRAFFIC	694
11.4.3.	OVERLAPPING CHANNEL TESTS.....	697
11.4.4.	MOVE AND CLOSING TIME	697
11.4.5.	30-MINUTE NON-OCCUPANCY PERIOD.....	701
11.5.	CLIENT-TO-CLIENT COMMUNICATIONS MODE RESULTS FOR 20 MHz BANDWIDTH 702	
11.5.1.	TEST CHANNEL.....	702
11.5.2.	RADAR WAVEFORM AND TRAFFIC	702
11.5.3.	OVERLAPPING CHANNEL TESTS.....	705
11.5.4.	MOVE AND CLOSING TIME	705
11.6.	CLIENT-TO-CLIENT COMMUNICATIONS MODE RESULTS FOR 40 MHz BANDWIDTH 709	
11.6.1.	TEST CHANNEL.....	709
11.6.2.	RADAR WAVEFORM AND TRAFFIC	709
11.6.3.	OVERLAPPING CHANNEL TESTS.....	712
11.6.4.	MOVE AND CLOSING TIME	712
11.7.	CLIENT-TO-CLIENT COMMUNICATIONS MODE RESULTS FOR 80 MHz BANDWIDTH 716	
11.7.1.	TEST CHANNEL.....	716
11.7.2.	RADAR WAVEFORM AND TRAFFIC	716
11.7.3.	OVERLAPPING CHANNEL TESTS.....	719
11.7.4.	MOVE AND CLOSING TIME	719
11.7.1.	30-MINUTE NON-OCCUPANCY PERIOD.....	723
11.8.	PEER TO PEER MODE EUT RESULTS FOR 20 MHz BANDWIDTH.....	724
11.8.1.	TEST CHANNEL.....	724

11.8.2.	RADAR WAVEFORM AND TRAFFIC	724
11.8.3.	OVERLAPPING CHANNEL TESTS	727
11.8.4.	MOVE AND CLOSING TIME	727
11.9.	PEER TO PEER MODE EUT RESULTS FOR 40 MHz BANDWIDTH.....	731
11.9.1.	TEST CHANNEL.....	731
11.9.2.	RADAR WAVEFORM AND TRAFFIC	731
11.9.3.	OVERLAPPING CHANNEL TESTS	734
11.9.4.	MOVE AND CLOSING TIME	734
11.10.	PEER TO PEER MODE EUT RESULTS FOR 80 MHz BANDWIDTH.....	738
11.10.1.	TEST CHANNEL.....	738
11.10.2.	RADAR WAVEFORM AND TRAFFIC	738
11.10.3.	OVERLAPPING CHANNEL TESTS	741
11.10.4.	MOVE AND CLOSING TIME	741
11.10.5.	30-MINUTE NON-OCCUPANCY PERIOD.....	745
11.11.	PEER TO PEER MODE PEER SLAVE DEVICE RESULTS FOR 20 MHz BANDWIDTH	746
11.11.1.	TEST CHANNEL.....	746
11.11.2.	RADAR WAVEFORM AND TRAFFIC	746
11.11.3.	OVERLAPPING CHANNEL TESTS	749
11.11.4.	MOVE AND CLOSING TIME	749
11.12.	PEER TO PEER MODE PEER SLAVE DEVICE RESULTS FOR 40 MHz BANDWIDTH	753
11.12.1.	TEST CHANNEL.....	753
11.12.2.	RADAR WAVEFORM AND TRAFFIC	753
11.12.3.	OVERLAPPING CHANNEL TESTS	756
11.12.4.	MOVE AND CLOSING TIME	756
11.13.	PEER TO PEER MODE PEER SLAVE DEVICE RESULTS FOR 80 MHz BANDWIDTH	760
11.13.1.	TEST CHANNEL.....	760
11.13.2.	RADAR WAVEFORM AND TRAFFIC	760
11.13.3.	OVERLAPPING CHANNEL TESTS	763
11.13.4.	MOVE AND CLOSING TIME	763
11.13.5.	30-MINUTE NON-OCCUPANCY PERIOD.....	767
12.	SETUP PHOTOS.....	768

1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: SMARTPHONE

MODEL: A1863, A1907

SERIAL NUMBER: C7CTP00MJ5TF, C7CT8037HXVM (DFS)

DATE TESTED: APRIL 10, 2017 – JULY 13, 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.



Tri Pham
TEST 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/D04 v01/D06 v02/ D07v02, FCC KDB 789033 D02 v01r04, 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:22541-1)
☐ Chamber B (IC:2324B-2)	☒ Chamber E (IC:22541-2)
☐ Chamber C (IC:2324B-3)	☒ Chamber F (IC:22541-3)
	☐ Chamber G (IC:22541-4)
	☒ Chamber H (IC:22541-5)

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:

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

4.3. MEASUREMENT UNCERTAINTY

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

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

Parameter	Uncertainty
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.32 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.45 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.24 dB
Occupied Channel Bandwidth	±0.39 %
Time	±0.02 %

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The equipment under test is a mobile phone with GSM, GPRS, EGPRS, UMTS, LTE, TD-SCDMA and CDMA technologies. It also supports IEEE 802.11a/b/g/n/ac, Bluetooth, GPS and NFC. The device has a built-in inductive charging receiver which is not user accessible. The rechargeable battery is not user accessible.

5.2. DIFFERENCE IN MODEL NUMBER

Model A1863 and A1907 are identical. Two model numbers are allocated for marketing and logistic purpose only.

5.3. 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	19.34	85.90
	802.11n HT20 STBC/SDM 1TX, 802.11ac VHT20 STBC/SDM 1TX	Covered by 802.11n HT20 SISO	
	802.11n HT20 CDD 2TX	20.89	122.74
	802.11n HT20 STBC/SDM 2TX, 802.11ac VHT20 STBC/SDM 2TX	Covered by 802.11n HT20 2TX CDD	
5190 - 5230	802.11n HT40 SISO	19.34	85.90
	802.11n HT40 STBC/SDM 1TX, 802.11ac VHT40 STBC/SDM 1TX	Covered by 802.11n HT20 SISO	
	802.11n HT40 CDD 2TX	22.45	175.79
	802.11n HT40 STBC/SDM 2TX, 802.11ac VHT40 STBC/SDM 2TX	Covered by 802.11n HT40 2TX CDD	
5210	802.11ac VHT80 SISO	15.43	34.91
	802.11ac VHT80 STBC/SDM 1TX	Covered by 802.11ac VHT80 SISO	
	802.11ac VHT80 CDD 2TX	17.82	60.53
	802.11ac VHT80 STBC/SDM 2TX	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	20.88	122.46
	802.11n HT20 STBC/SDM 1TX, 802.11ac VHT20 STBC/SDM 1TX	Covered by 802.11n HT20 SISO	
	802.11n HT20 CDD 2TX	20.90	123.03
	802.11n HT20 STBC/SDM 2TX, 802.11ac VHT20 STBC/SDM 2TX	Covered by 802.11n HT20 2TX CDD	
5270 - 5310	802.11n HT40 SISO	19.43	87.70
	802.11n HT40 STBC/SDM 1TX, 802.11ac VHT40 STBC/SDM 1TX	Covered by 802.11n HT40 SISO	
	802.11n HT40 CDD 2TX	22.43	174.98
	802.11n HT40 STBC/SDM 2TX, 802.11ac VHT40 STBC/SDM 2TX	Covered by 802.11n HT40 2TX CDD	
5290	802.11ac VHT80 SISO	14.92	31.05
	802.11ac VHT80 STBC/SDM 1TX	Covered by 802.11ac VHT80 SISO	
	802.11ac VHT80 CDD 2TX	17.42	55.21
	802.11ac VHT80 STBC/SDM 2TX	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	20.89	122.74
	802.11n HT20 STBC/SDM 1TX	Covered by 802.11n HT20 SISO	
5720	802.11ac VHT20 SISO (based on UNII-2C band output power)	19.51	89.33
	802.11ac VHT20 STBC/SDM 1TX	Covered by 802.11ac VHT20 SISO	
5500 - 5700	802.11n HT20 CDD 2TX	20.88	122.46
	802.11n HT20 STBC/SDM 2TX, 802.11ac VHT20 STBC/SDM 2TX	Covered by 802.11n HT20 CDD 2TX	
5720	802.11ac VHT20 CDD 2TX (based on UNII-2C band output power)	19.34	85.90
	802.11ac VHT20 STBC SISO/2TX (based on UNII-2C band output power)	Covered by 802.11n HT20 2TX CDD	
5500 - 5700		Covered by 802.11n HT20 2TX CDD	
5720	802.11n HT20 STBC 2TX	Covered by 802.11n HT20 2TX CDD	
5720	802.11ac VHT20 STBC 2TX (based on UNII-2C band output power)	Covered by 802.11n HT20 2TX CDD	
5510 - 5670	802.11n HT40 SISO	19.46	88.31
	802.11n HT40 STBC/SDM 1TX	Covered by 802.11n HT40 SISO	
5710	802.11ac VHT40 SISO (based on UNII-2C band output power)	19.95	98.86
	802.11ac VHT40 STBC/SDM 1TX	Covered by 802.11ac VHT40 SISO	
5510 - 5670	802.11n HT40 CDD 2TX	22.37	172.58
	802.11n HT40 STBC/SDM 2TX, 802.11ac VHT40 STBC/SDM 2TX	Covered by 802.11n HT40 CDD 2TX	
5710	802.11ac VHT40 CDD 2TX (based on UNII-2C band output power)	22.66	184.50
	802.11ac VHT40 STBC 2TX (based on UNII-2C band output power)	Covered by 802.11n HT40 2TX CDD	
5530-5610	802.11ac VHT80 SISO	18.89	77.45
	802.11ac VHT80 STBC/SDM 1TX	Covered by 802.11ac VHT80 SISO	
5690	802.11ac VHT80 SISO (based on UNII-2C band output power)	20.27	106.41
	802.11ac VHT80 STBC/SDM 1TX	Covered by 802.11ac VHT80 SISO	
5530-5610	802.11ac VHT80 CDD 2TX	21.91	155.24
	802.11ac VHT80 STBC/SDM 2TX	Covered by 802.11ac VHT80 CDD 2TX	
5690	802.11ac VHT80 CDD 2TX (based on UNII-2C band output power)	23.31	214.29
	802.11ac VHT80 STBC/SDM 2TX	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	
	802.11n HT20 SISO	20.94	124.17
	802.11n HT20 STBC/SDM 1TX, 802.11ac VHT20 STBC/SDM 1TX	Covered by 802.11n HT20 SISO	
	802.11n HT20 CDD 2TX	23.90	245.47
	802.11n HT20 STBC/SDM 2TX, 802.11ac VHT20 STBC/SDM 2TX	Covered by 802.11n HT20 CDD 2TX	
5755 - 5795	802.11n HT40 SISO	19.47	88.51
	802.11n HT40 STBC/SDM 1TX, 802.11ac VHT40 STBC/SDM 1TX	Covered by 802.11n HT40 SISO	
	802.11n HT40 CDD 2TX	22.44	175.39
	802.11n HT40 STBC/SDM 2TX, 802.11ac VHT40 STBC/SDM 2TX	Covered by 802.11n HT40 CDD 2TX	
5775	802.11ac VHT80 SISO	18.95	78.52
	802.11ac VHT80 STBC/SDM 1TX	Covered by 802.11n HT80 SISO	
	802.11ac VHT80 CDD 2TX	21.94	156.31
	802.11ac VHT80 STBC/SDM 2TX	Covered by 802.11ac VHT80 CDD 2TX	

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Band (GHz)	Antenna Gain (dBi)	
	UAT 2	LAT 3
5.2	-3.36	-1.30
5.3	-2.84	-0.46
5.5	-2.25	-0.41
5.8	-1.61	-0.15

5.5. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was version 13.10.452.12

5.6. WORST-CASE CONFIGURATION AND MODE

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

Radiated band edge, harmonic, and spurious emissions from 1GHz to 18GHz were performed with the EUT was set to transmit at highest power on Low/Middle/High channels.

Radiated emissions below 30MHz, below 1GHz, above 18GHz and power line conducted emissions were performed with the EUT was set to transmits at the channel with the highest output power as worst-case scenario.

For SISO modes, there are two transmission antennas. The antenna used in any given time can be either UAT 2 or LAT 3. Both antenna ports have the same power; output power and PSD measurement for SISO modes on both antennas are reported. For MIMO modes, both UAT 2 and LAT 3 used at the same time.

The fundamental of the EUT was investigated in three orthogonal orientations X (Flatbed), Y (Landscape), Z (Portrait), on both UAT 2 and LAT 3 antennas. In addition, the EUT was also investigated with and without AC/DC charger, headphones & laptop, It was determined that (see table below) was worst-case orientation for both antennas without AC/DC charger, headphones, or laptop; therefore, all final radiated testing was performed with EUT only in (see table below) orientation for 1 - 18GHz and 18 – 40GHz. And for 30-1000MHz EUT was tested with AC/DC charger.

All radiated harmonic 1-18GHz emissions on SISO mode, straddle channels are covered by 2TX MIMO mode with power setting equal or higher than SISO among the CDD/STBC/SDM modes.

Frequency Band (GHz)	Mode	Antenna Port	Worst-case Orientation
5.2-5.8	1TX SISO	UAT 2	Z-Portrait
		LAT 3	Y-Landscape
	2TX MIMO	UAT 2 + LAT 3	Y-Landscape

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 WiFi/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 LAT 3 in the 2.4GHz BT/BLE and 5GHz bands, tests were conducted for various configurations having the highest power. No noticeable new emission was found.

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop AC/DC adapter	HP	PA-1900-08H2	849877681	NA
Laptop	HP	Probook 450 G2	CND537BBZH	NA
Dongle	N/A	N/A	NA	NA

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
NA						

I/O CABLES (RADIATED BELOW 1 GHZ)

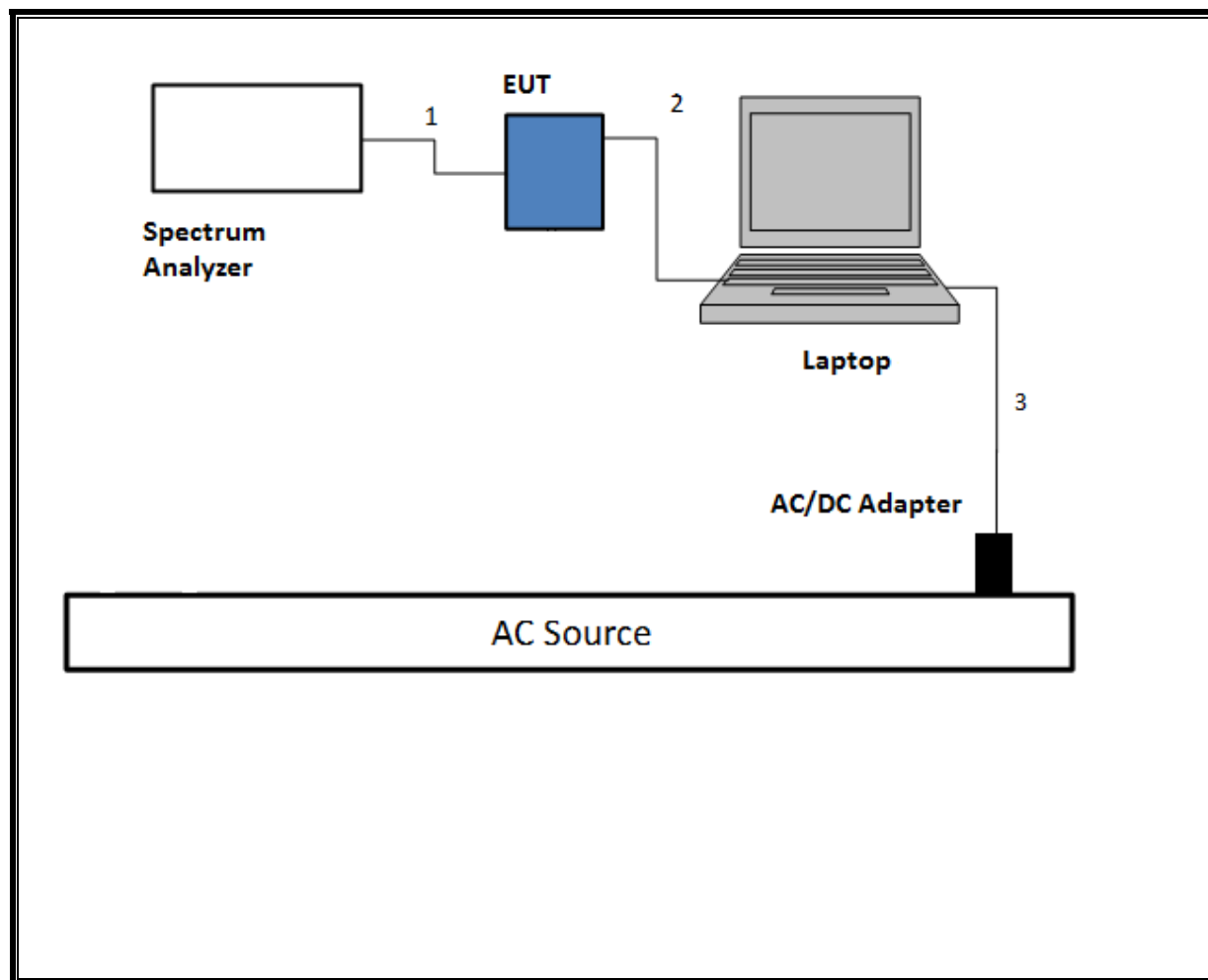
I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Un-shielded	3	N/A

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

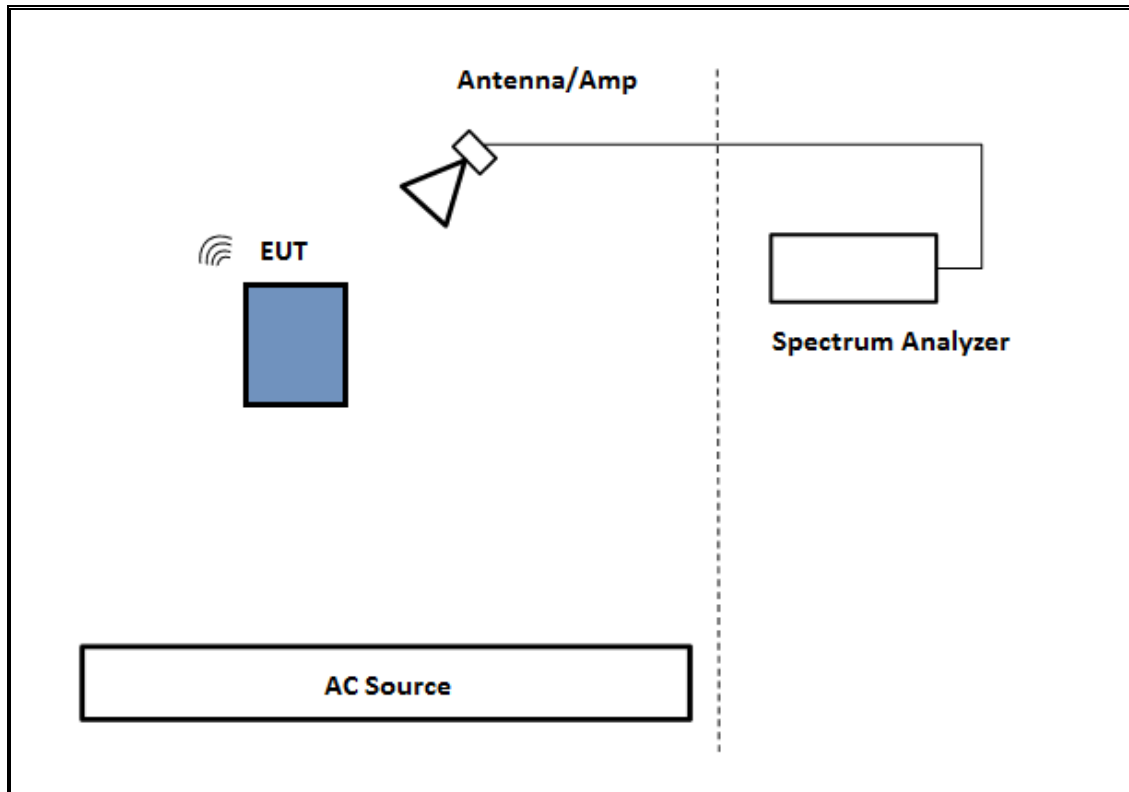
I/O Cable List						
Cable No	Port	# of identical	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Un-shielded	3	N/A
2	USB	1	USB	Shielded	1	N/A

