



CERTIFICATION TEST REPORT

Report Number. : 12204475-E3V3

Applicant : APPLE, INC.
1 APPLE PARK WAY
CUPERTINO, CA 95014, U.S.A.

Model : A2098

FCC ID : BCG-E3233A

ISED ID : 579C-E3233A

EUT Description : SMARTPHONE

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C
ISED RSS-247 ISSUE 2

Date Of Issue:
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NVLAP LAB CODE 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	7/17/2018	Initial Issue	Chin Pang
V2	7/19/2018	Address TCB's Questions	Chin Pang
V3	8/10/2018	Address TCB's Questions	Jingang Li

TABLE OF CONTENTS

REPORT REVISION HISTORY	2
TABLE OF CONTENTS	3
1. ATTESTATION OF TEST RESULTS	5
2. TEST METHODOLOGY	6
3. FACILITIES AND ACCREDITATION	6
4. CALIBRATION AND UNCERTAINTY	7
4.1. <i>MEASURING INSTRUMENT CALIBRATION</i>	7
4.2. <i>SAMPLE CALCULATION</i>	7
4.3. <i>MEASUREMENT UNCERTAINTY</i>	7
5. EQUIPMENT UNDER TEST	8
5.1. <i>EUT DESCRIPTION</i>	8
5.2. <i>MAXIMUM OUTPUT POWER</i>	8
5.3. <i>DESCRIPTION OF AVAILABLE ANTENNAS</i>	8
5.4. <i>SOFTWARE AND FIRMWARE</i>	8
5.5. <i>WORST-CASE CONFIGURATION AND MODE</i>	9
5.6. <i>DESCRIPTION OF TEST SETUP</i>	10
6. MEASUREMENT METHOD	15
7. TEST AND MEASUREMENT EQUIPMENT	16
8. ANTENNA PORT TEST RESULTS	17
8.1. <i>ON TIME AND DUTY CYCLE</i>	17
8.2. <i>99% BANDWIDTH</i>	19
8.2.1. 802.11b MODE	20
8.2.2. 802.11n HT20 MODE	24
8.2.3. 2TX Antenna 4 + Antenna 3 CDD MODE	30
8.3. <i>6 dB BANDWIDTH</i>	35
8.3.1. 802.11b MODE	36
8.3.2. 802.11n HT20 MODE	40
8.3.3. 2TX Antenna 4 + Antenna 3 CDD MODE	46
8.4. <i>OUTPUT POWER</i>	51
8.4.1. 802.11b MODE	53
8.4.2. 802.11n HT20 MODE	55
8.4.3. 2TX ANT. 4 + ANT. 3 CDD MODE	57
8.5. <i>POWER SPECTRAL DENSITY</i>	58
8.5.1. 802.11b MODE	59
8.5.2. 802.11n HT20 MODE	65
8.5.3. 2TX Antenna 4 + Antenna 3 CDD MODE	71

8.1. CONDUCTED SPURIOUS EMISSIONS.....	76
8.1.1. 802.11b MODE	77
8.1.2. 802.11n HT20 MODE	81
9. RADIATED TEST RESULTS.....	95
9.1. <i>Antenna 4, b mode 1TX Above 1GHz</i>	96
9.1.1. RESTRICTED BANDEDGE	96
9.1.2. HARMONICS AND SPURIOUS EMISSIONS	106
9.2. <i>Antenna 3, b Mode 1TX ABOVE 1 GHz</i>	112
9.2.1. RESTRICTED BANDEDGE, b MODE.....	112
9.2.2. HARMONICS AND SPURIOUS EMISSIONS	122
9.3. <i>Antenna 4, 802.11HT20 1Tx MODE</i>	128
9.3.1. RESTRICTED BANDEDGE	128
9.4. <i>Antenna 3, 802.11HT20 1Tx MODE</i>	144
9.4.1. RESTRICTED BANDEDGE	144
9.5. <i>Antenna 4+3, 802.11n HT20 2Tx CDD MODE</i>	160
9.5.1. RESTRICTED BANDEDGE	160
9.5.2. 2TX Antenna 4 + Antenna 3 CDD MODE	180
9.6. <i>Worst Case Below 1 GHz</i>	186
9.7. <i>Worst Case 18-26 GHz</i>	188
10. AC POWER LINE CONDUCTED EMISSIONS.....	190
10.1.1. AC Power Line EUT WITH AC ADAPTER	191
10.1.2. AC Power Line EUT WITHWITH LAPTOP	193
11. SETUP PHOTOS.....	195

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE, INC.
1 APPLE PARK WAY
CUPERTINO, CA 95014, U.S.A.