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

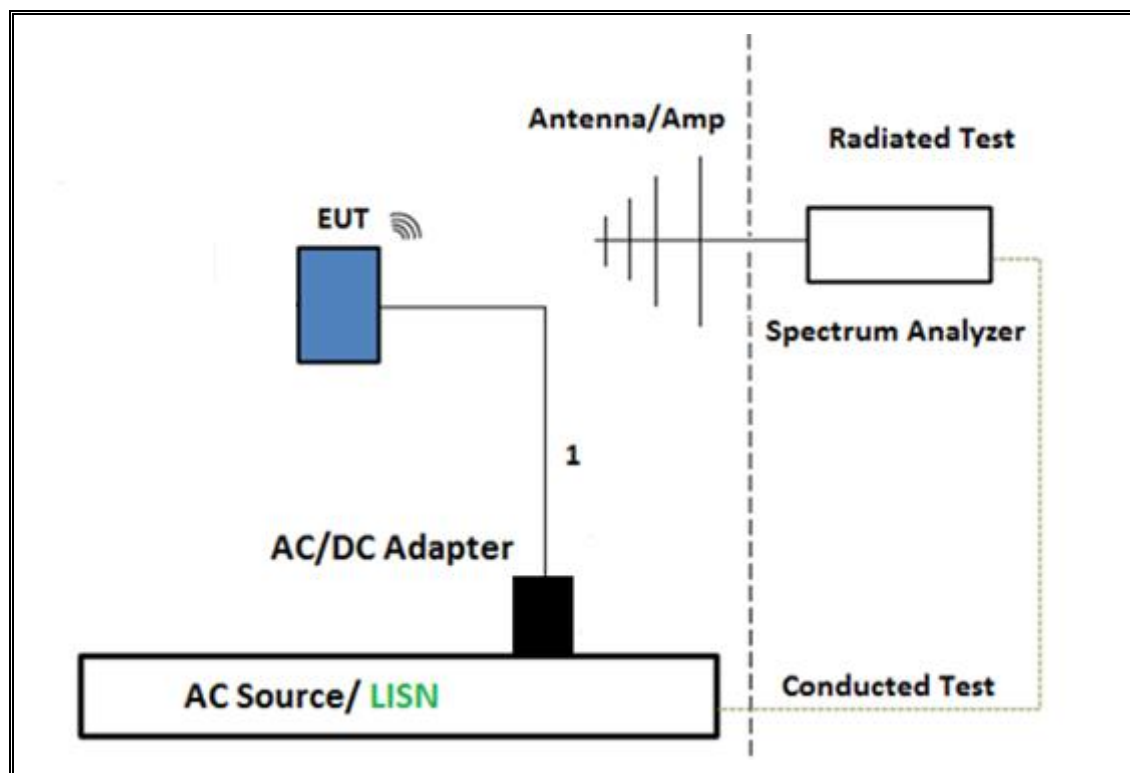
SETUP DIAGRAM



TEST SETUP- BELOW 1GHz

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

SETUP DIAGRAM



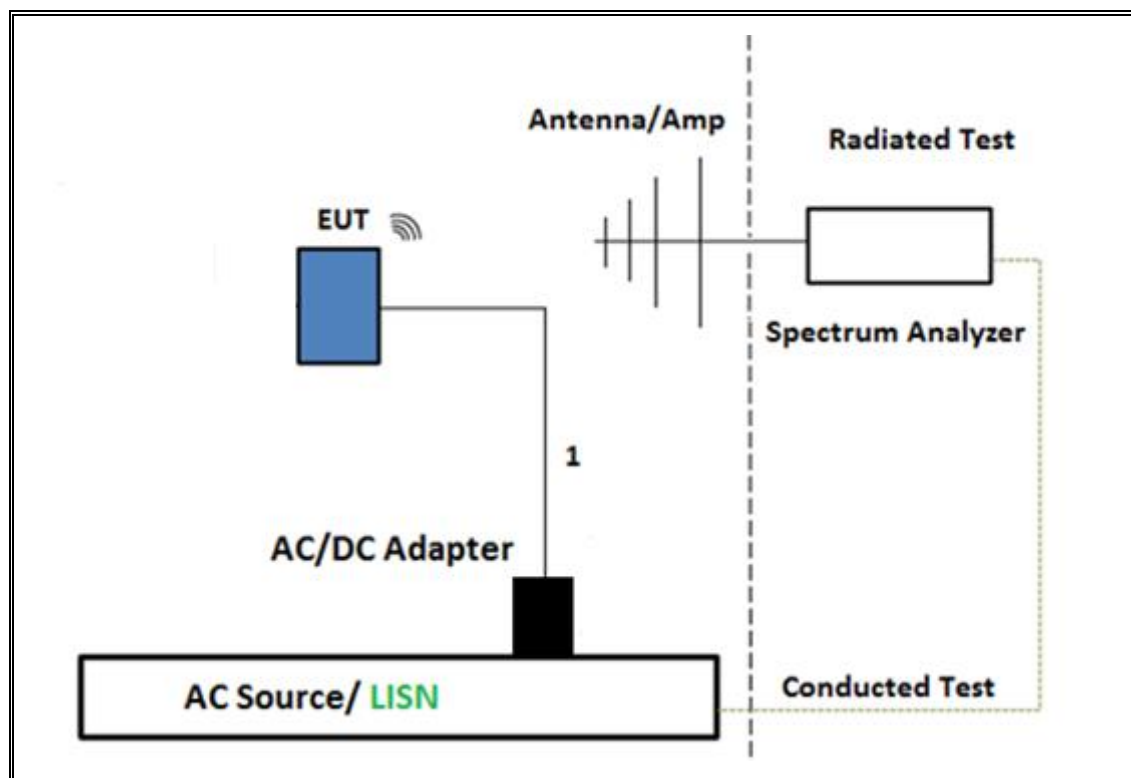
TEST SETUP- RADIATED-ABOVE 1 GHZ

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

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.

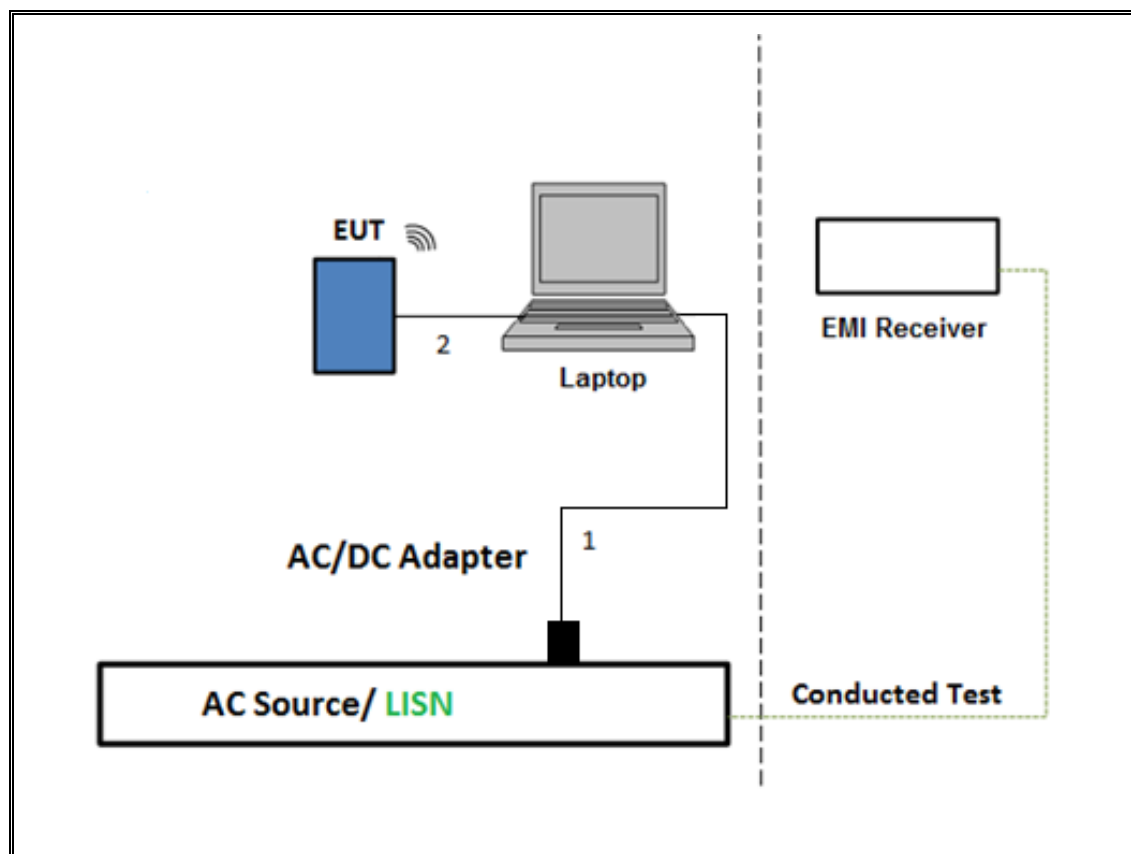
SETUP DIAGRAM



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

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Asset	Cal Due
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T862	4/20/2018
Amplifier, 1 to 18GHz	Miteq	AFS42-00101800-25-S-42	T740	11/29/2017
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	T340	12/14/2017
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T863	6/9/2018
Amplifier, 1 to 18GHz	Miteq	AFS42-00101800-25-S-42	T741	11/29/2017
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	T1113	12/20/2017
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T119	3/28/2018
Amplifier, 1 to 18GHz	Miteq	AFS42-00101800-25-S-42	T742	11/29/2017
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T344	4/20/2018
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB1	T185	3/30/2018
Amplifier, 1 to 18GHz, 35dB	Ampical	AMP1G18-35	T1569	9/15/2017
*Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	T835	6/18/2017
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	T1613	12/2/2017
*Antenna Horn, 18 to 26GHz	ARA	MWH-1826	T447	6/16/2017
Spectrum Analyzer, 40GHz	Agilent	8564E	T106	9/7/2017
*Antenna, Horn 26GHz to 40GHz	ARA	MWH-2640/B	T446	5/25/2017
Amplifier, 26GHz to 40GHz	Miteq	NSP 4000 SP2	T88	4/29/2017
Horn Antenna, 40GHz	ARA	MWH-2640/B	1029	8/19/2017
Pre-Amp 18-26GHz	Agilent Technology	8449B	T404	7/5/2017
Power Meter, P-series single channel	Keysight	N1912A	T1245	1/05/2018
Power Sensor	Keysight	N1921A	T1224	1/31/2018
AC Line Conducted				
EMI Test Receiver 9KHz-7GHz	Rohde & Schwarz	ESCI7	T1436	01/06/2018
*LISN for Conducted Emissions CISPR-16	Fischer	50/250-25-2-01	T1310	06/08/2017
Power Cable, Line Conducted Emissions	UL	PG1	T861	9/1/2017
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	

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

NOTE: *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.

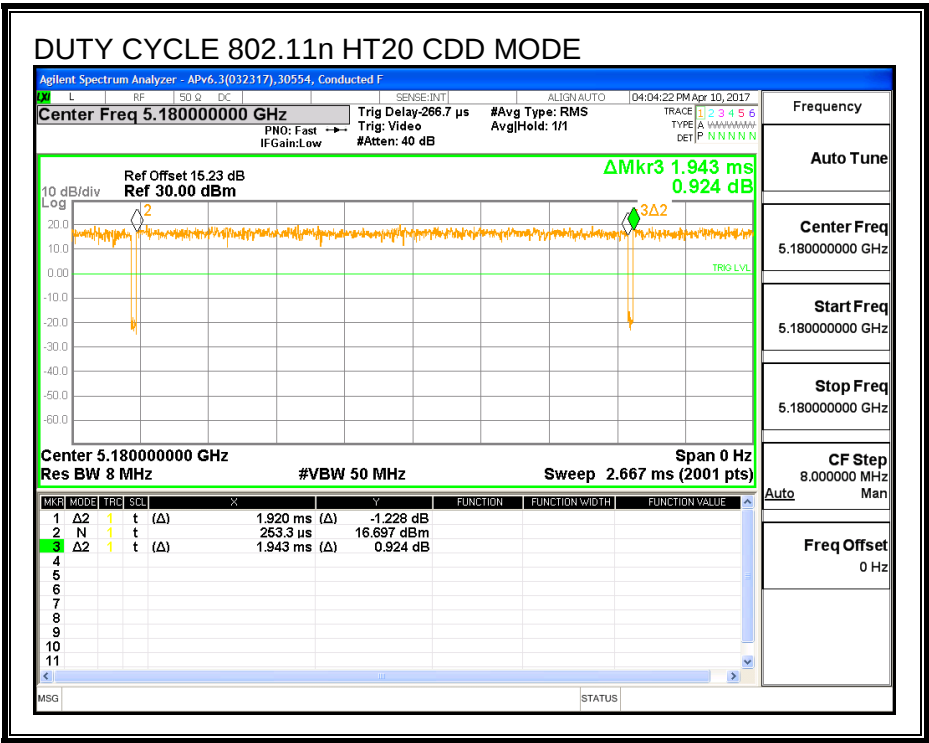
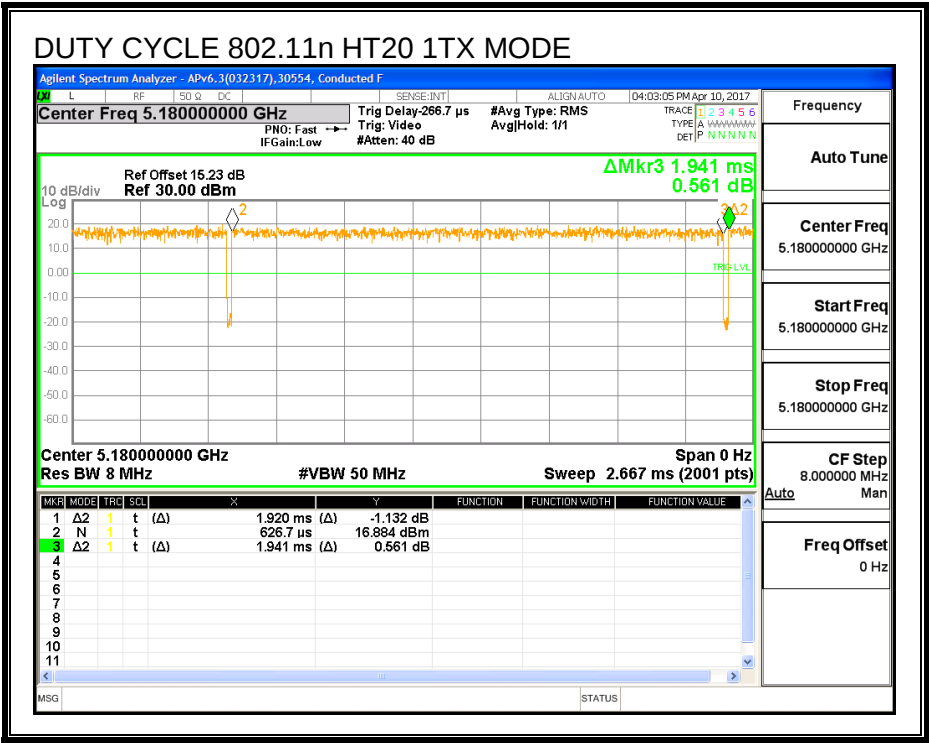
PROCEDURE

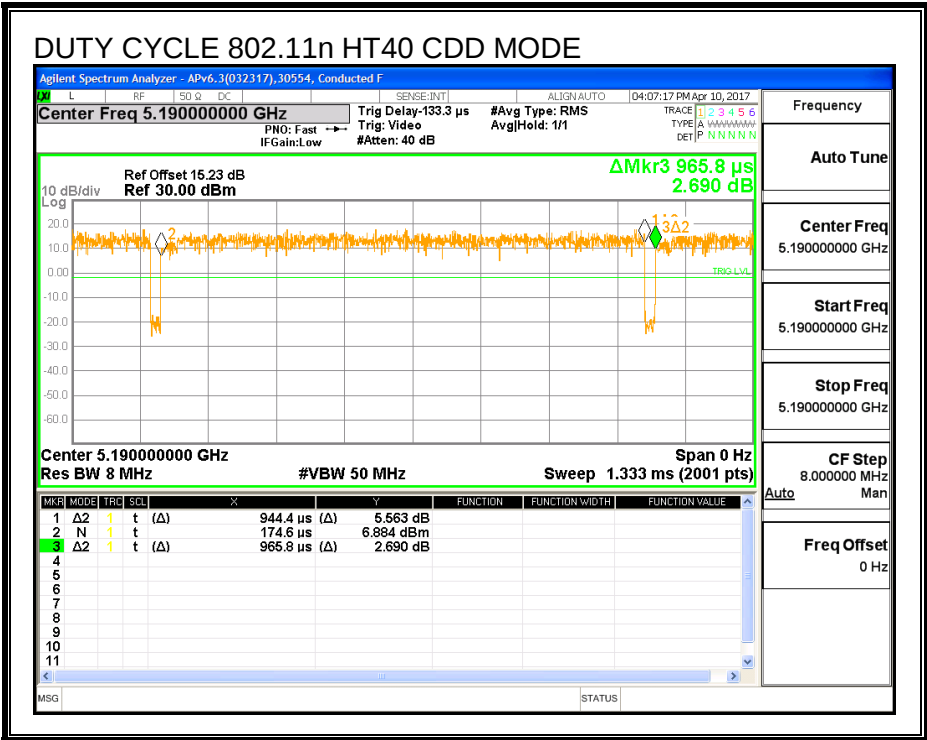
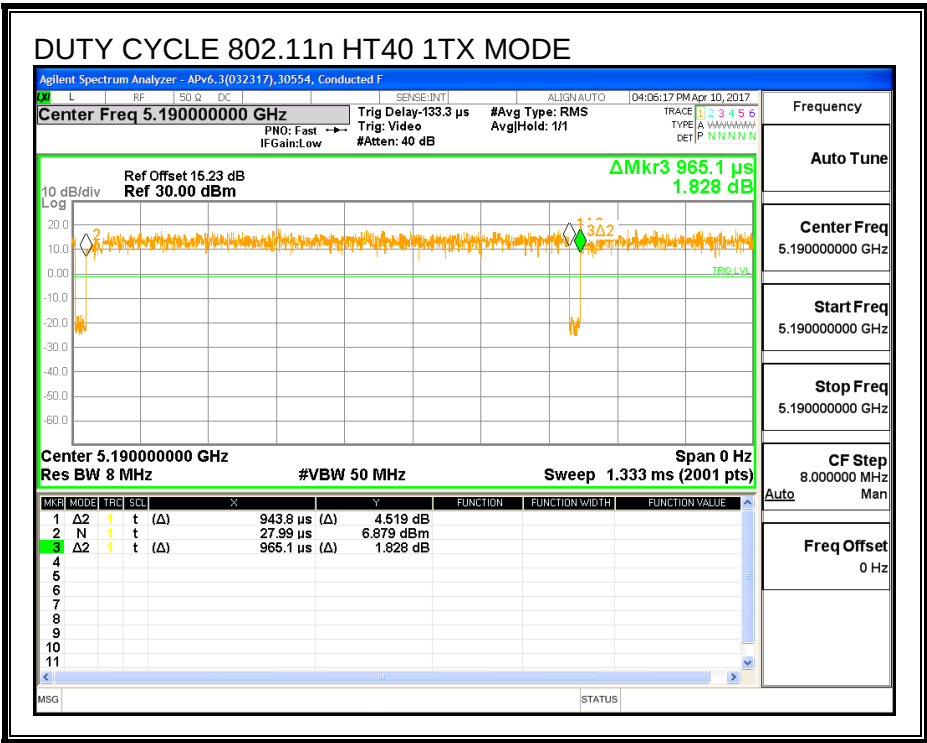
KDB 789033 Zero-Span Spectrum Analyzer Method.

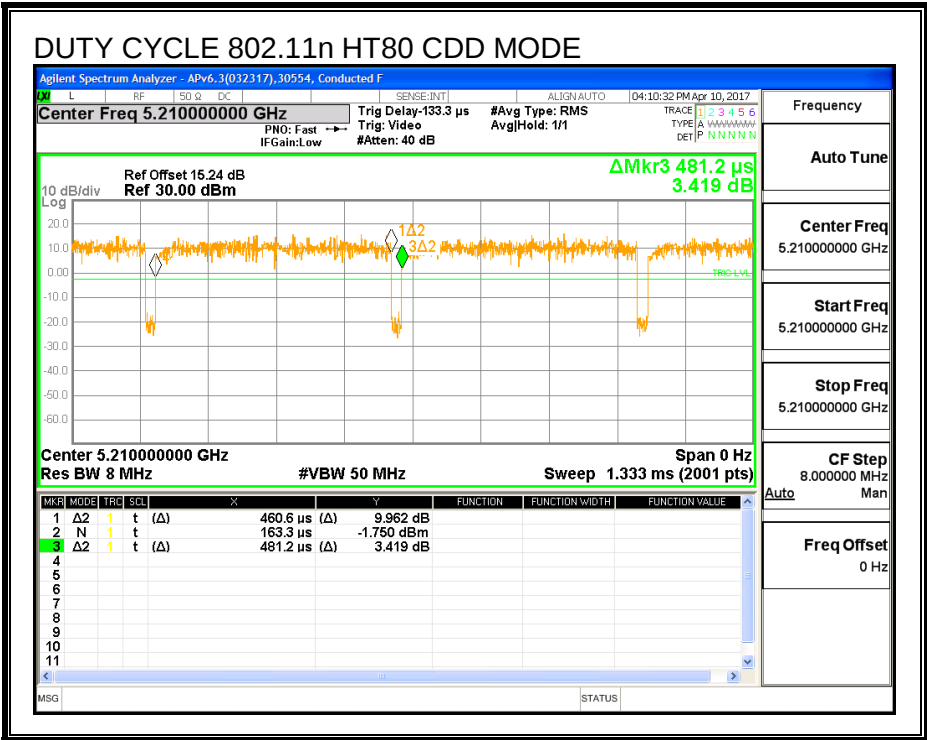
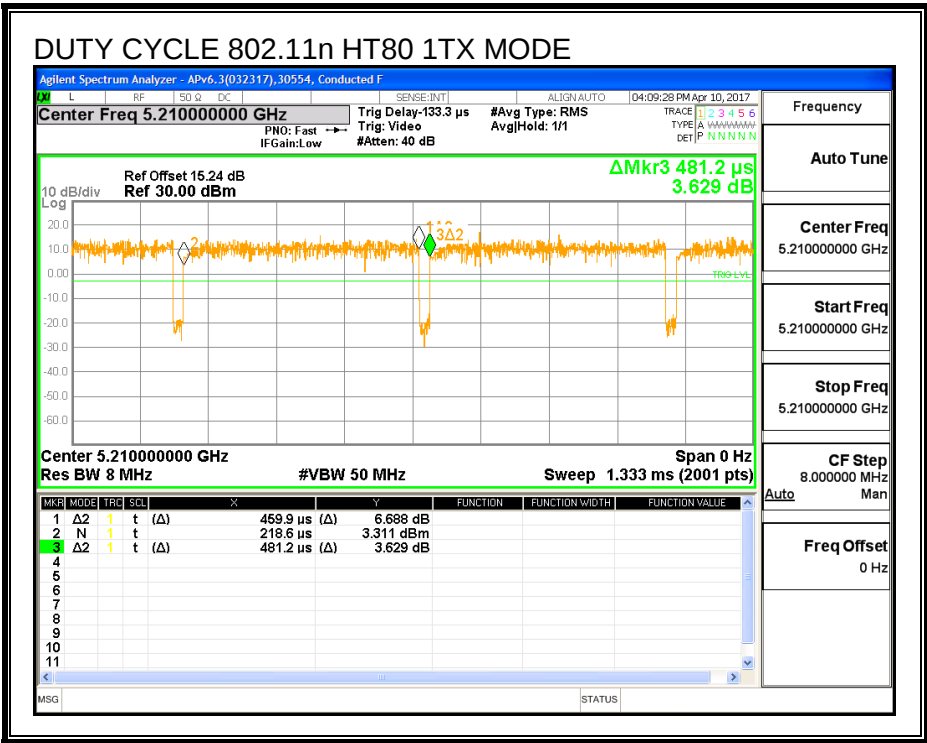
RESULTS

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 2TX	1.920	1.943	0.988	98.82%	0.00	0.010
802.11n HT40 1TX	0.944	0.965	0.978	97.79%	0.10	1.060
802.11n HT40 CDD 2TX	0.944	0.966	0.978	97.78%	0.10	1.059
802.11ac VHT80 1TX	0.460	0.481	0.956	95.57%	0.20	2.174
802.11ac VHT80 CDD 2TX	0.460	0.481	0.956	95.59%	0.20	2.174

DUTY CYCLE PLOTS







8. MEASUREMENT METHODS

6 dB Emission BW: KDB 789033 D02 v01r04, Section C.

26 dB Emission BW: KDB 789033 D02 v01r04, Section C.

99% Occupied BW: KDB 789033 D02 v01r04, Section D.

Conducted Output Power: KDB 789033 D02 v01r04, Section E.3.b (Method PM-G).

Power Spectral Density: KDB 789033 D02 v01r04, Section F (Method SA-2).

Unwanted emissions in restricted bands: KDB 789033 D02 v01r04, Sections G.3, G.4, G.5, and G.6.

Unwanted emissions in non-restricted bands: KDB 789033 D02 v01r04, Sections G.3, G.4, and G.5.

Conducted line emissions: C63.10, Clause 6.2

ANTENNA PORT TEST RESULTS

8.1. 11n HT20 UAT 2 SISO MODE IN THE 5.2GHz BAND

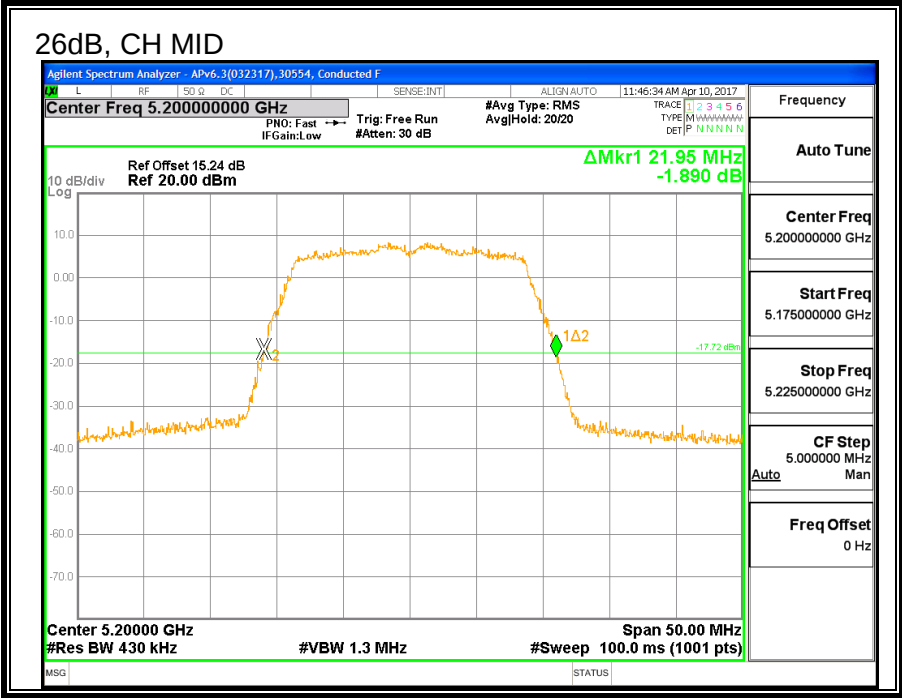
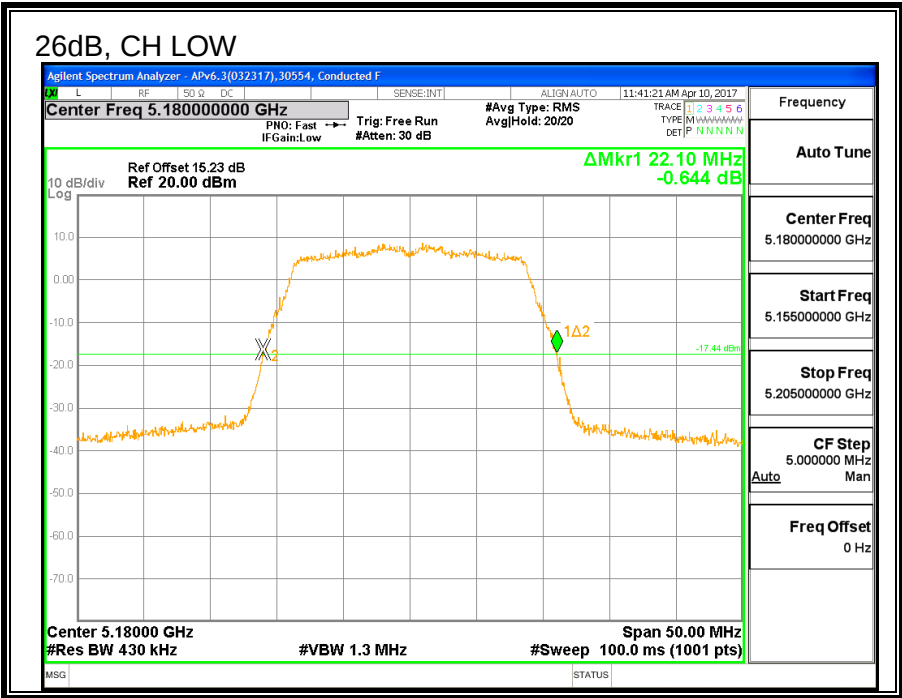
8.1.1. 26 dB BANDWIDTH

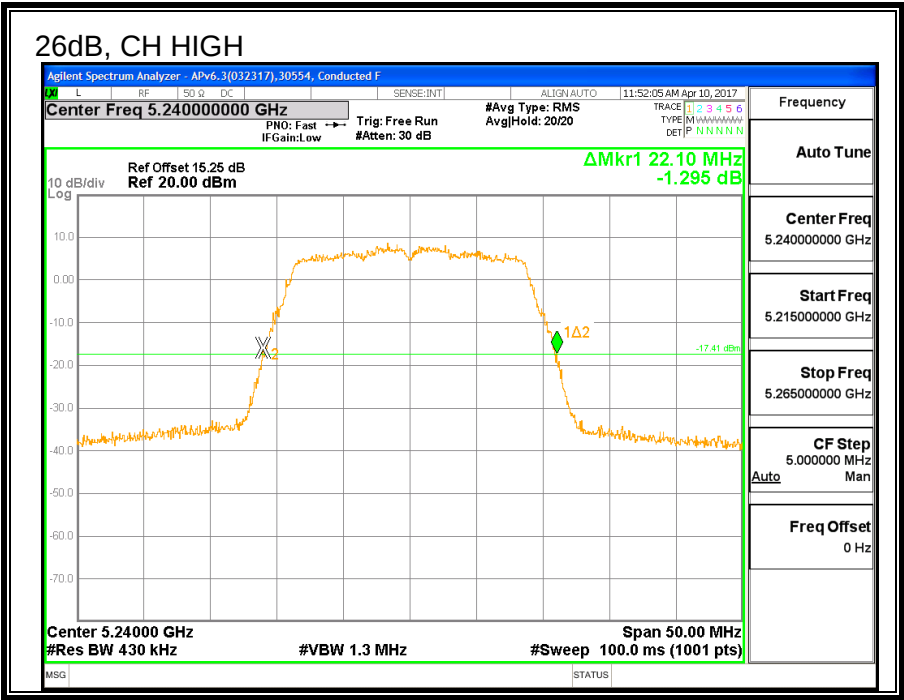
LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency	26 dB BW UAT 2 (MHz)
Low	5180	22.10
Mid	5200	21.95
High	5240	22.10





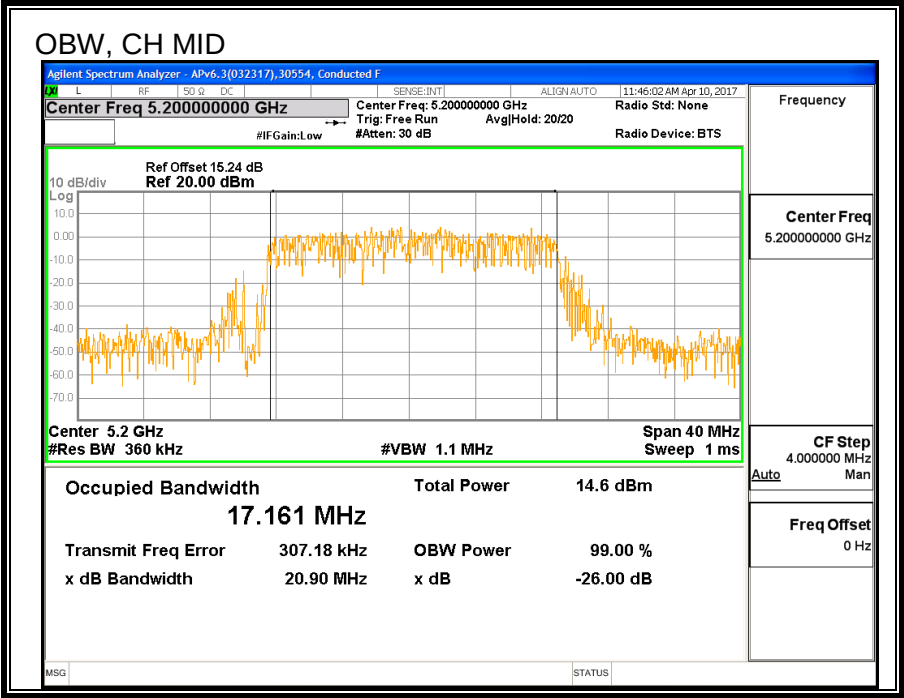
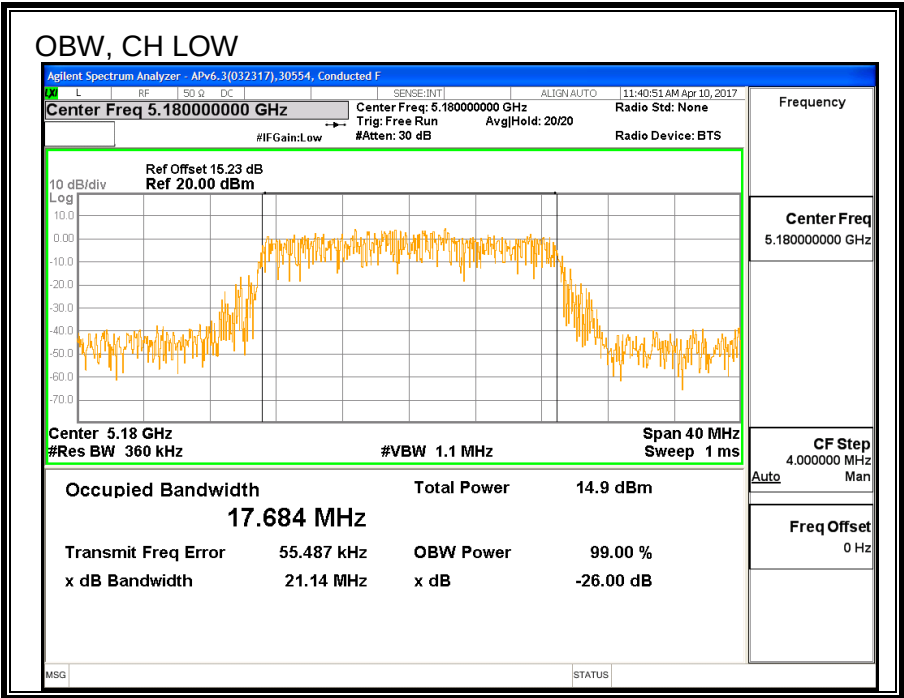
8.1.2. 99% BANDWIDTH

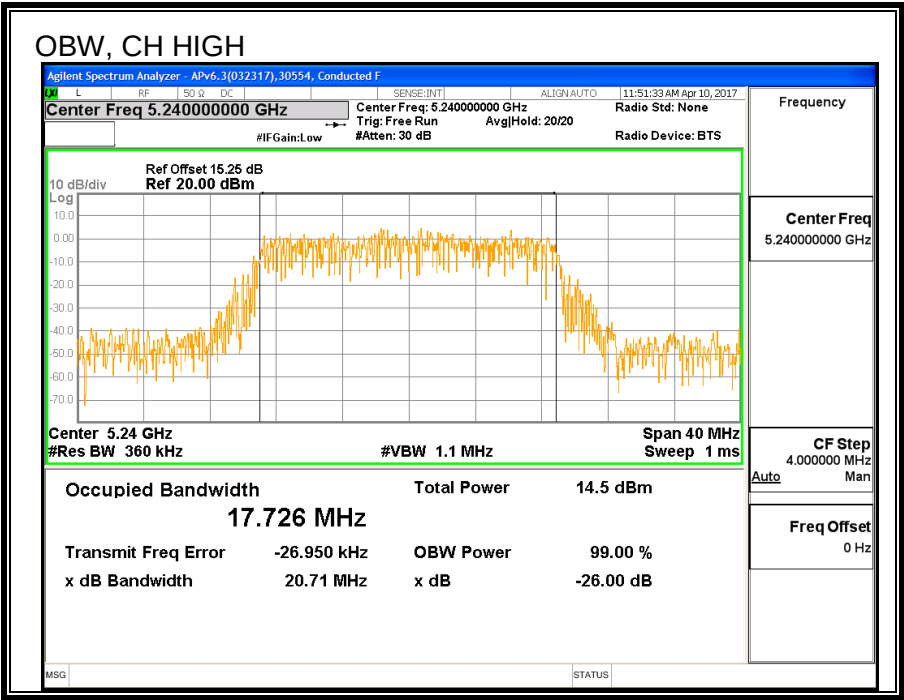
LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency	99% BW UAT 2 (MHz)
Low	5180	17.684
Mid	5200	17.161
High	5240	17.726





8.1.3. AVERAGE POWER

ID:	30554	Date:	7/13/2017
------------	-------	--------------	-----------

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

RESULTS

Channel	Frequency	Power UAT 2 (dBm)
Low	5180	17.28
Mid	5200	19.34
High	5240	20.77

8.1.4. OUTPUT POWER AND PPSD

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	-3.36	-3.36	24.00	11.00
Mid	5200	-3.36	-3.36	24.00	11.00
High	5240	-3.36	-3.36	24.00	11.00

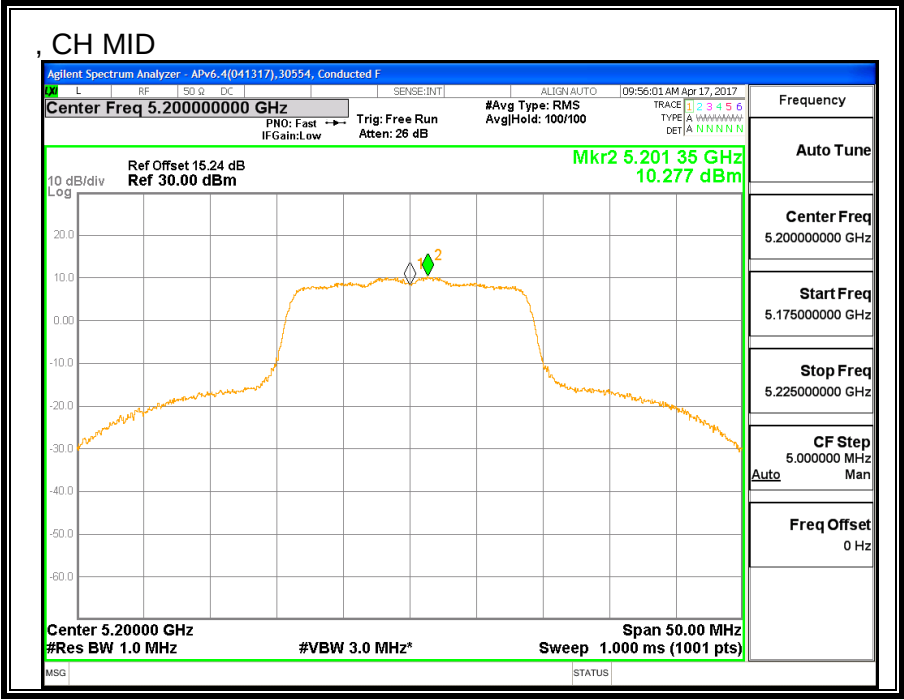
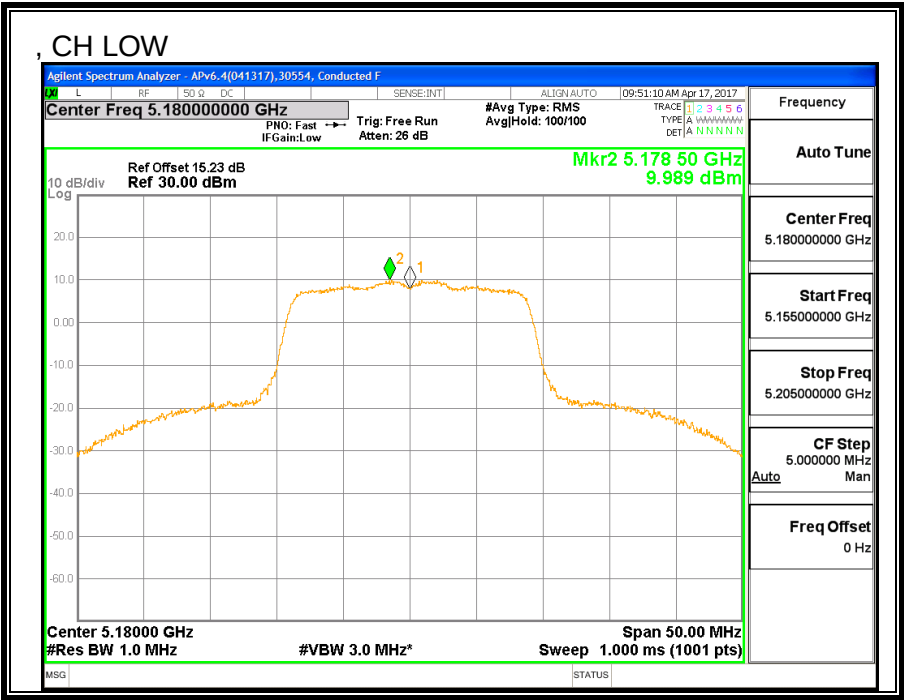
Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD
--------------------	------	--

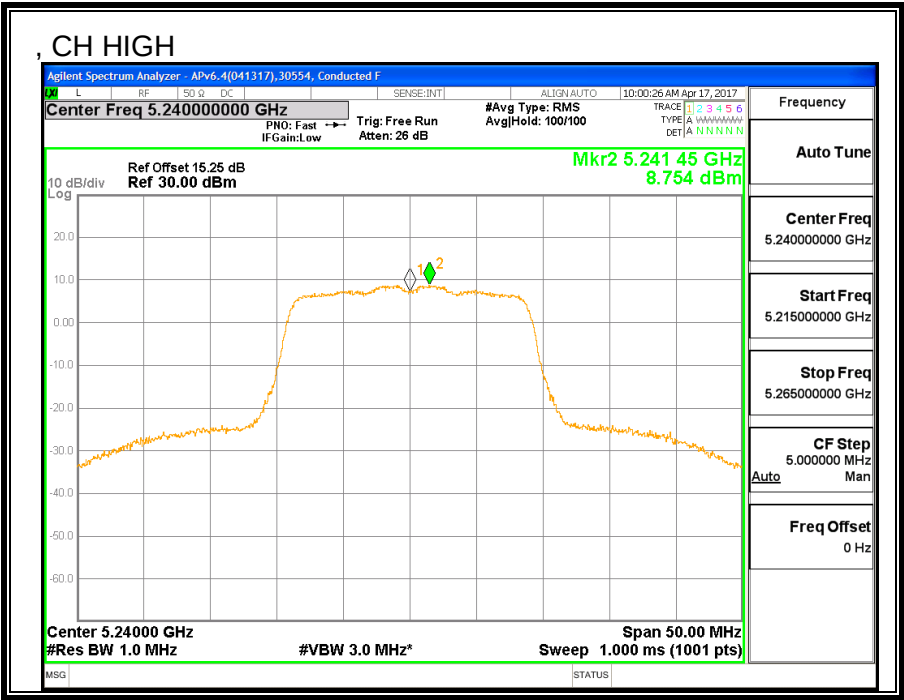
Output Power Results

Channel	Frequency (MHz)	UAT 2 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	17.28	17.28	24.00	-6.72
Mid	5200	19.34	19.34	24.00	-4.66
High	5240	20.77	20.77	24.00	-3.23

PSD Results

Channel	Frequency (MHz)	UAT 2 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5180	9.99	9.99	11.00	-1.01
Mid	5200	10.28	10.28	11.00	-0.72
High	5240	8.75	8.75	11.00	-2.25