EUT DESCRIPTION: SMARTPHONE

MODEL: A2098

SERIAL NUMBER: C39WF025JWW1

DATE TESTED: JANUARY 24, 2018 – JUNE 26, 2018

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5	Complies

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 the U.S. government.

Approved & Released For
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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, KDB 558074 D01 v04, ANSI C63.10-2013, RSS-GEN Issue 5, and RSS-247 Issue 2.

3. FACILITIES AND ACCREDITATION

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

47173 Benicia Street	47266 Benicia Street
<input type="checkbox"/> Chamber A (ISED:2324B-1)	<input type="checkbox"/> Chamber D (ISED:22541-1)
<input type="checkbox"/> Chamber B (ISED:2324B-2)	<input checked="" type="checkbox"/> Chamber E (ISED:22541-2)
<input type="checkbox"/> Chamber C (ISED:2324B-3)	<input checked="" type="checkbox"/> Chamber F (ISED:22541-3)
	<input checked="" type="checkbox"/> Chamber G (ISED:22541-4)
	<input type="checkbox"/> Chamber H (ISED:22541-5)

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers A through C is covered under ISED company address code 2324B with site numbers 2324B -1 through 2324B-3, respectively. Chambers D through H are covered under ISED Canada company address code 22541 with site numbers 22541 -1 through 22541-5, respectively.

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 [NVLAP Lab Search](#).

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:

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

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
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

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

5. EQUIPMENT UNDER TEST

5.1. EUT DESCRIPTION

The Apple iPhone, is a smartphone with multimedia functions (music, application support, and video), cellular GSM, GPRS, EGPRS, UMTS, LTE, TD-SCDMA, CDMA, IEEE 802.11a/b/g/n/ac, Bluetooth, GPS and NFC. All models support at least one UICC based SIM. The second SIM is either UICC based, electronic SIM (e-SIM), or second SIM is not present. The device has a built-in inductive charging receiver which is not user accessible. The rechargeable battery is not user accessible.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
1Tx			
2412 - 2472	802.11b	21.94	156.31
2412 - 2472	802.11g	Covered by 11n HT20	
2412 - 2472	802.11n HT20	21.89	154.53

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2Tx			
2412 - 2472	802.11n HT20 CDD	23.87	243.78

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Range (GHz)	Antenna 4 (dBi)	Antenna 3 (dBi)
2.4	-2.8	-4.1

5.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was v16.30.67.7

5.5. WORST-CASE CONFIGURATION AND MODE

The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z, it was determined that Y (Landscape) orientation was the worst-case orientation for both Ant 4 (Antenna 4) and Ant 3 (Antenna 3). And for 2TX, X (Flatbed) orientation was the worst case

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, 18-26GHz and power line conducted emissions were performed with the EUT transmits at the channel with the highest output power as worst-case scenario.

For HT20 modes, radiated harmonics spurious were performed with the EUT set at the 2TX CDD mode with power setting equal or higher than SISO modes as the worst-case scenario. G mode covered by HT20 mode since it has the same power as HT20.

Below 1GHz tests were performed with EUT connected to AC power adapter as the worst case; and for above 1GHz, the worst-case configuration reported was tested with EUT only. For AC line conducted emission, test was investigated with AC power adapter and with laptop. There were no emissions found below 30MHz within 20dB of the limit.