8.2. 11n HT20 LAT 3 SISO MODE IN THE 5.2GHz BAND

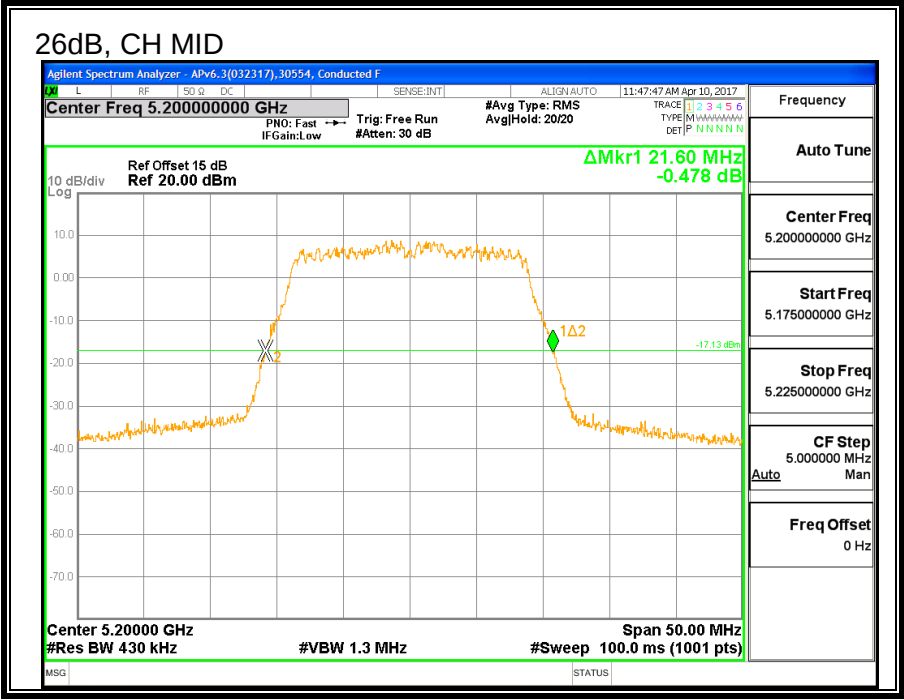
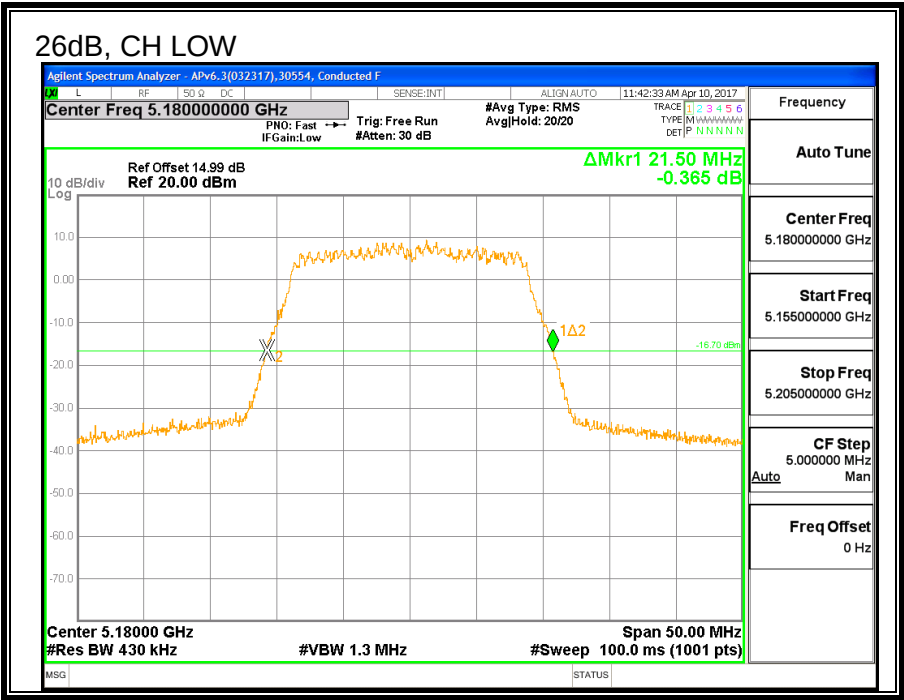
8.2.1. 26 dB BANDWIDTH

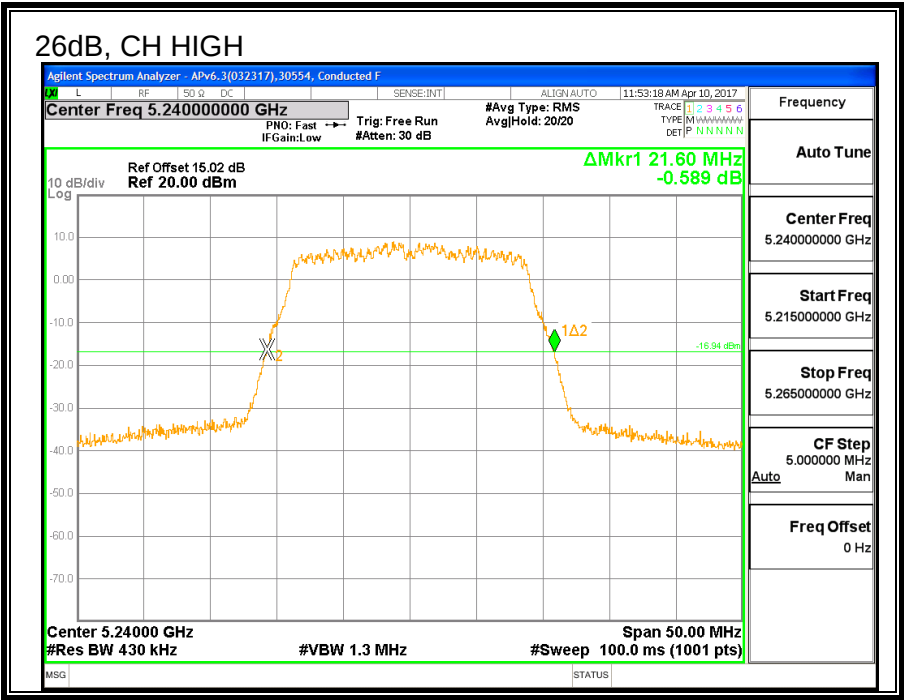
LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency	26 dB BW LAT 3 (MHz)
Low	5180	21.50
Mid	5200	21.60
High	5240	21.60





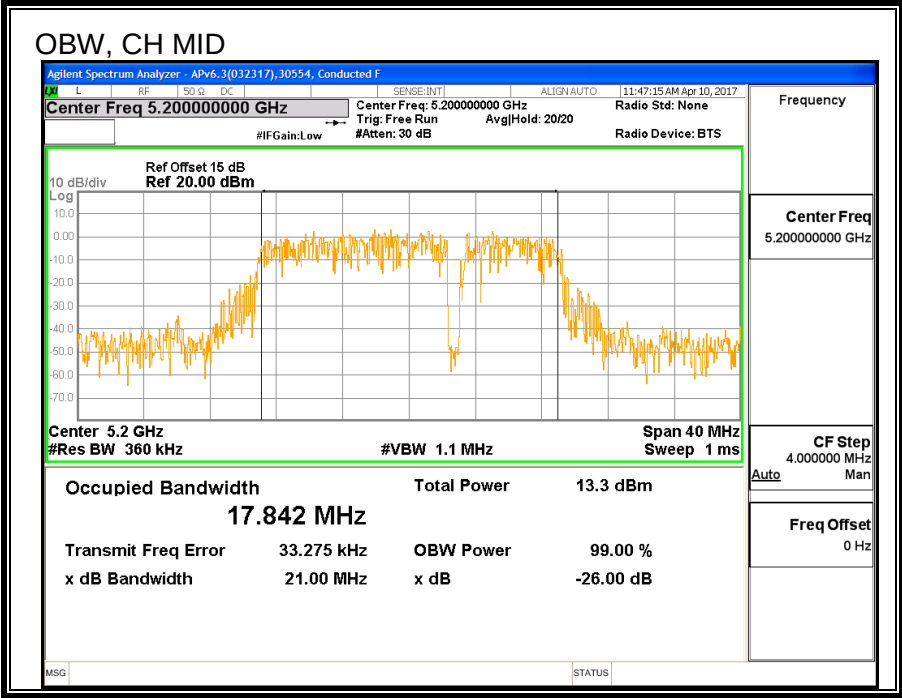
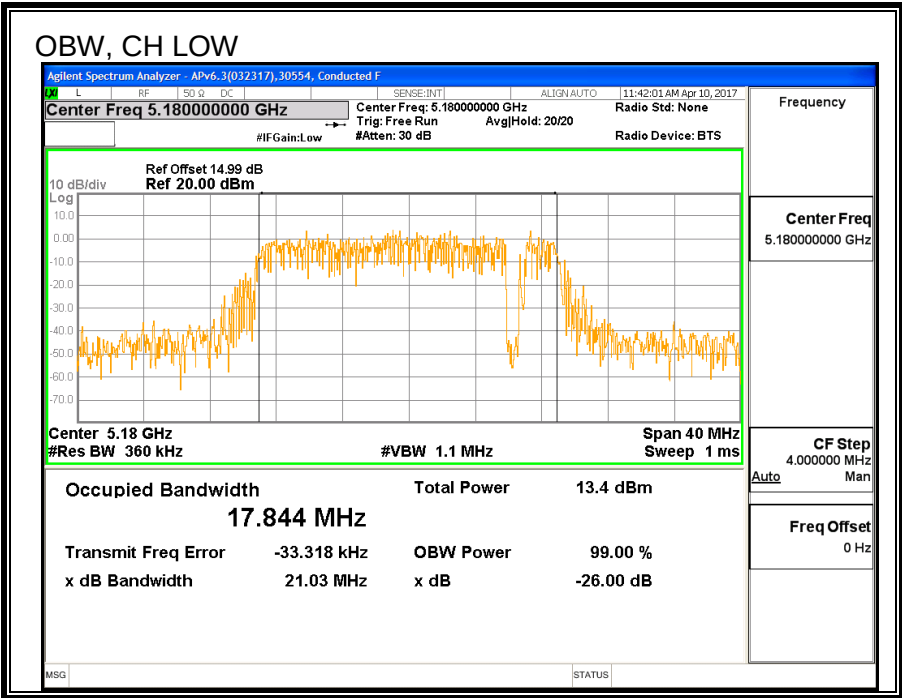
8.2.2. 99% BANDWIDTH

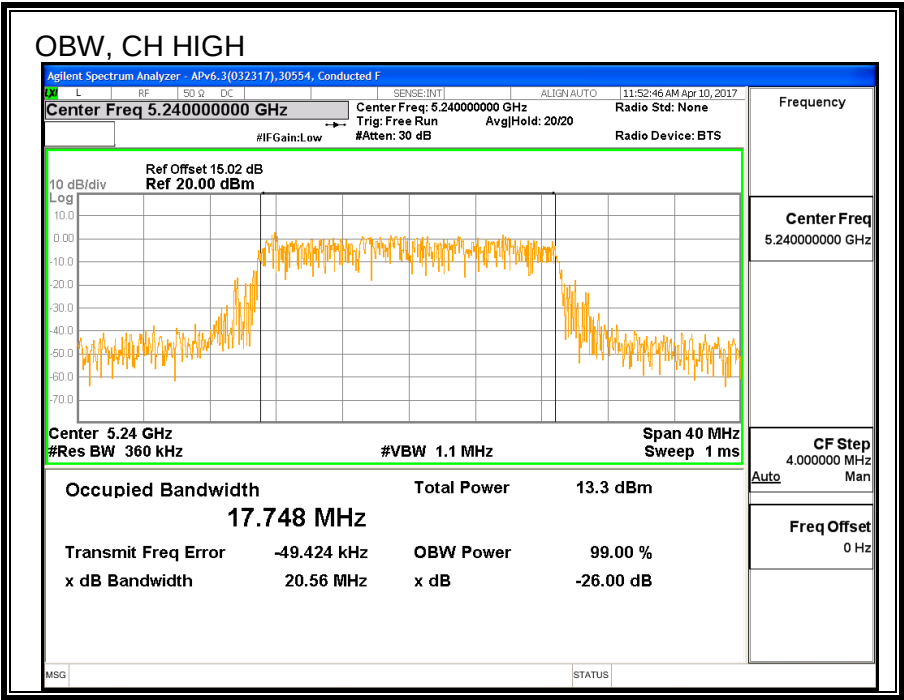
LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency	99% BW LAT 3 (MHz)
Low	5180	17.844
Mid	5200	17.842
High	5240	17.748





8.2.3. AVERAGE POWER

ID:	30554	Date:	7/13/2017
------------	-------	--------------	-----------

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

RESULTS

Channel	Frequency	Power LAT 3 (dBm)
Low	5180	17.32
Mid	5200	19.29
High	5240	20.80

8.2.4. OUTPUT POWER AND PPSD

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	-1.30	-1.30	24.00	11.00
Mid	5200	-1.30	-1.30	24.00	11.00
High	5240	-1.30	-1.30	24.00	11.00

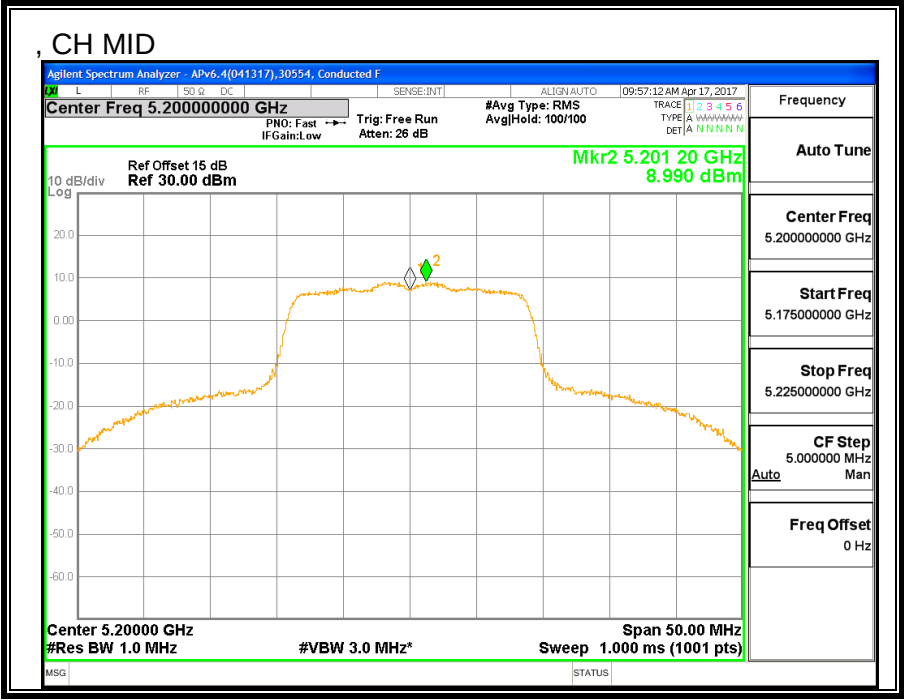
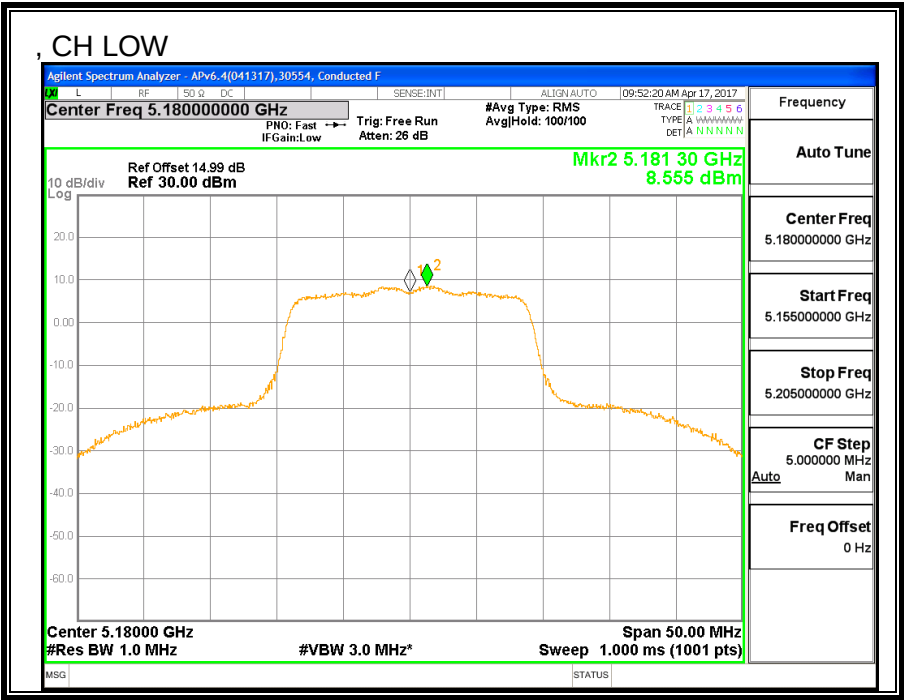
Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD
--------------------	------	--

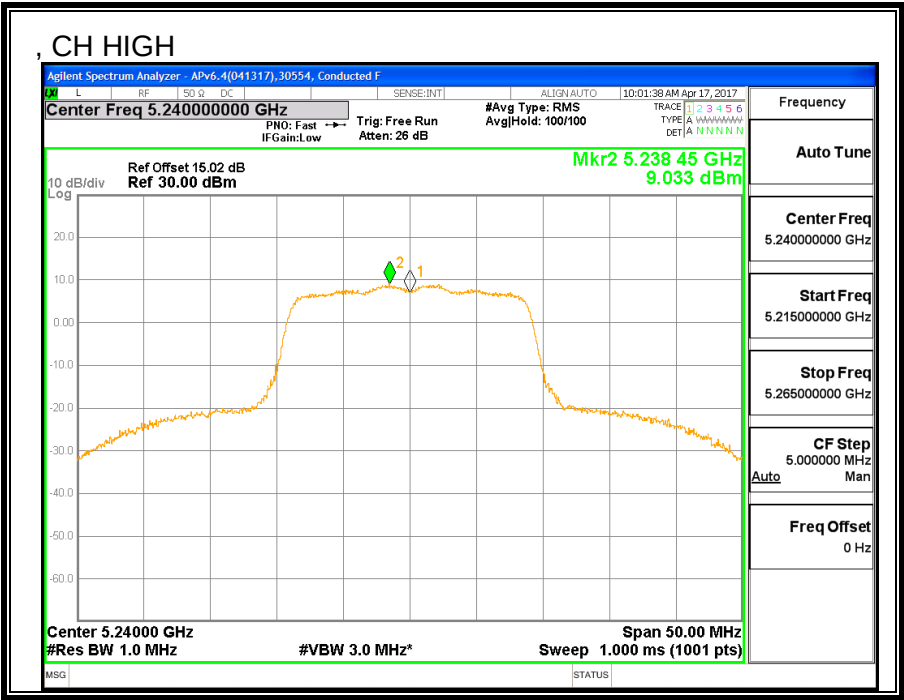
Output Power Results

Channel	Frequency (MHz)	LAT 3 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	17.32	17.32	24.00	-6.68
Mid	5200	19.29	19.29	24.00	-4.71
High	5240	20.80	20.80	24.00	-3.20

PSD Results

Channel	Frequency (MHz)	LAT 3 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5180	8.56	8.56	11.00	-2.45
Mid	5200	8.99	8.99	11.00	-2.01
High	5240	9.03	9.03	11.00	-1.97





8.3. 11n HT20 2TX CDD MIMO MODE IN THE 5.2GHz BAND

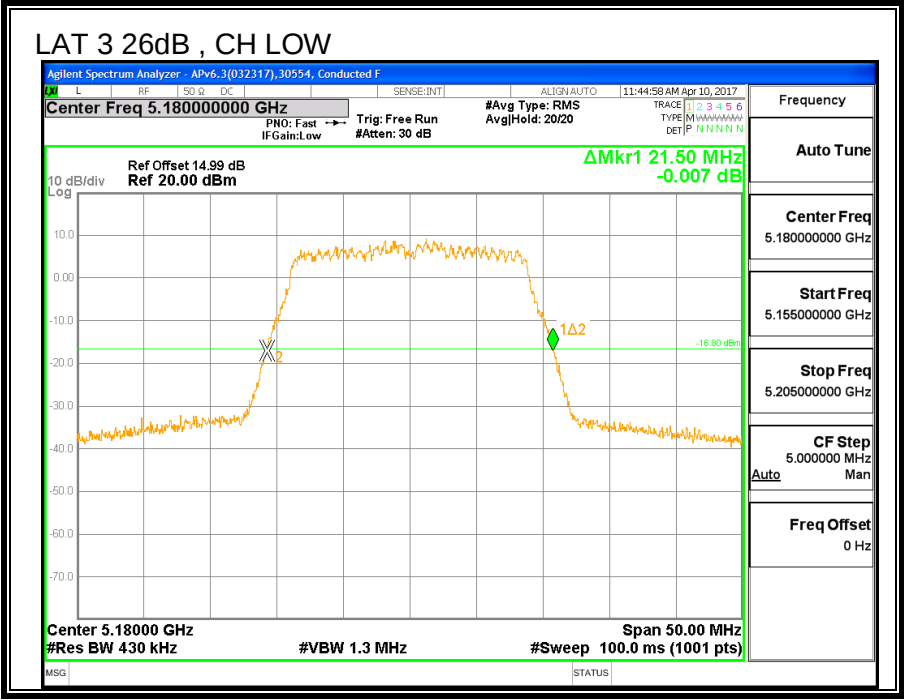
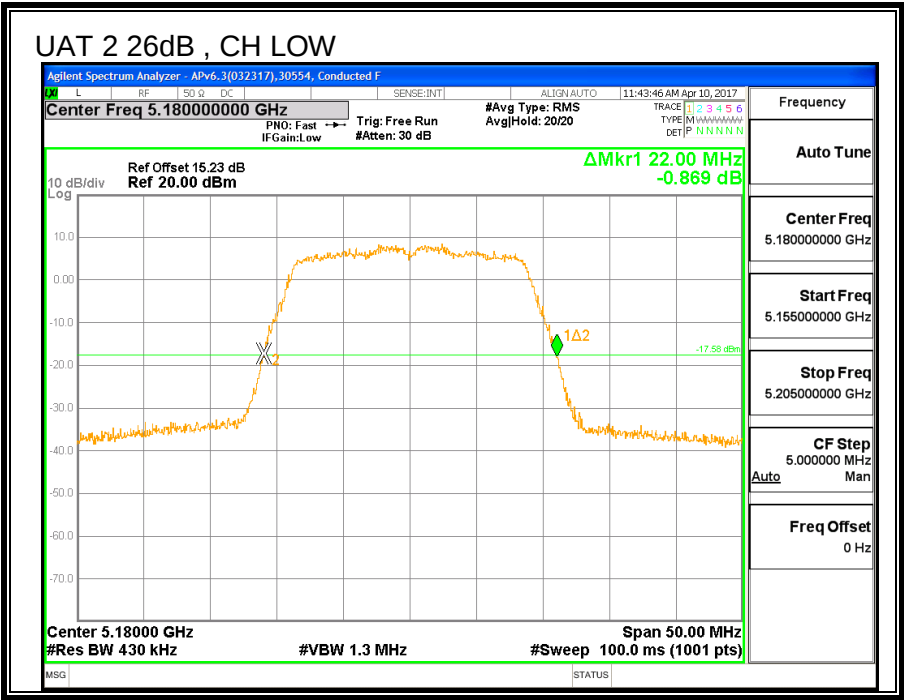
8.3.1. 26 dB BANDWIDTH

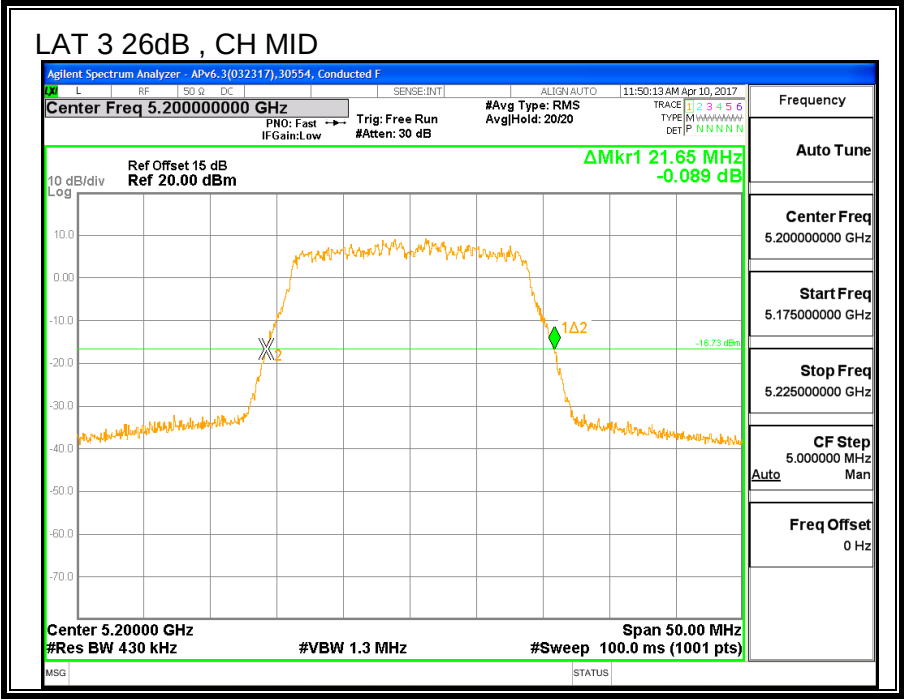
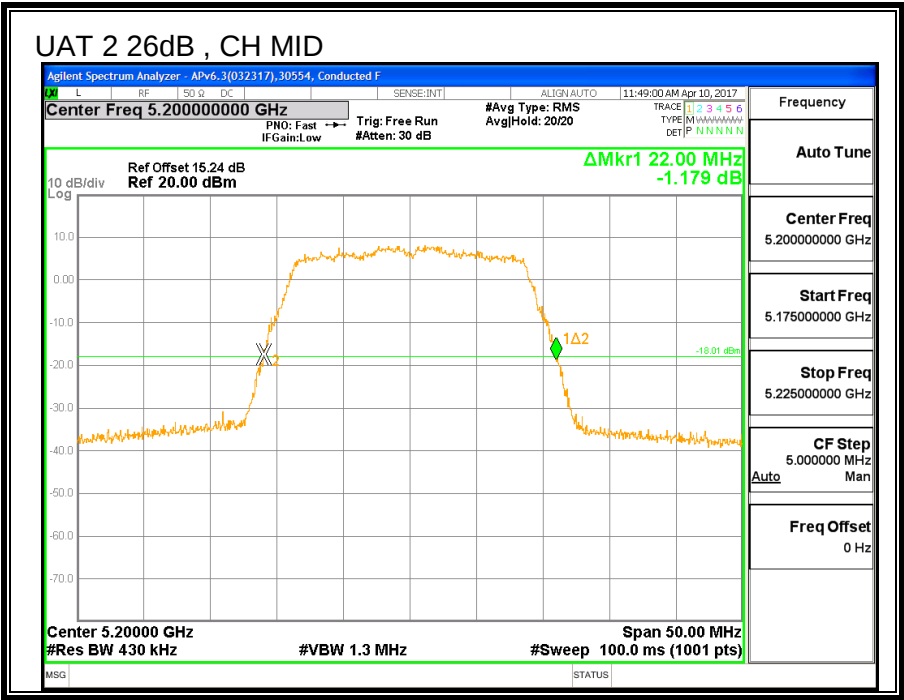
LIMITS

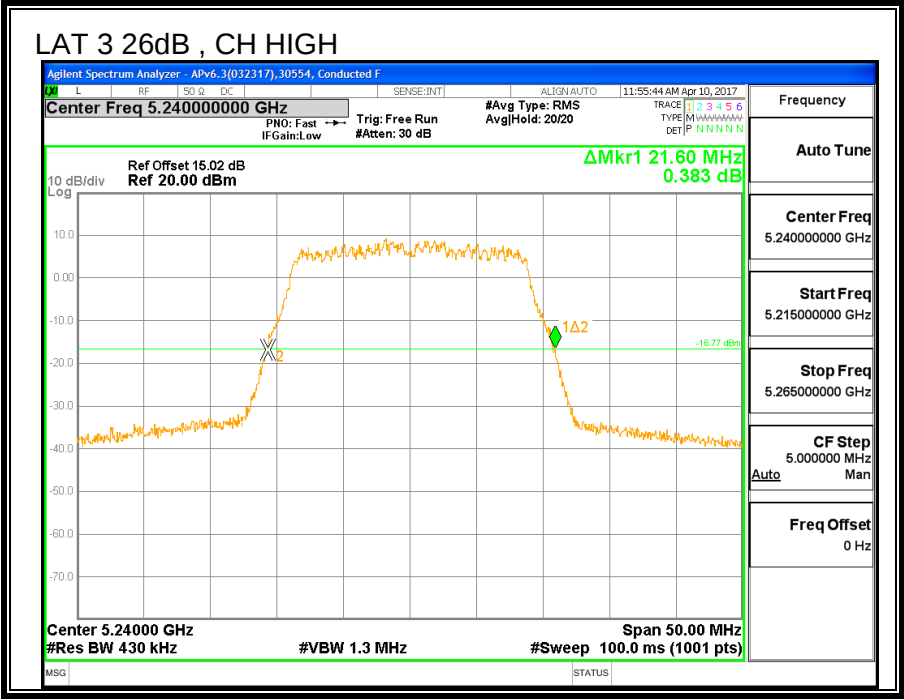
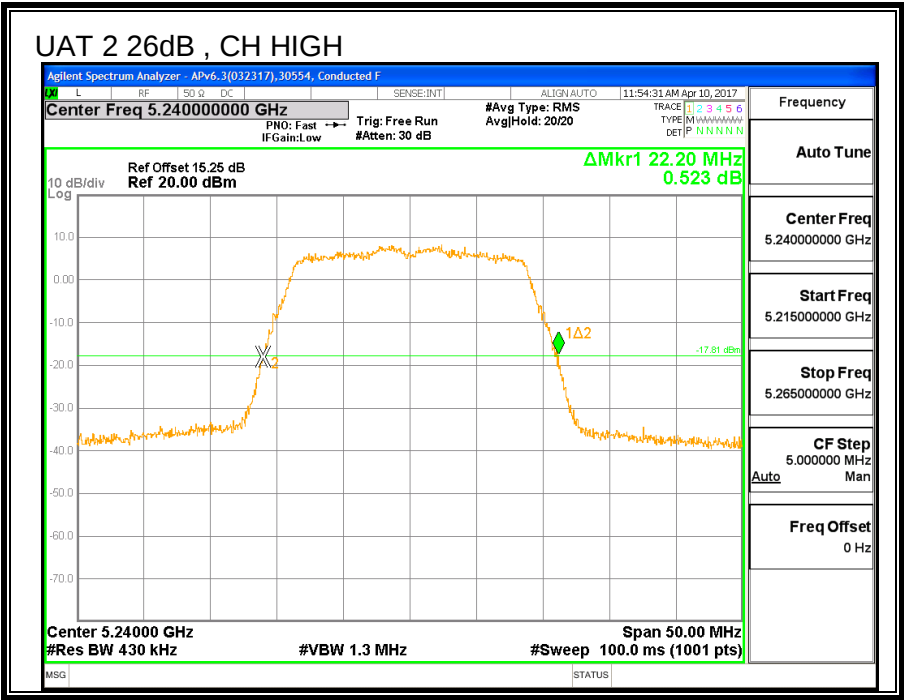
None; for reporting purposes only.

RESULTS

Channel	Frequency	26 dB BW UAT 2 (MHz)	26 dB BW LAT 3 (MHz)
Low	5180	22.00	21.50
Mid	5200	22.00	21.65
High	5240	22.20	21.60







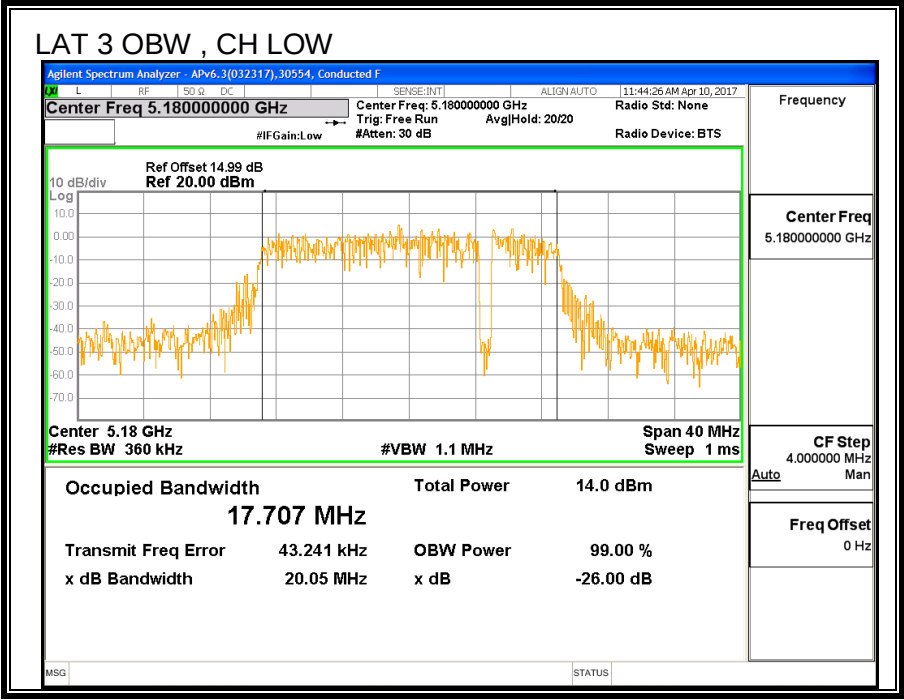
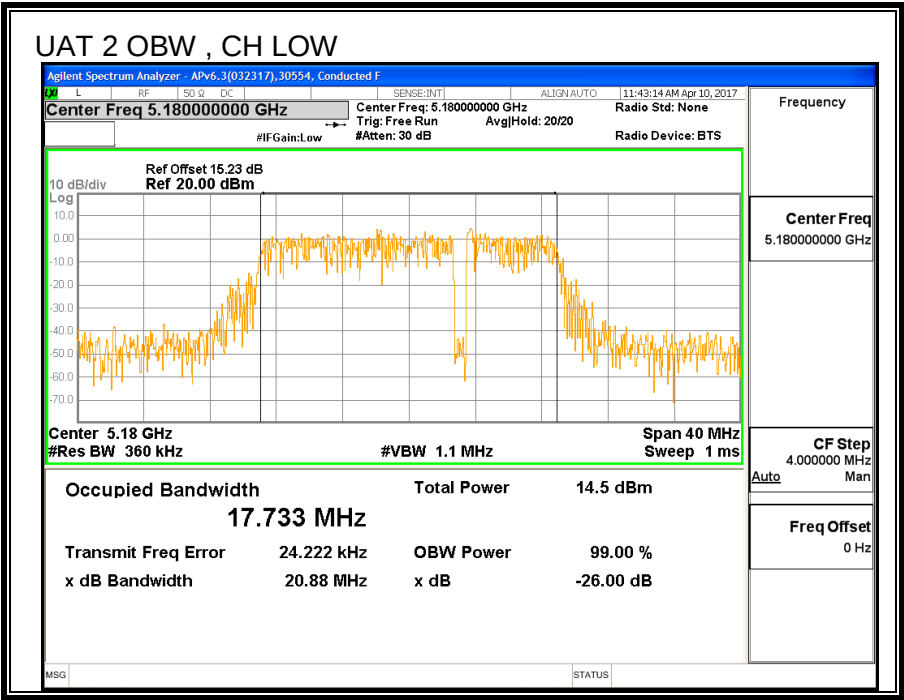
8.3.2. 99% BANDWIDTH

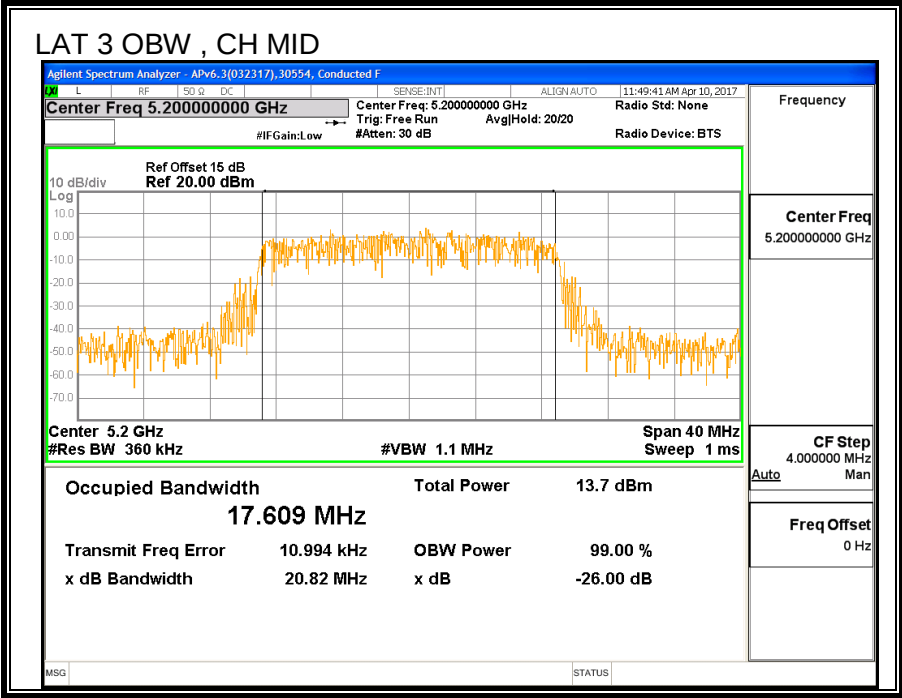
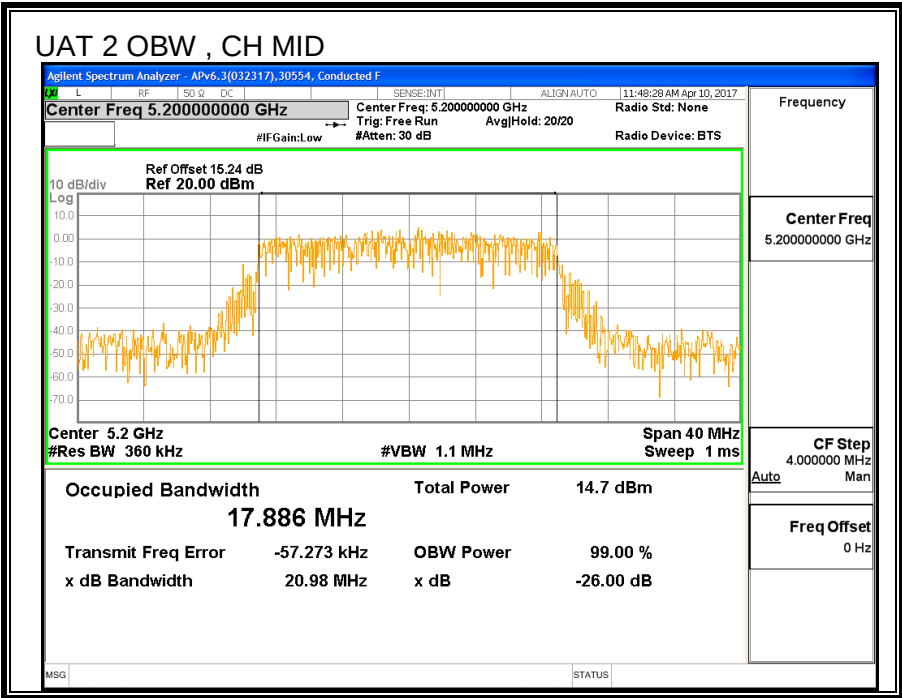
LIMITS

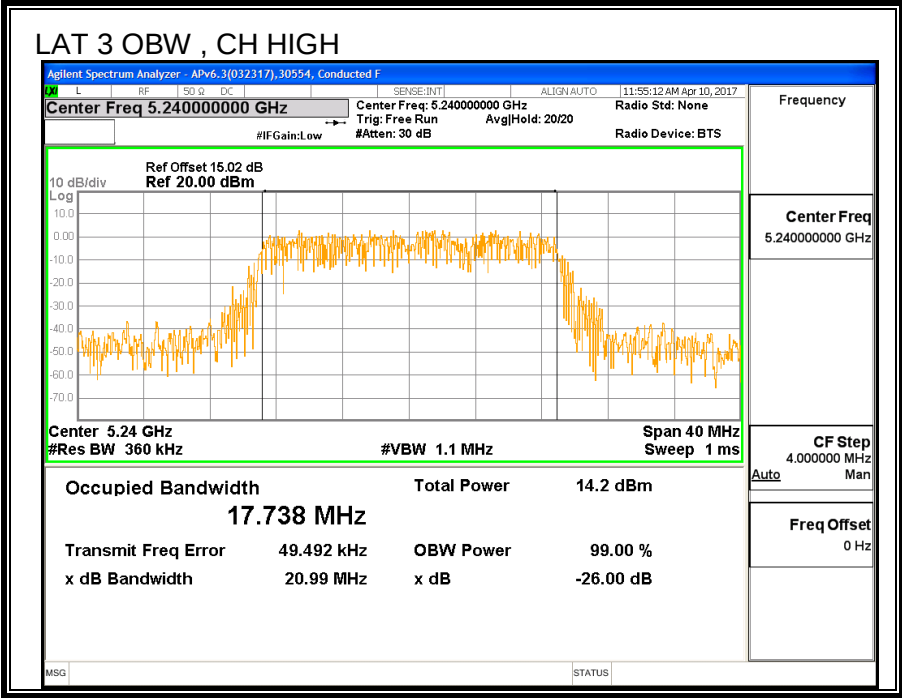
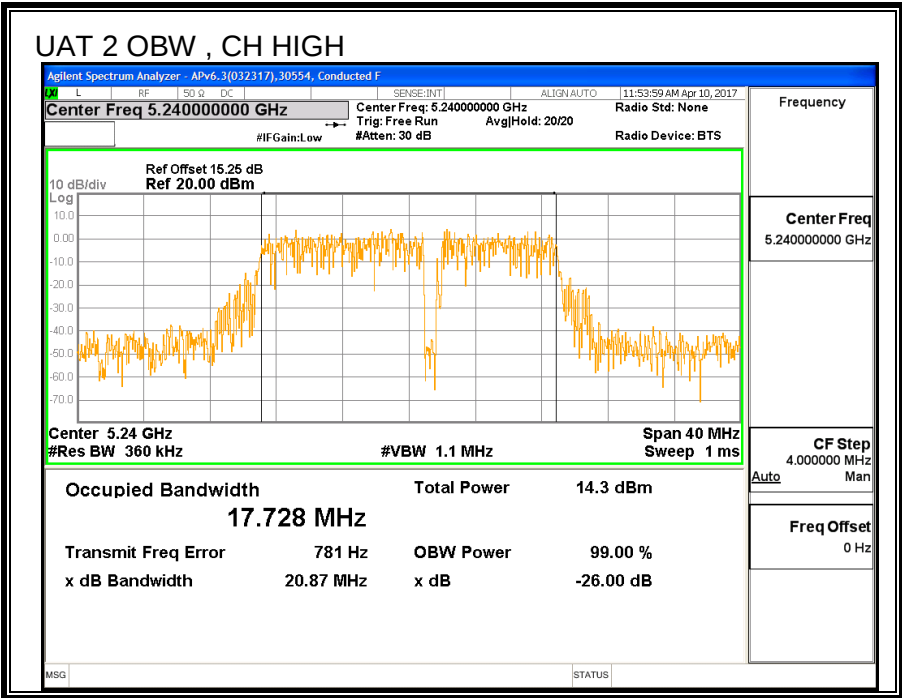
None; for reporting purposes only.