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

802.11b mode: 1 Mbps
802.11n HT20 mode: MCS0

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.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
laptop	Apple	Macbook Pro	C02P41RZG086	FCC Doc
Laptop AC/DC adapter	Liteon Technology	PA-1450-BA1	B123	NA
EUT AC Adapter	Apple	A1385	D293062F3WVDHLHCF	NA

I/O CABLES

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

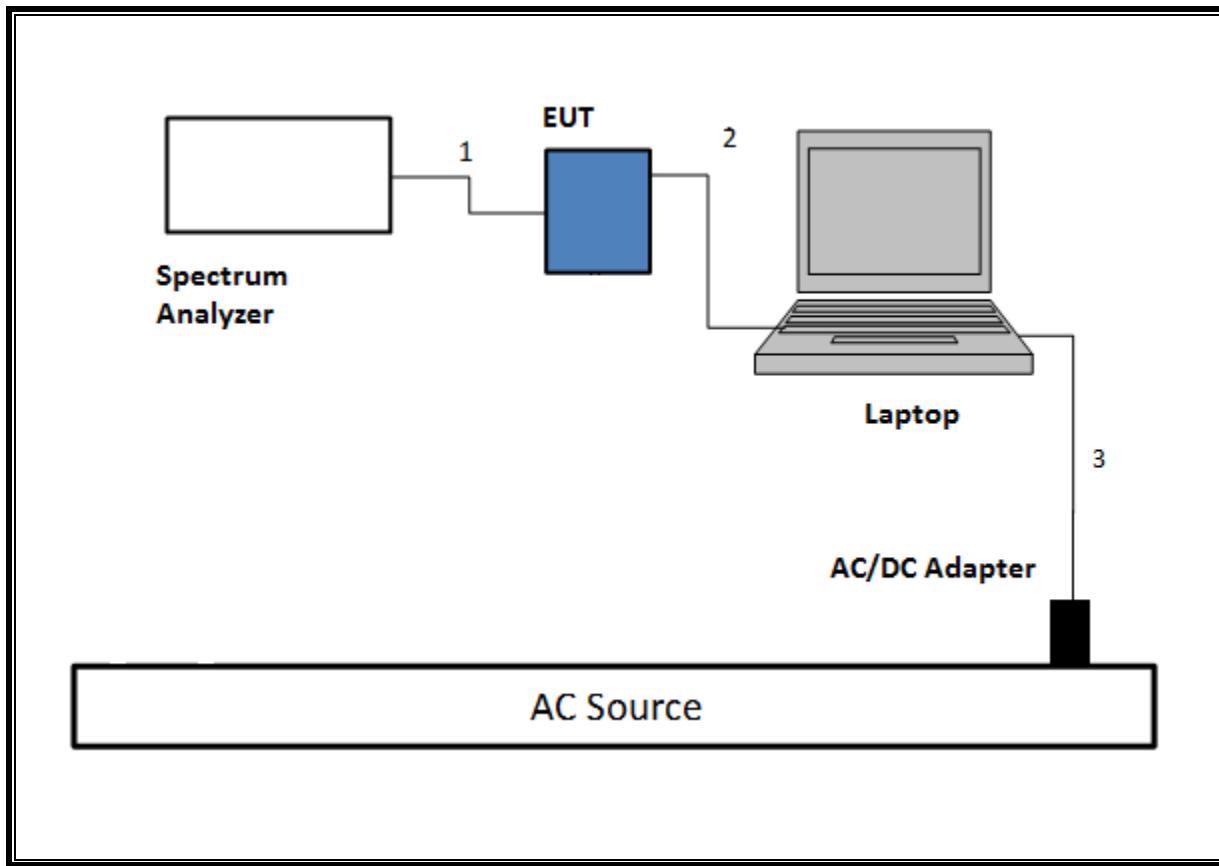
I/O CABLES (RADIATED ABOVE 1 GHZ)