RESULTS

Channel	Frequency	99% BW UAT 2 (MHz)	99% BW LAT 3 (MHz)
Low	5180	17.733	17.707
Mid	5200	17.886	17.609
High	5240	17.728	17.738







8.3.3. AVERAGE POWER

ID:	30554	Date:	7/13/2017
------------	-------	--------------	-----------

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

RESULTS

Average Power Results

Channel	Frequency (MHz)	UAT 2 Power (dBm)	LAT 3 Power (dBm)	Total Power (dBm)
Low	5180	16.92	16.85	19.90
Mid	5200	17.77	17.84	20.82
High	5240	17.82	17.93	20.89

8.3.4. OUTPUT POWER AND PPSD

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

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

UAT 2 Antenna Gain (dBi)	LAT 3 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
-3.36	-1.30	-2.21

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

UAT 2 Antenna Gain (dBi)	LAT 3 Antenna Gain (dBi)	Correlated Chains Directional Gain (dBi)
-3.36	-1.30	0.74

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	-2.21	0.74	24.00	11.00
Mid	5200	-2.21	0.74	24.00	11.00
High	5240	-2.21	0.74	24.00	11.00

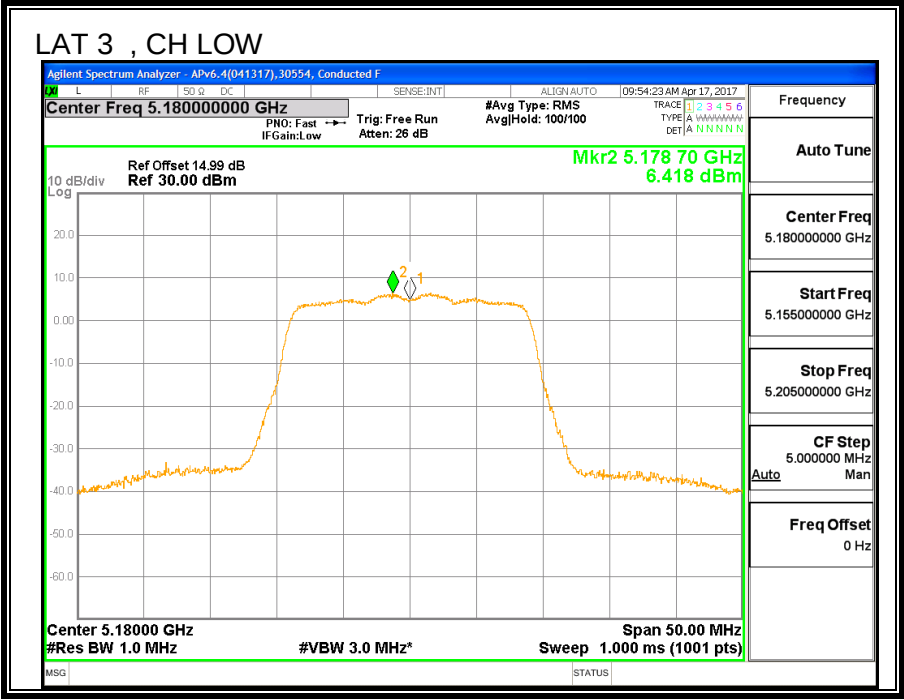
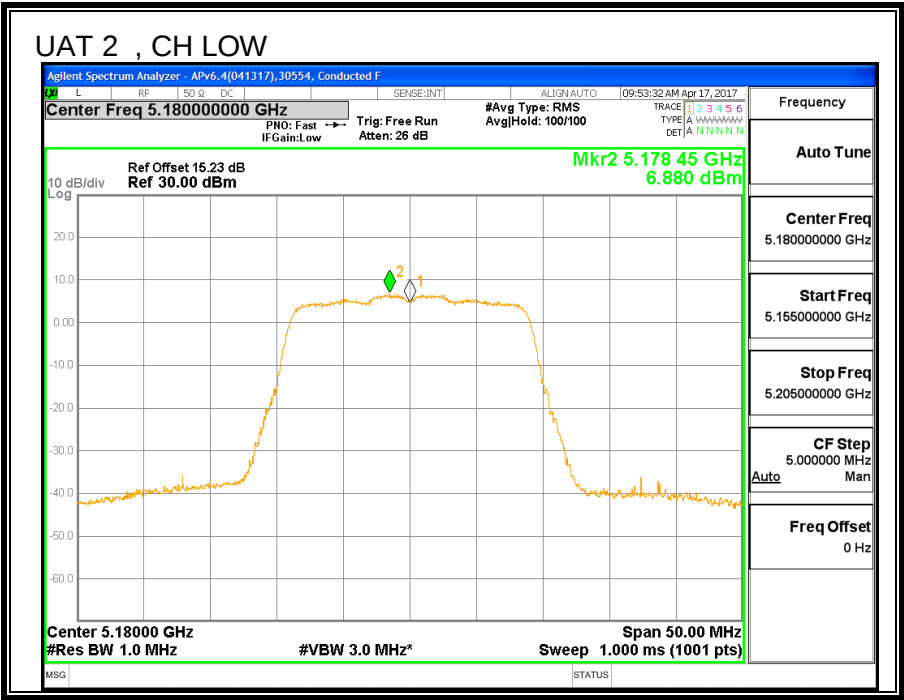
Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD
--------------------	------	--

Output Power Results

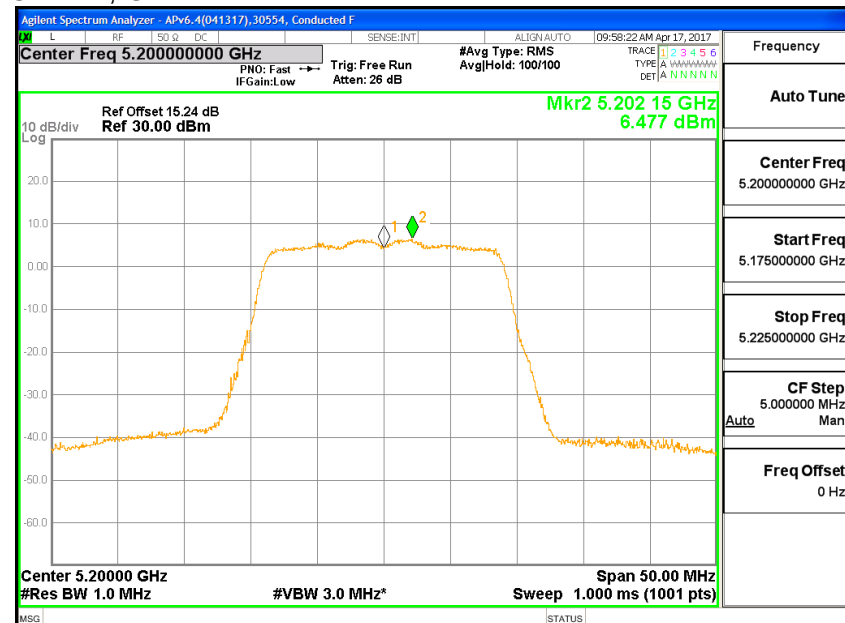
Channel	Frequency (MHz)	UAT 2 Meas Power (dBm)	LAT 3 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	16.920	16.850	19.90	24.00	-4.10
Mid	5200	17.770	17.840	20.82	24.00	-3.18
High	5240	17.820	17.930	20.89	24.00	-3.11

PSD Results

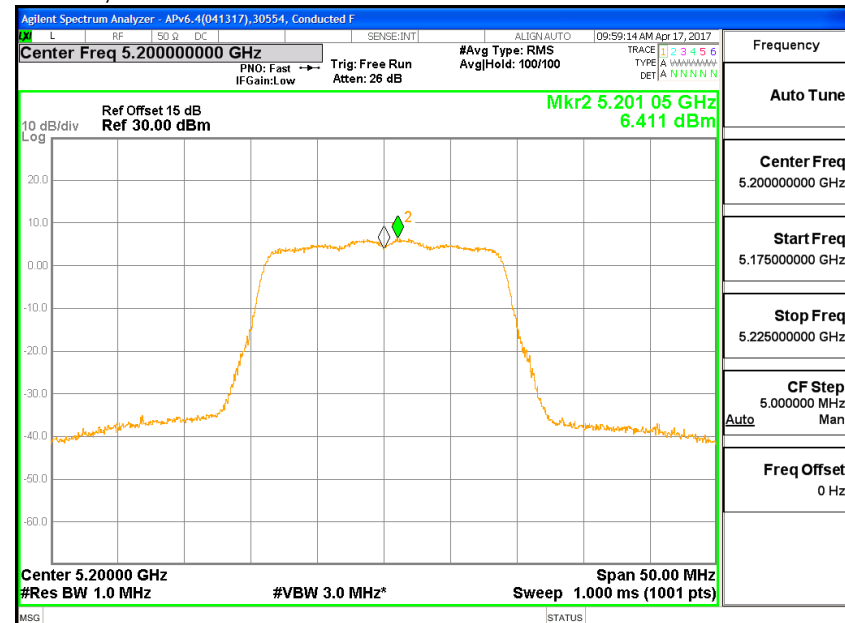
Channel	Frequency (MHz)	UAT 2 Meas PSD (dBm)	LAT 3 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5180	6.88	6.42	9.67	11.00	-1.33
Mid	5200	6.48	6.41	9.45	11.00	-1.55
High	5240	6.49	5.99	9.26	11.00	-1.74

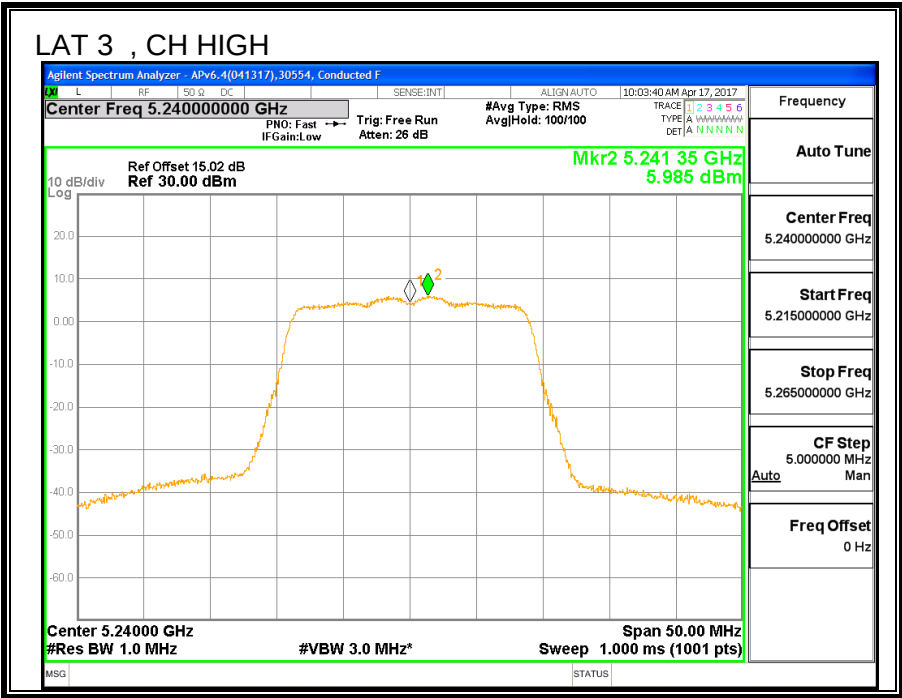
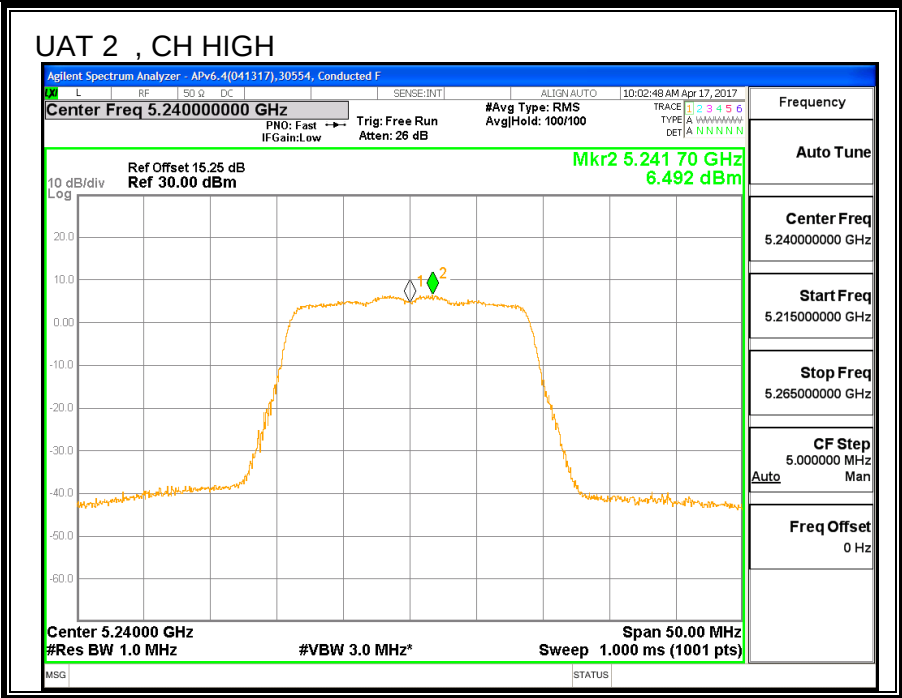


UAT 2 , CH MID



LAT 3 , CH MID





8.4. 11n HT40 UAT 2 SISO MODE IN THE 5.2GHz BAND

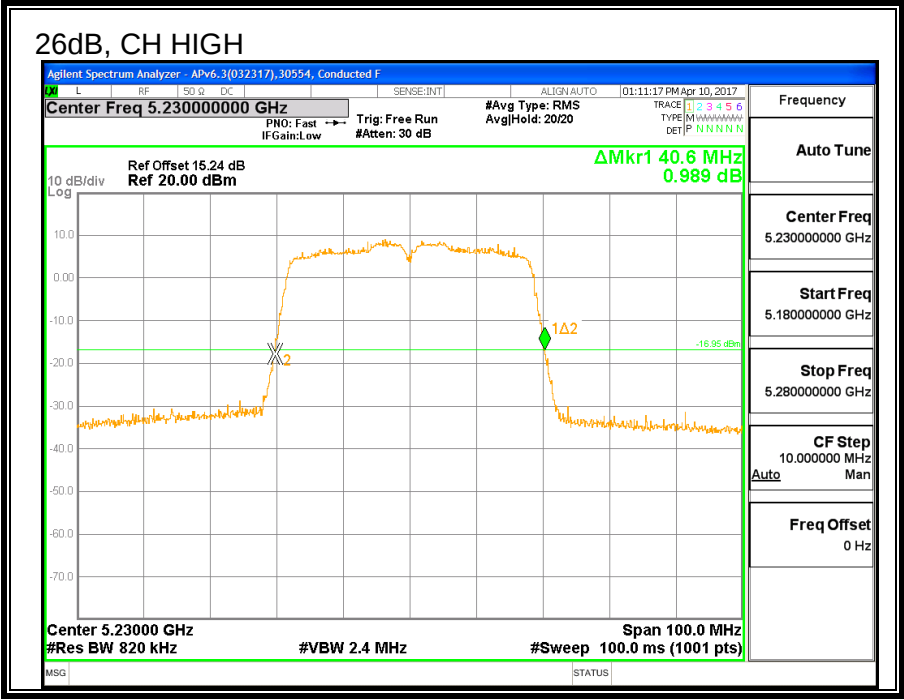
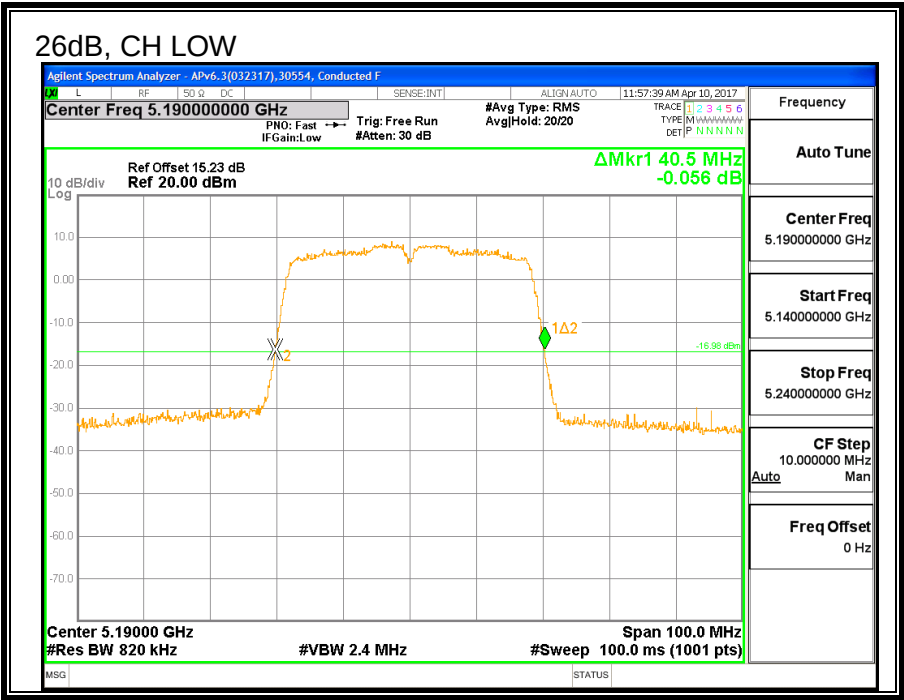
8.4.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency	26 dB BW UAT 2 (MHz)
Low	5190	40.5
High	5230	40.6



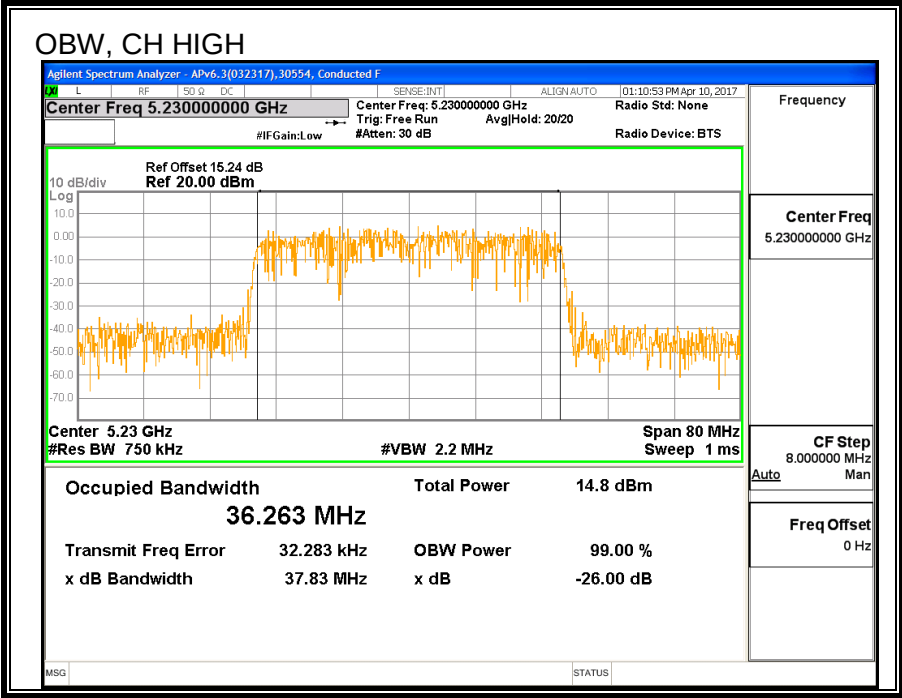
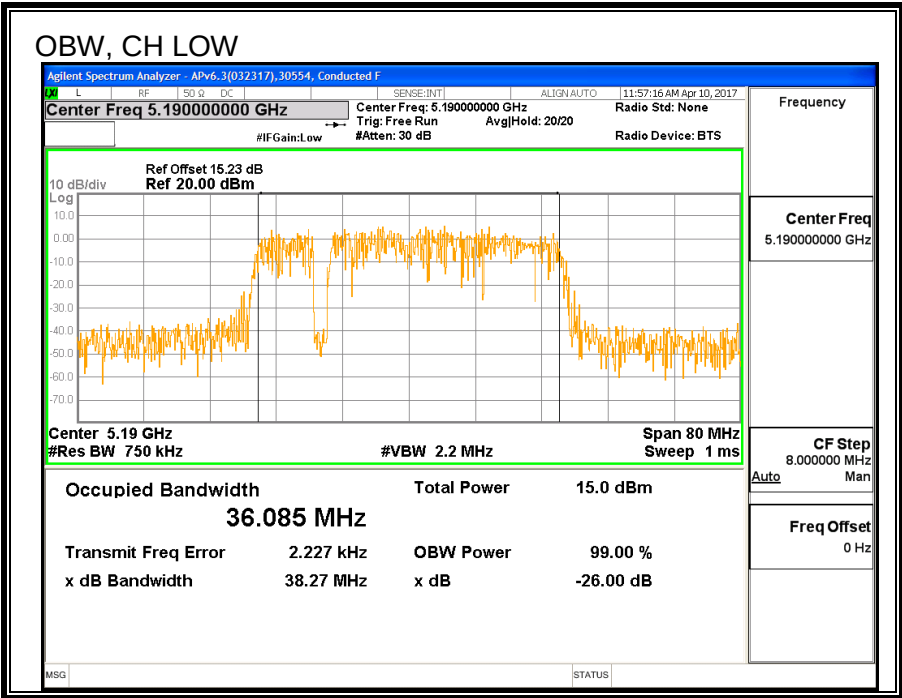
8.4.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency	99% BW UAT 2 (MHz)
Low	5190	36.085
High	5230	36.263



8.4.3. AVERAGE POWER

ID:	30554	Date:	7/13/2017
------------	-------	--------------	-----------

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

RESULTS

Channel	Frequency	Power UAT 2 (dBm)
Low	5190	16.31
High	5230	19.34

8.4.4. OUTPUT POWER AND PPSD

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	5190	-3.36	-3.36	24.00	11.00
High	5230	-3.36	-3.36	24.00	11.00