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

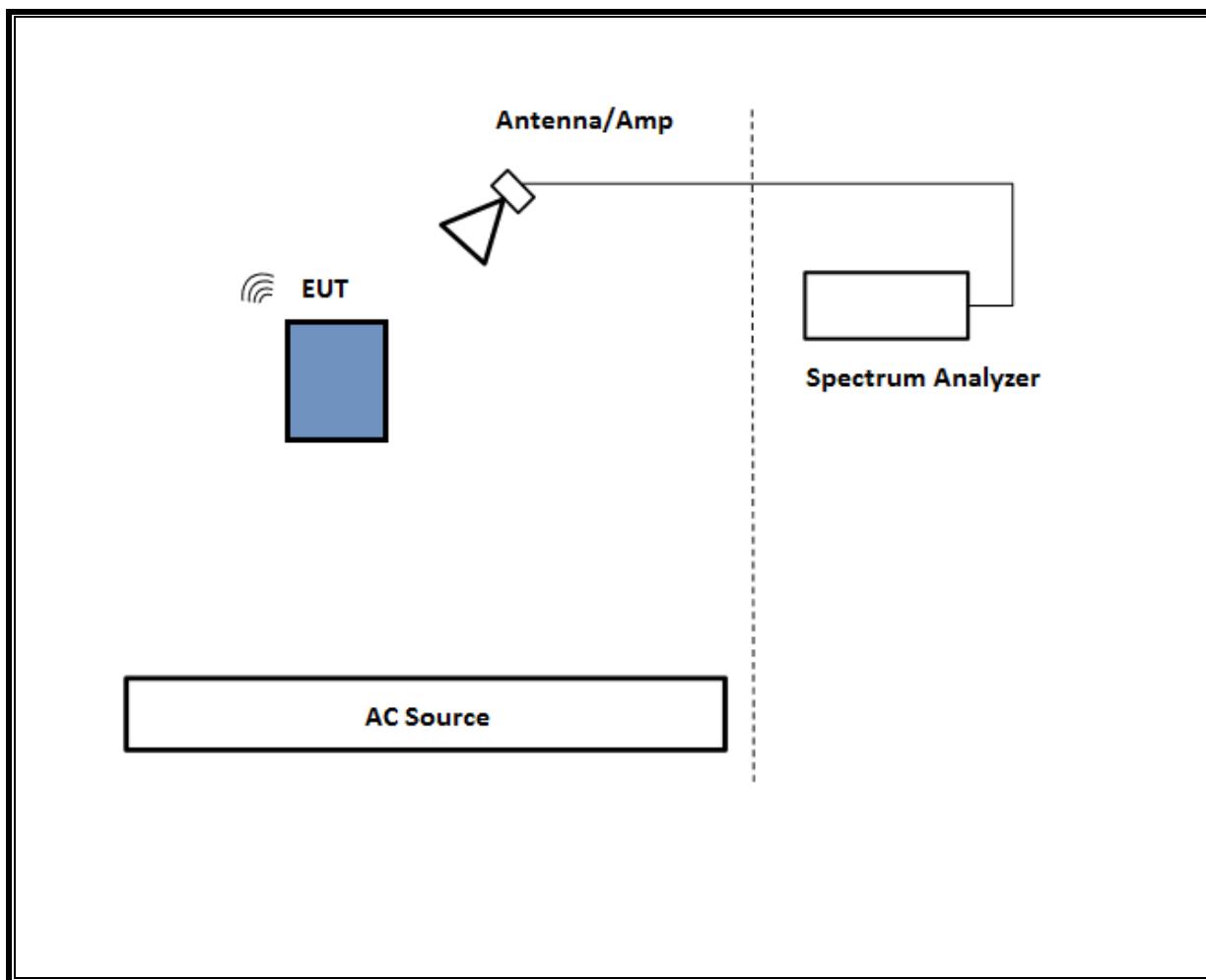
I/O CABLES (BELOW 1GHz AND AC POWER LINE TEST WITH ADAPTER AND LAPTOP)