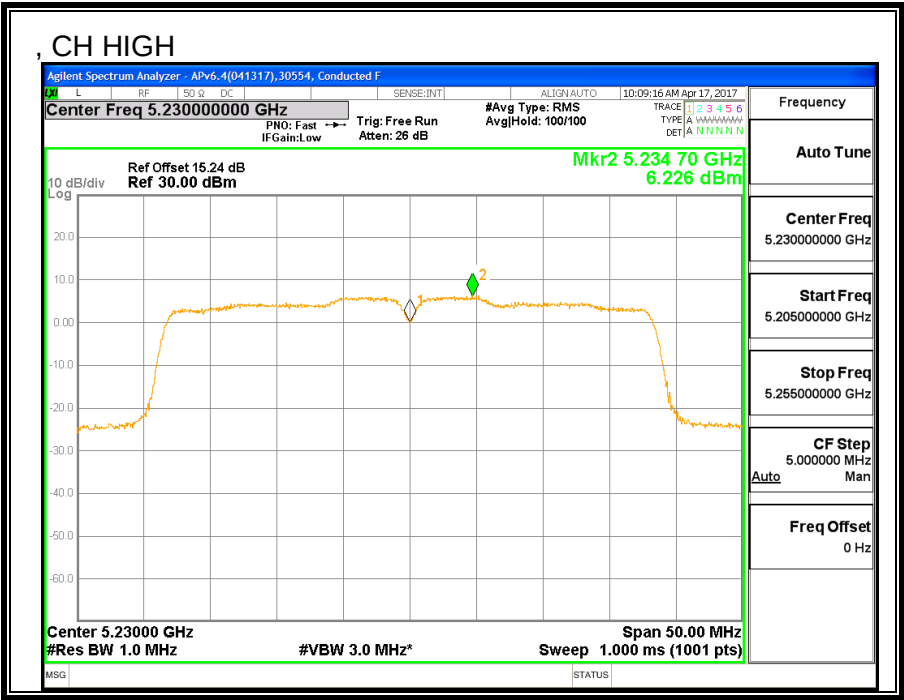
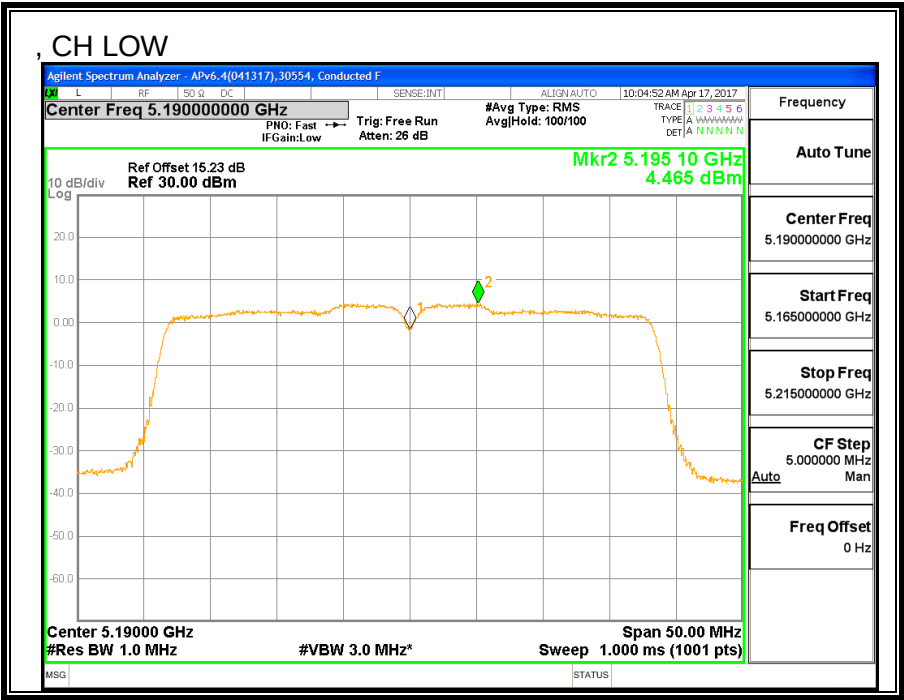
Duty Cycle CF (dB)	0.10	Included in Calculations of Corr'PSD
--------------------	------	--------------------------------------

Output Power Results

Channel	Frequency (MHz)	UAT 2 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5190	16.31	16.31	24.00	-7.69
High	5230	19.34	19.34	24.00	-4.66

PSD Results

Channel	Frequency (MHz)	UAT 2 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5190	4.47	4.57	11.00	-6.44
High	5230	6.23	6.33	11.00	-4.67



8.5. 11n HT40 LAT 3 SISO MODE IN THE 5.2GHz BAND

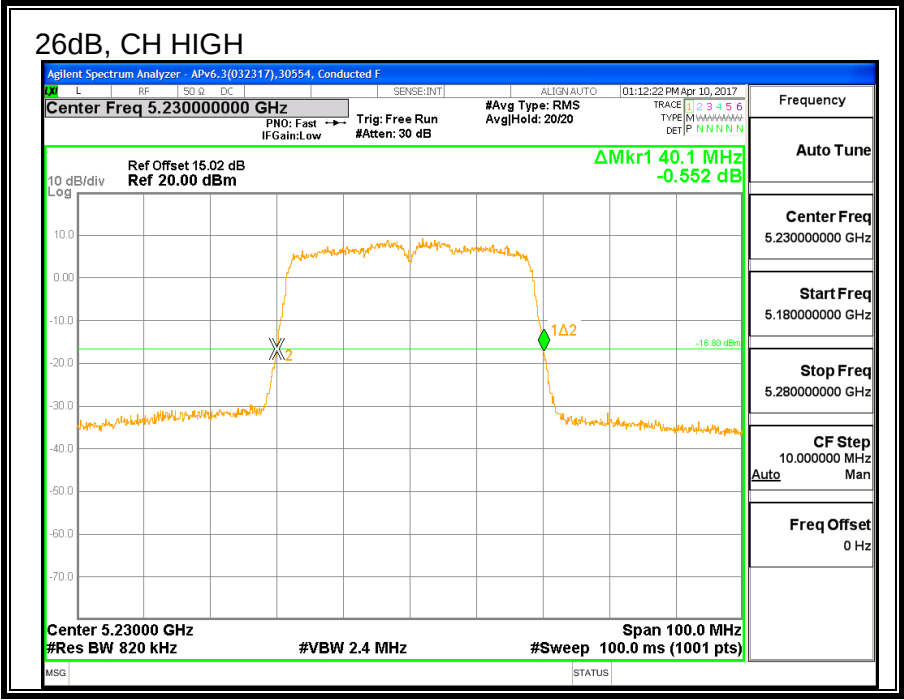
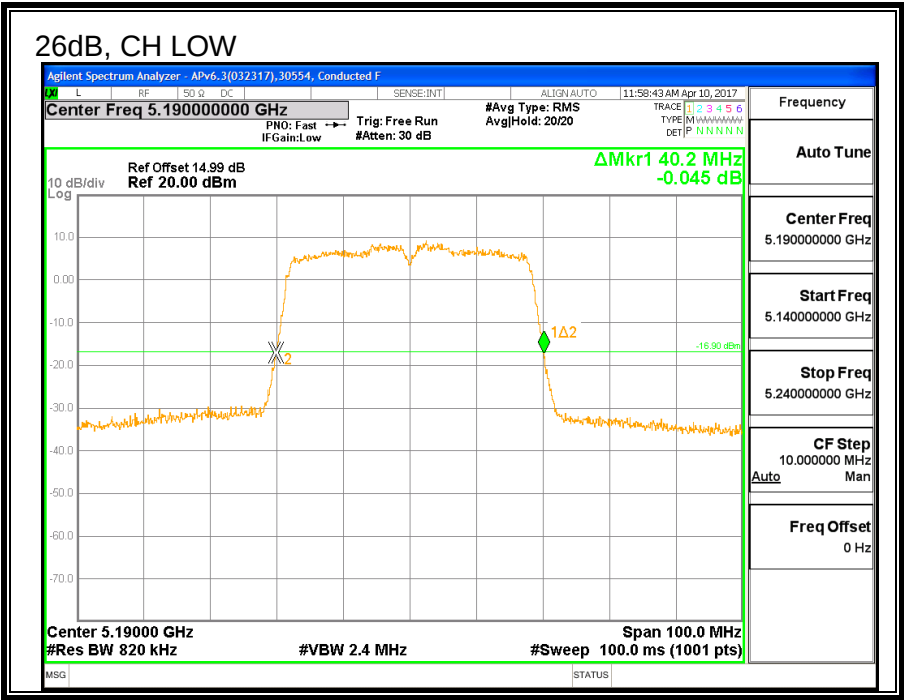
8.5.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency	26 dB BW LAT 3 (MHz)
Low	5190	40.2
High	5230	40.1



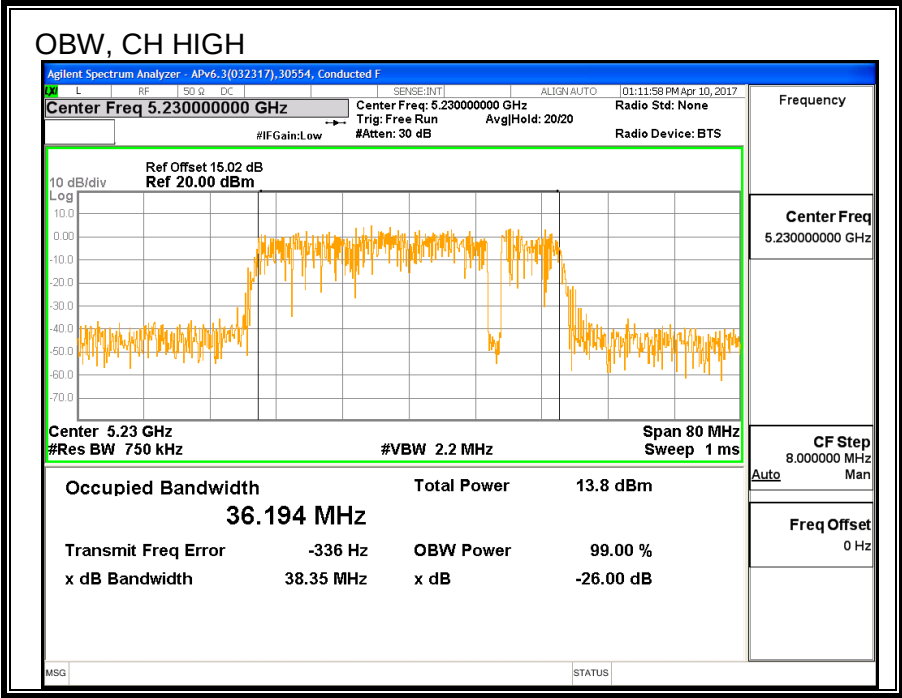
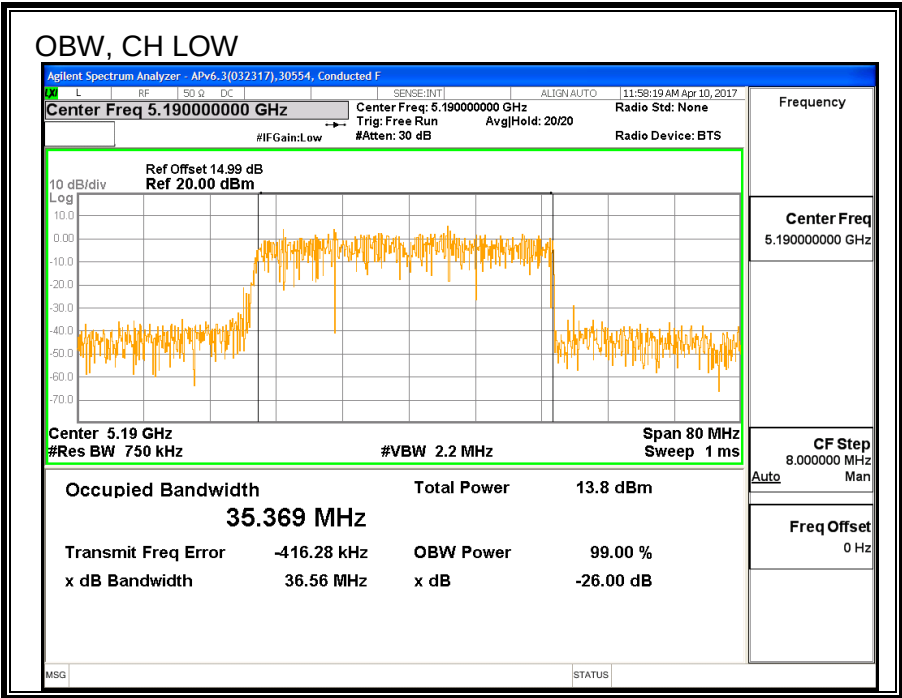
8.5.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency	99% BW LAT 3 (MHz)
Low	5190	35.369
High	5230	36.194



8.5.3. AVERAGE POWER

ID:	30554	Date:	7/13/2017
------------	-------	--------------	-----------

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

RESULTS

Channel	Frequency	Power LAT 3 (dBm)
Low	5190	16.27
High	5230	19.32

8.5.4. OUTPUT POWER AND PPSD

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	5190	-1.30	-1.30	24.00	11.00
High	5230	-1.30	-1.30	24.00	11.00

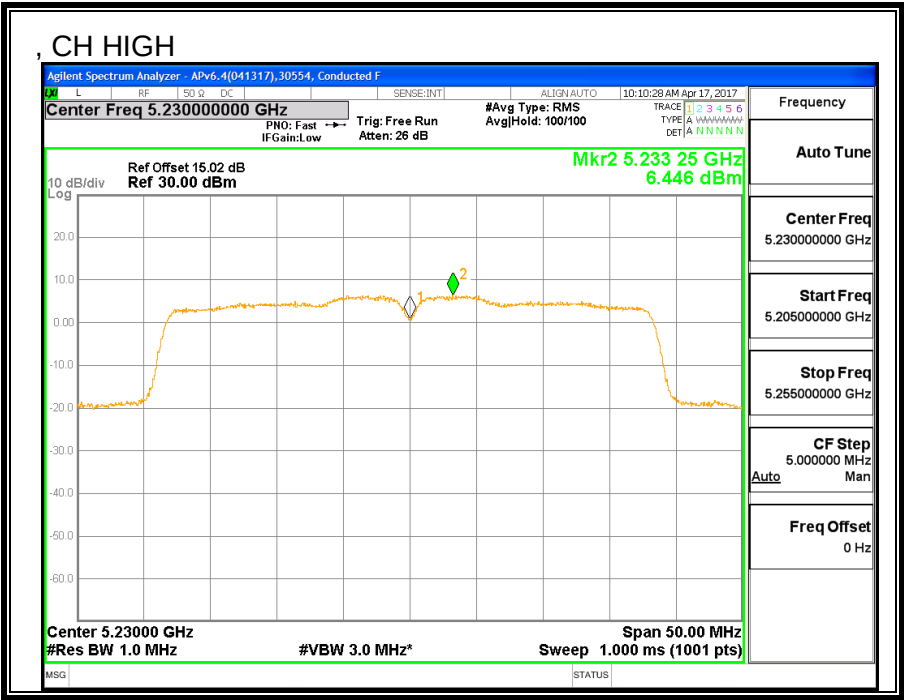
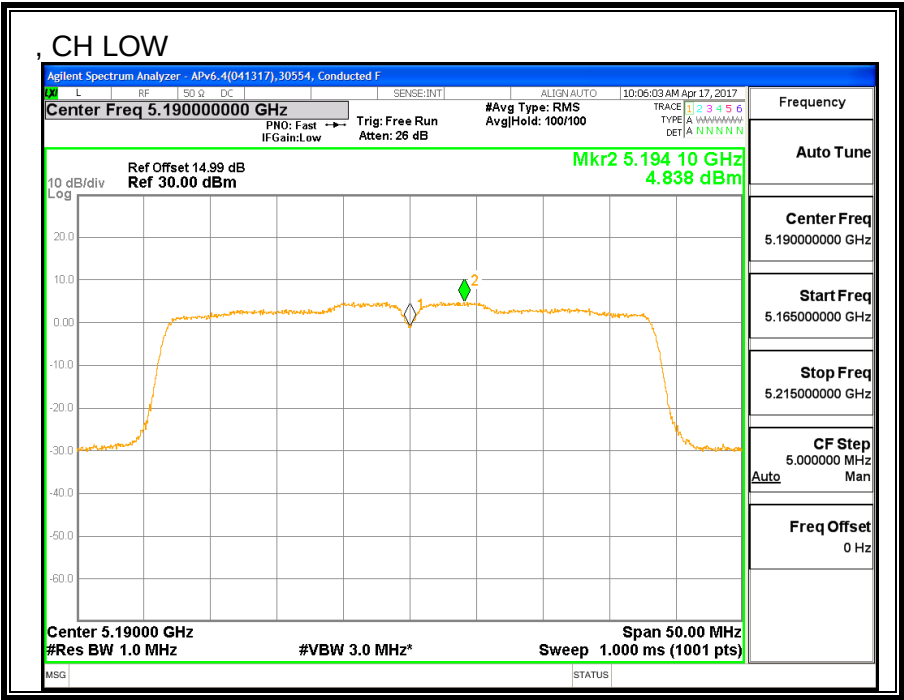
Duty Cycle CF (dB)	0.10	Included in Calculations of Corr'PSD
--------------------	------	--------------------------------------

Output Power Results

Channel	Frequency (MHz)	LAT 3 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5190	16.27	16.27	24.00	-7.73
High	5230	19.32	19.32	24.00	-4.68

PSD Results

Channel	Frequency (MHz)	LAT 3 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5190	4.84	4.94	11.00	-6.06
High	5230	6.45	6.55	11.00	-4.45



8.6. 11n HT40 2TX CDD MIMO MODE IN THE 5.2GHz BAND

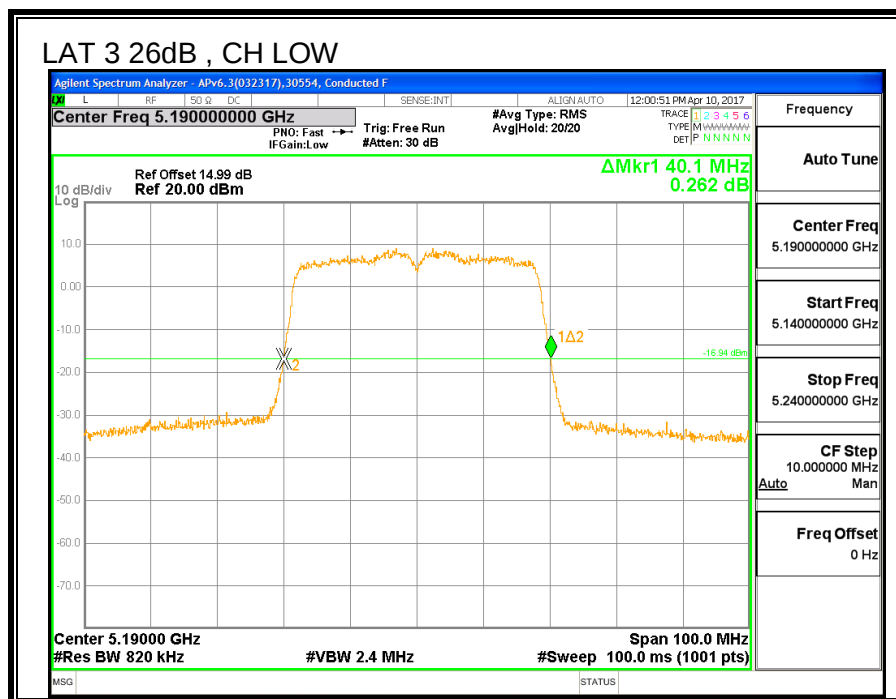
8.6.1. 26 dB BANDWIDTH

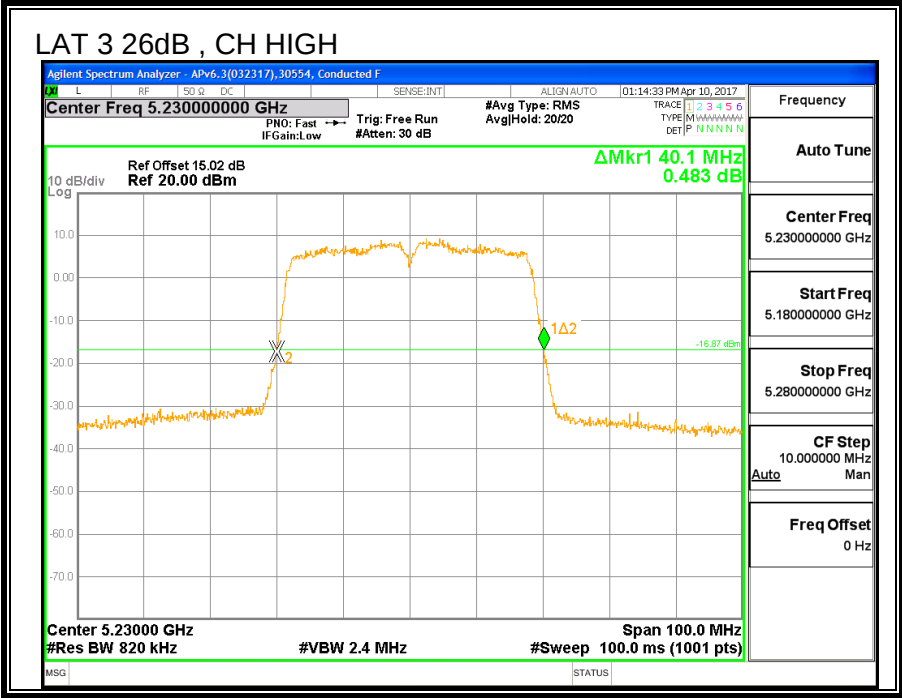
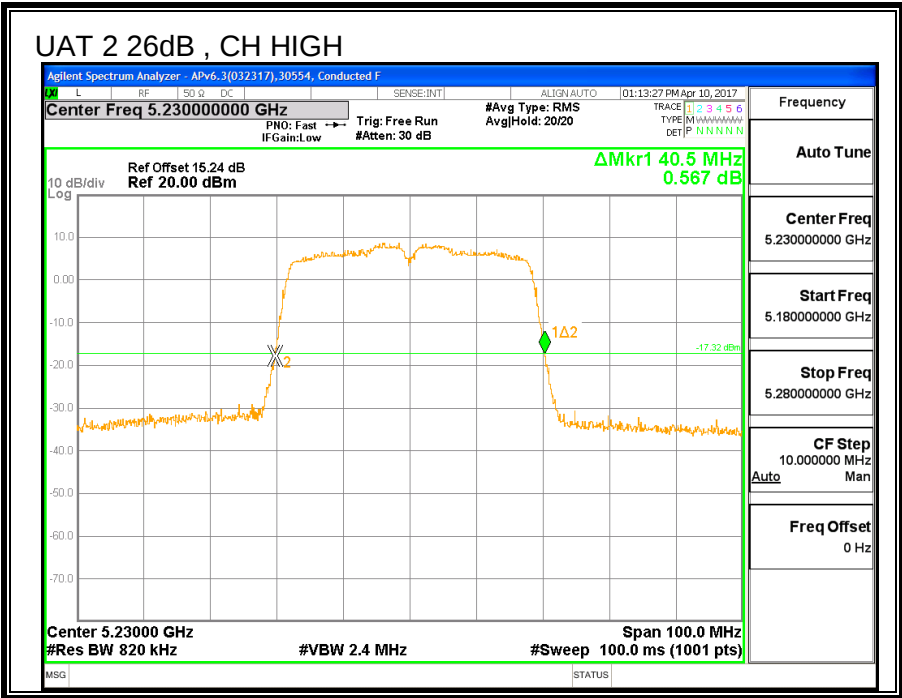
LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency	26 dB BW UAT 2 (MHz)	26 dB BW LAT 3 (MHz)
Low	5190	40.4	40.1
High	5230	40.5	40.1





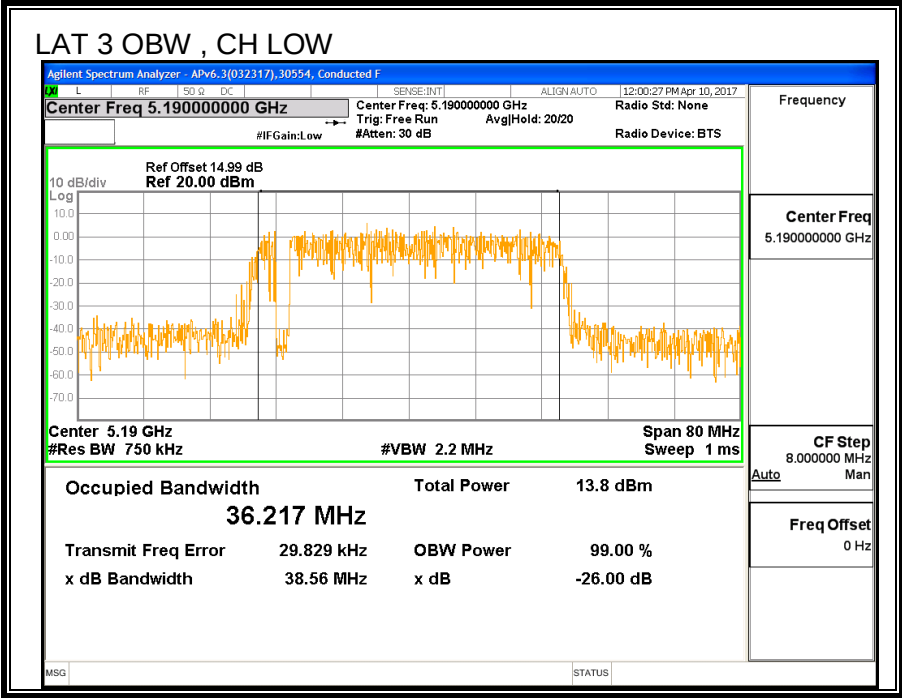
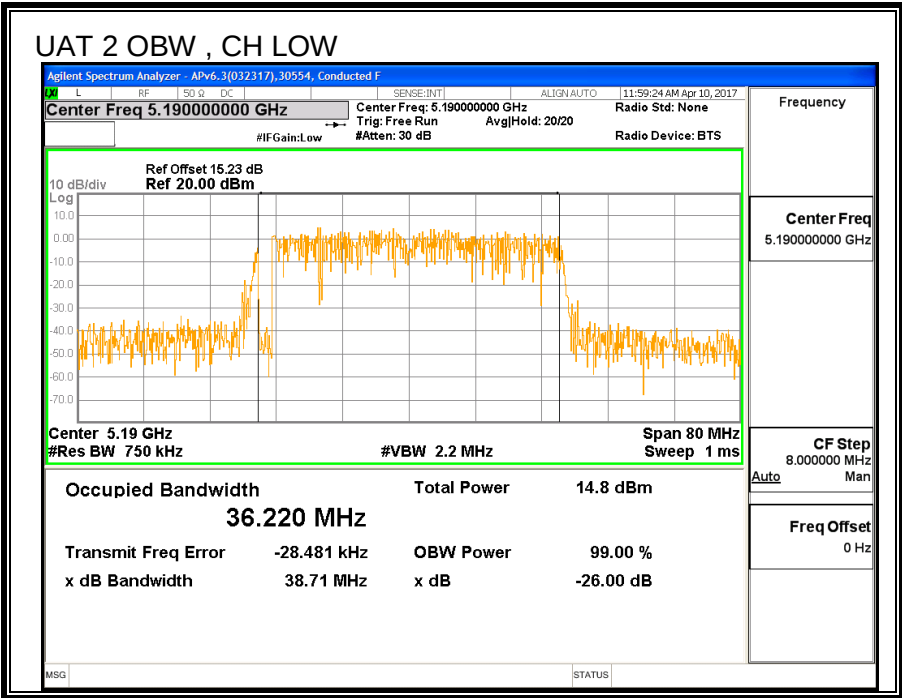
8.6.2. 99% BANDWIDTH

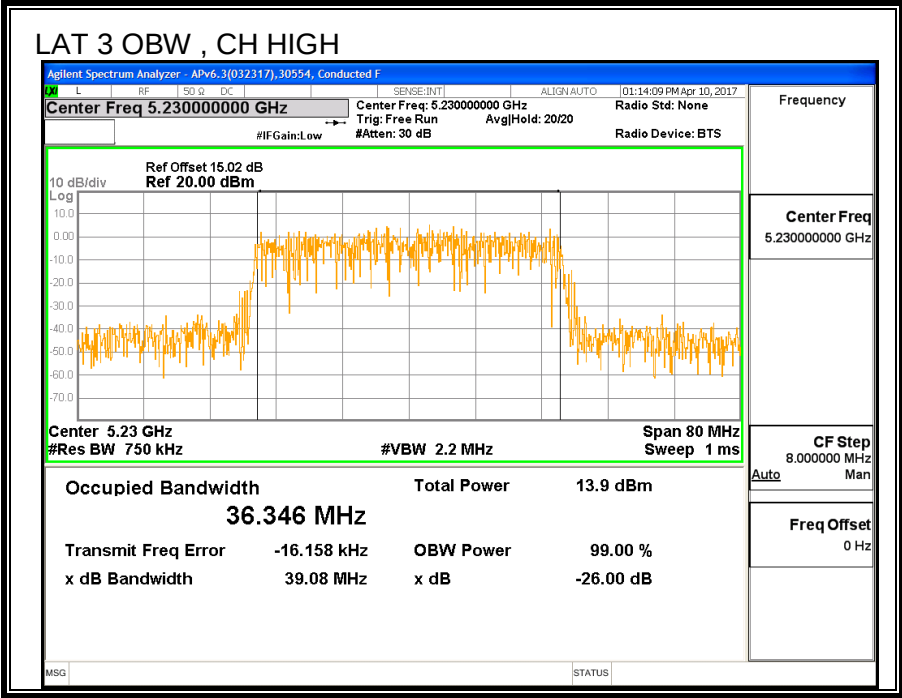
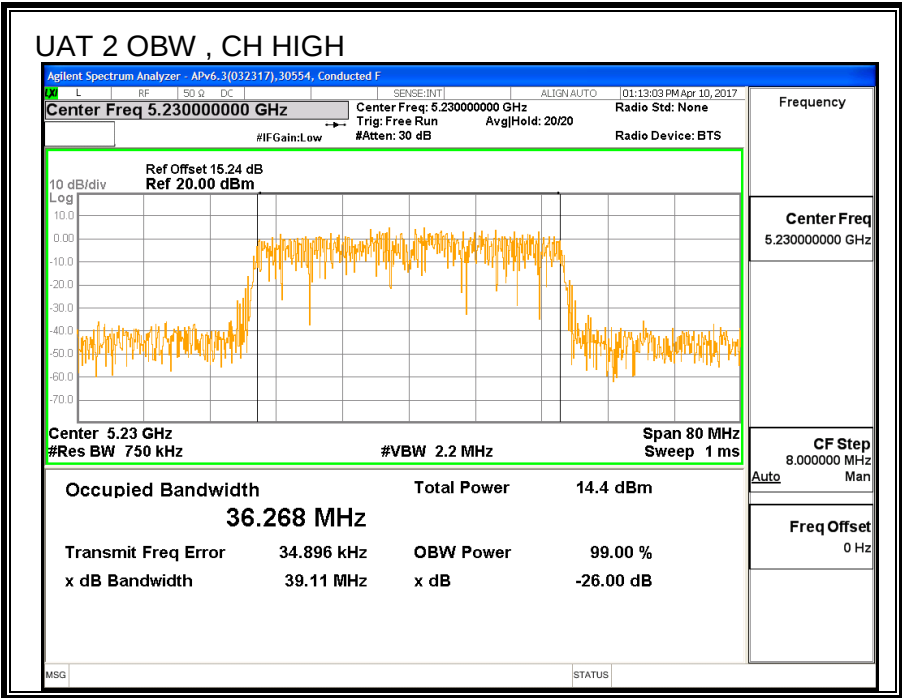
LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency	99% BW UAT 2 (MHz)	99% BW LAT 3 (MHz)
Low	5190	36.220	36.217
High	5230	36.268	36.346





8.6.3. AVERAGE POWER

ID:	30554	Date:	7/13/2017
------------	-------	--------------	-----------

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

RESULTS

Average Power Results

Channel	Frequency (MHz)	UAT 2 Power (dBm)	LAT 3 Power (dBm)	Total Power (dBm)
Low	5190	14.79	14.98	17.90
High	5230	19.41	19.46	22.45

8.6.4. OUTPUT POWER AND PPSD

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

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

UAT 2 Antenna Gain (dBi)	LAT 3 Antenna Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)
-3.36	-1.30	-2.21

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

UAT 2 Antenna Gain (dBi)	LAT 3 Antenna Gain (dBi)	Correlated Chains Directional Gain (dBi)
-3.36	-1.30	0.74

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	5190	-2.21	0.74	24.00	11.00
High	5230	-2.21	0.74	24.00	11.00

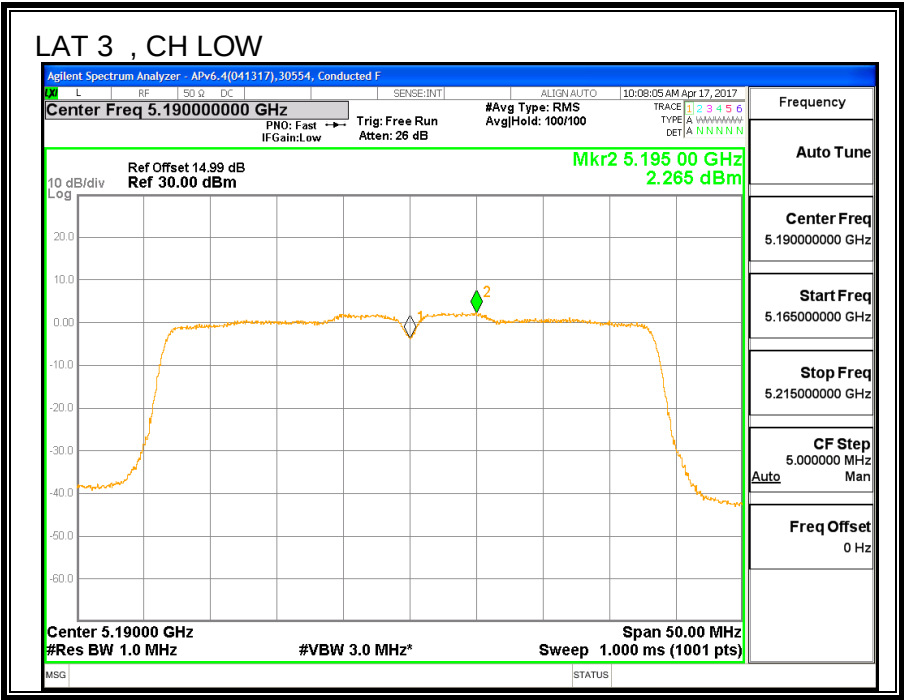
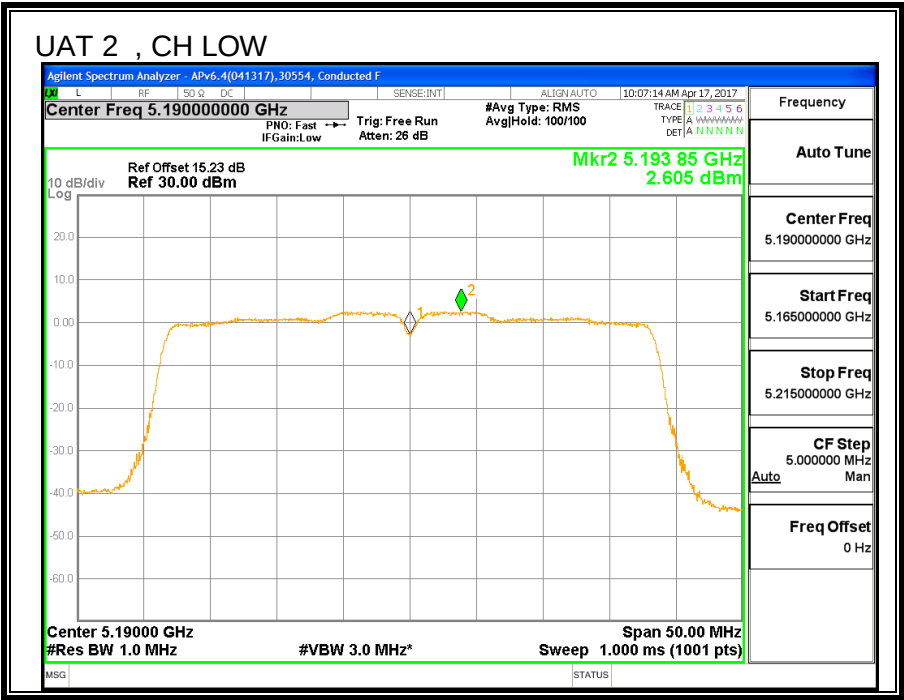
Duty Cycle CF (dB)	0.10	Included in Calculations of Corr'd PSD
--------------------	------	--

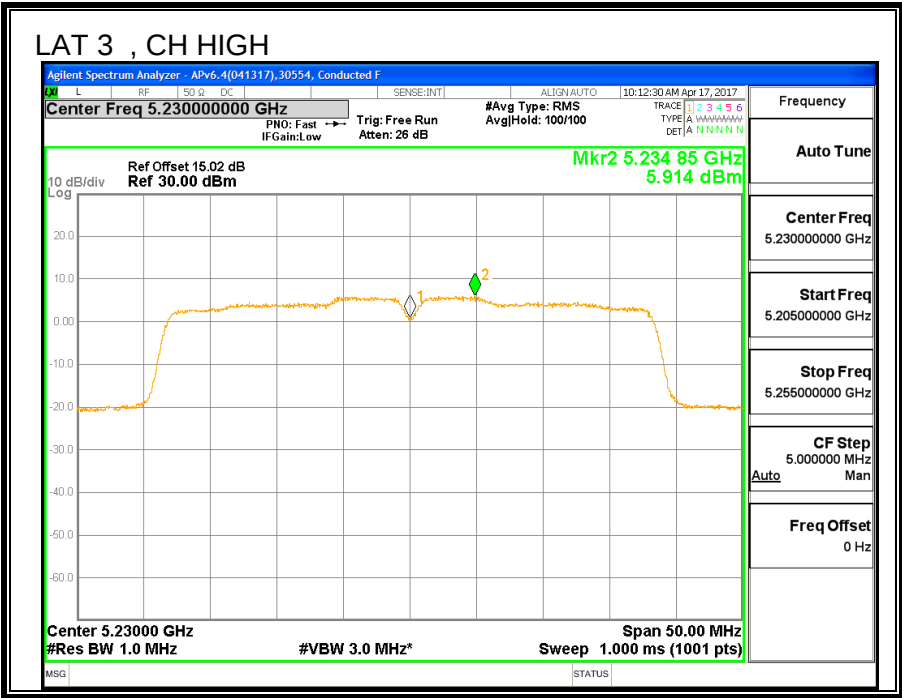
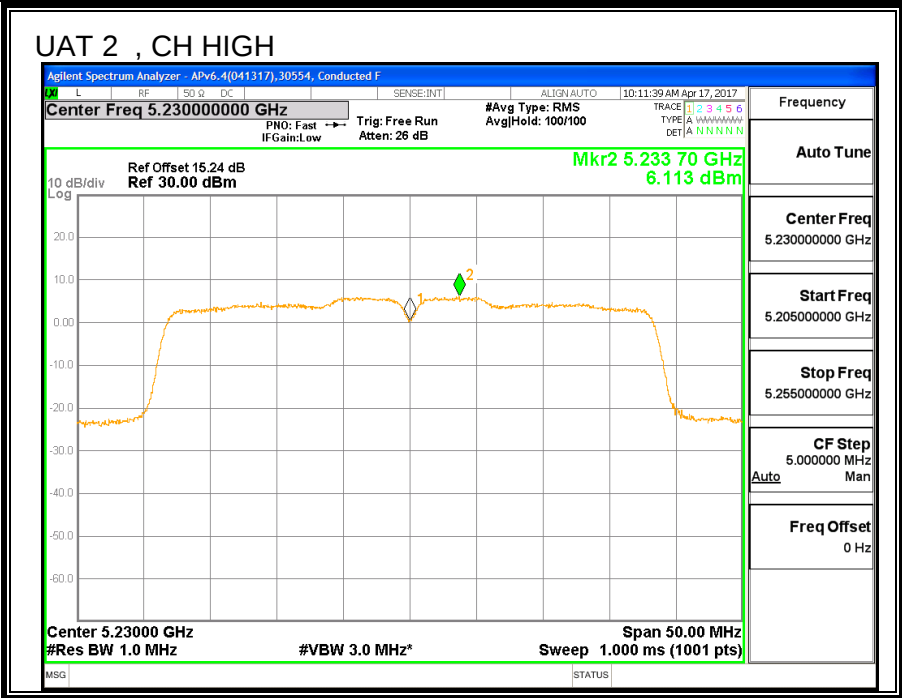
Output Power Results

Channel	Frequency (MHz)	UAT 2 Meas Power (dBm)	LAT 3 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5190	14.79	14.98	17.90	24.00	-6.10
High	5230	19.41	19.46	22.45	24.00	-1.55

PSD Results

Channel	Frequency (MHz)	UAT 2 Meas PSD (dBm)	LAT 3 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Low	5190	2.61	2.27	5.55	11.00	-5.45
High	5230	6.11	5.91	9.12	11.00	-1.88





8.7. 11ac HT80 UAT 2 SISO MODE IN THE 5.2GHz BAND

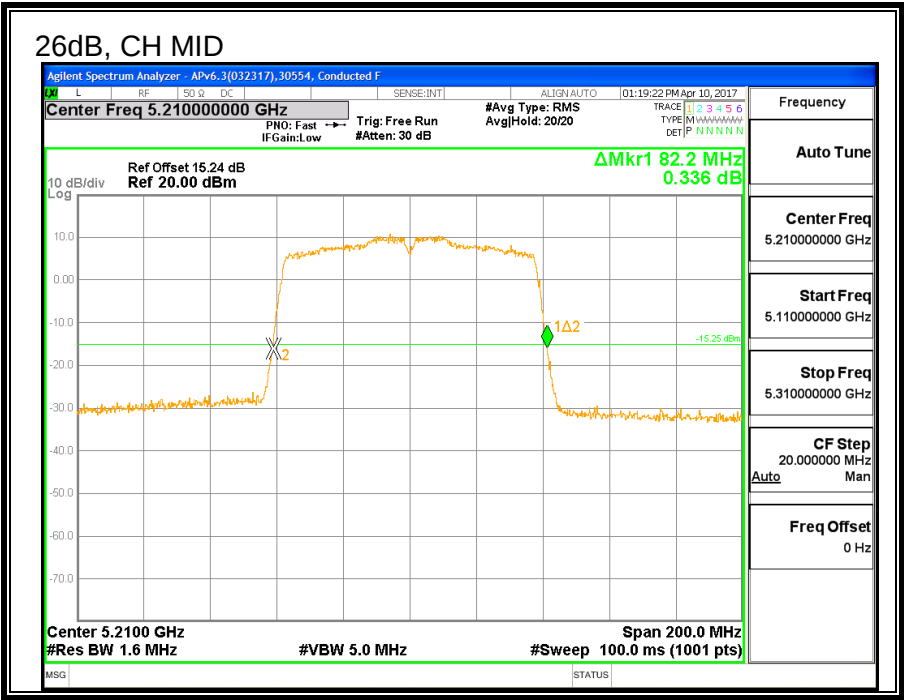
8.7.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency	26 dB BW UAT 2 (MHz)
Mid	5210	82.20



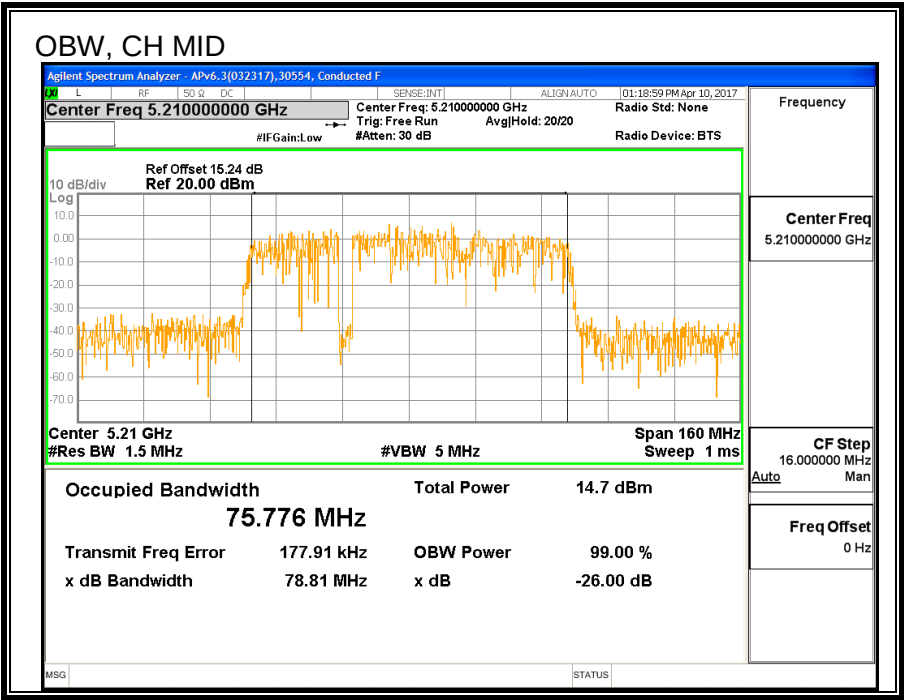
8.7.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency	99% BW UAT 2 (MHz)
Mid	5210	75.776



8.7.3. AVERAGE POWER

ID:	30554	Date:	7/13/2017
------------	-------	--------------	-----------

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

RESULTS

Channel	Frequency	Power UAT 2 (dBm)
Mid	5210	15.42

8.7.4. OUTPUT POWER AND PPSD

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)
Mid	5210	-3.36	-3.36	24.00	11.00

Duty Cycle CF (dB)	0.20	Included in Calculations of Corr'd PSD
--------------------	------	--

Output Power Results

Channel	Frequency (MHz)	UAT 2 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Mid	5210	15.42	15.42	24.00	-8.58

PSD Results

Channel	Frequency (MHz)	UAT 2 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
Mid	5210	1.27	1.47	11.00	-9.53