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

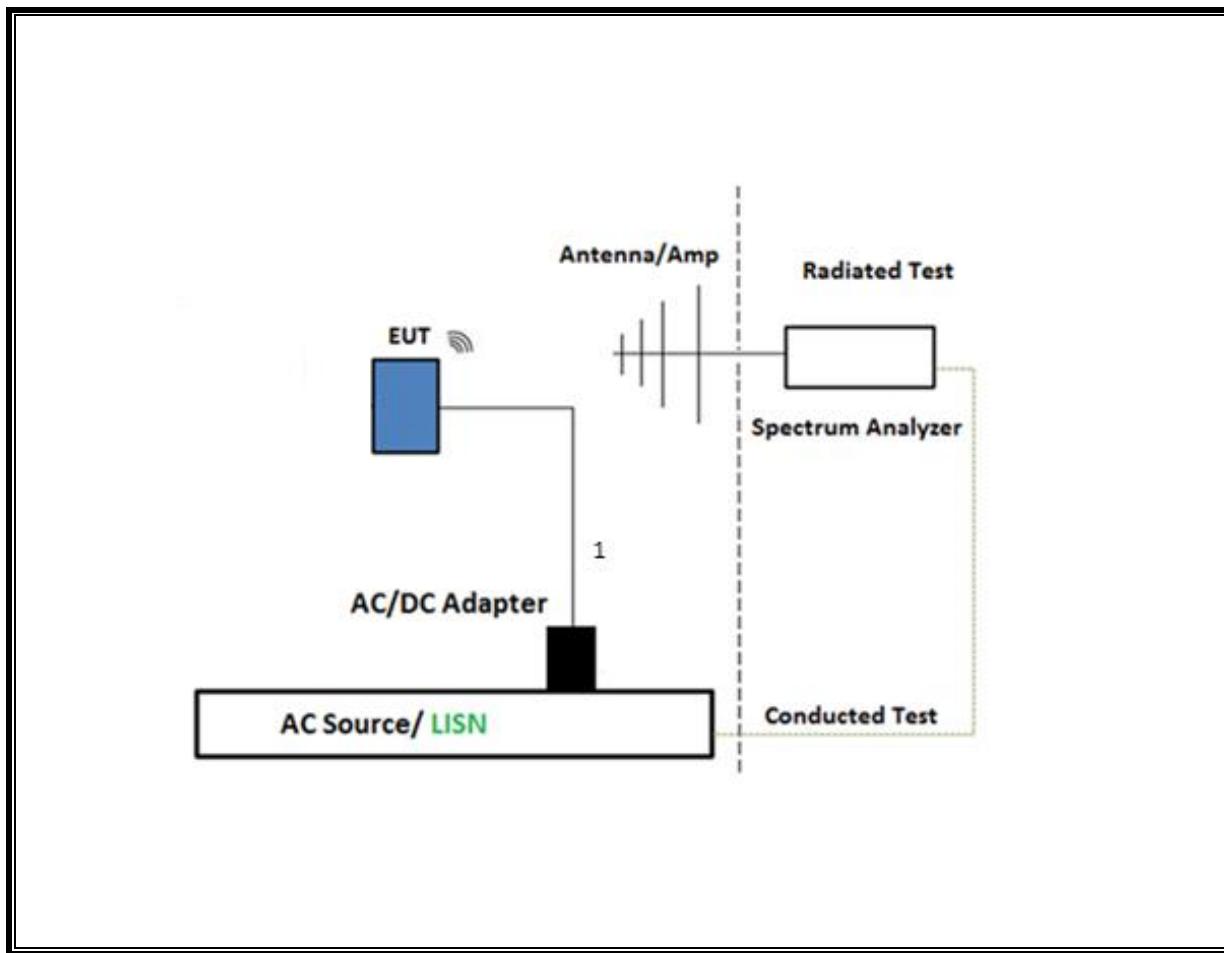
SETUP DIAGRAM FOR CONDUCTED TESTS



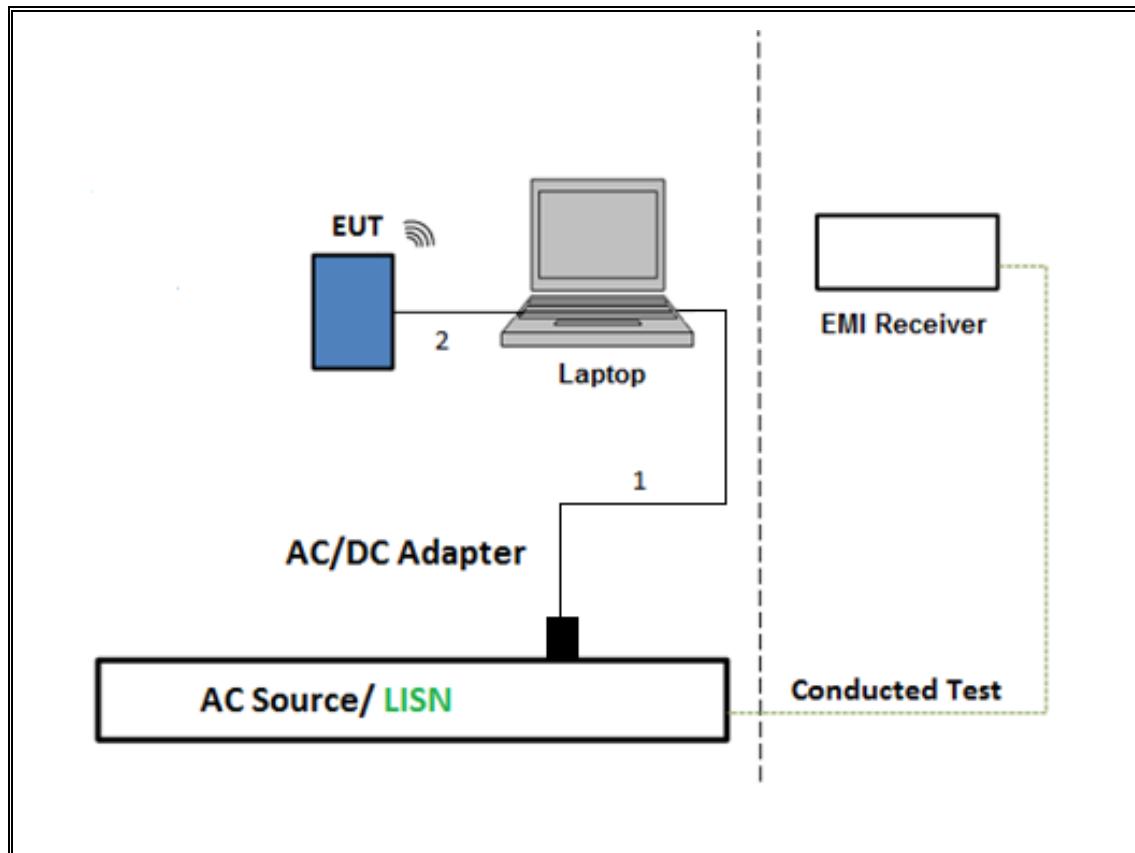
SETUP DIAGRAM FOR RADIATED TESTS



SETUP DIAGRAM FOR LINE CONDUCTED TEST



TEST SETUP- AC LINE CONDUCTED: LAPTOP CONFIGURATION



6. MEASUREMENT METHOD

On Time and Duty Cycle: KDB 558074 D01 v04, Section 6.

6 dB BW: KDB 558074 D01 v04, Section 8.1.

99% BW: ANSI C63.10-2013, Section 6.9.3.

Output Power: KDB 558074 D01 v04, Section 9.2.3.2.

Power Spectral Density: KDB 558074 D01 v04, Section 10.2.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v04, Section 11.1 (b).

Out-of-band emissions in restricted bands: KDB 558074 D01 v04, Section 12.1.

Band-edge: KDB 558074 D01 v04, Section 12.1.

AC Power Line Conducted Emissions: ANSI C63.10-2013, Section 6.2.

7. TEST AND MEASUREMENT EQUIPMENT

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

Description	Manufacturer	Model	ID Num	Cal Due
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T346	04/03/2019
Amplifier, 1 to 18GHz	Miteq	AFS42-00101800-25-S-42	T741	12/30/2018
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	T906	02/16/2019
*Antenna, Horn 1-18GHz	ETS Lindgren	3117	T345	04/14/2018
*Amplifier, 1 to 18GHz	Miteq	AFS42-00101800-25-S-42	T491	06/01/2018
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A-544	T341	11/12/2018
*Antenna, Horn 1-18GHz	ETS Lindgren	3117	T344	04/20/2018
*Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB1	T185	03/30/2018
*Amplifier, 1 to 18GHz, 35dB	Ampical	AMP1G18-35	T1569	05/31/2018
*Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	T835	06/24/2018
*Spectrum Analyzer, PSA, 3Hz to 44GHz	Agilent (Keysight) Technologies	E4446A	T177	03/20/2018
*Antenna Horn 18 to 26.5GHz	ARA	MWH-1826/B	T449	06/12/2018
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1454	01/08/2019
Pre-Amp 18-26GHz	Agilent Technology	8449B	T404	07/23/2018
Antenna, Active Loop 9Khz to 30MHz	ETS-Lindgren	6502	T757	09/14/2018
Power Meter, P-series single channel	Keysight	N1912A	T1273	07/17/2018
Power Sensor	Keysight	N1921A	T1226	08/30/2018
AC Line Conducted				
EMI Test Receiver 9Khz-7GHz	Rohde & Schwarz	ESCI7	T1436	01/25/2019
*LISN for Conducted Emissions CISPR-16	Fischer	50/250-25-2-01	T1310	06/15/2018
Power Cable, Line Conducted Emissions	UL	PG1	T861	08/31/2018
*LISN for Conducted Emissions CISPR-16	Fischer	50/250-25-2-01	T1310	06/15/2018
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: *Testing is completed before equipment expiration date.

8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

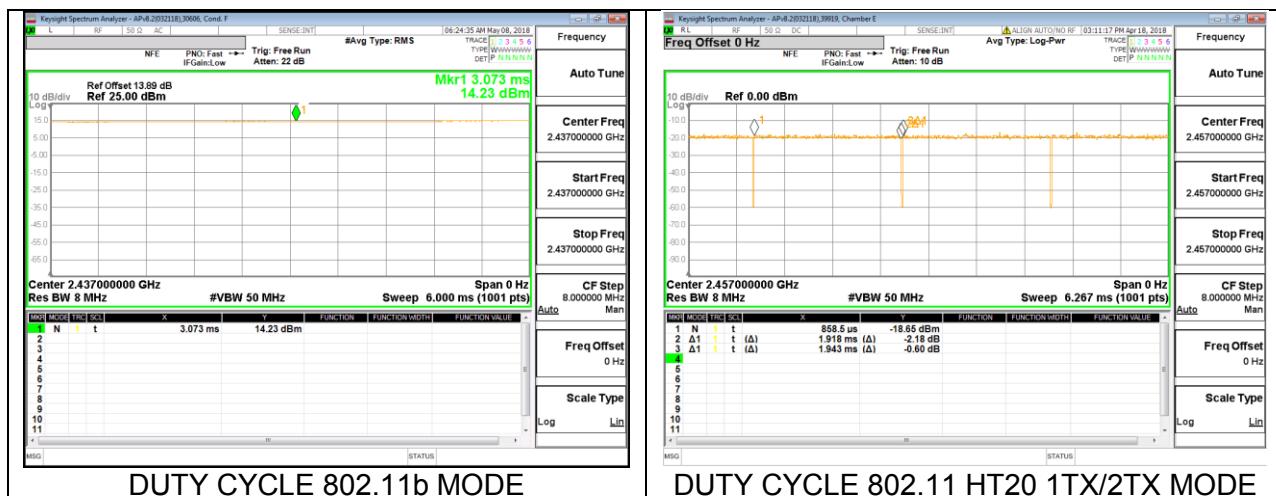
PROCEDURE

KDB 558074 D01 v04, Section 6.

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4GHz Band						
802.11b 1TX	100.0	100.0	1.000	100.00%	0.00	0.010
802.11n HT20 1TX/2TX	1.918	1.943	0.987	98.71%	0.00	0.010

DUTY CYCLE PLOTS



8.2. 99% BANDWIDTH

LIMITS

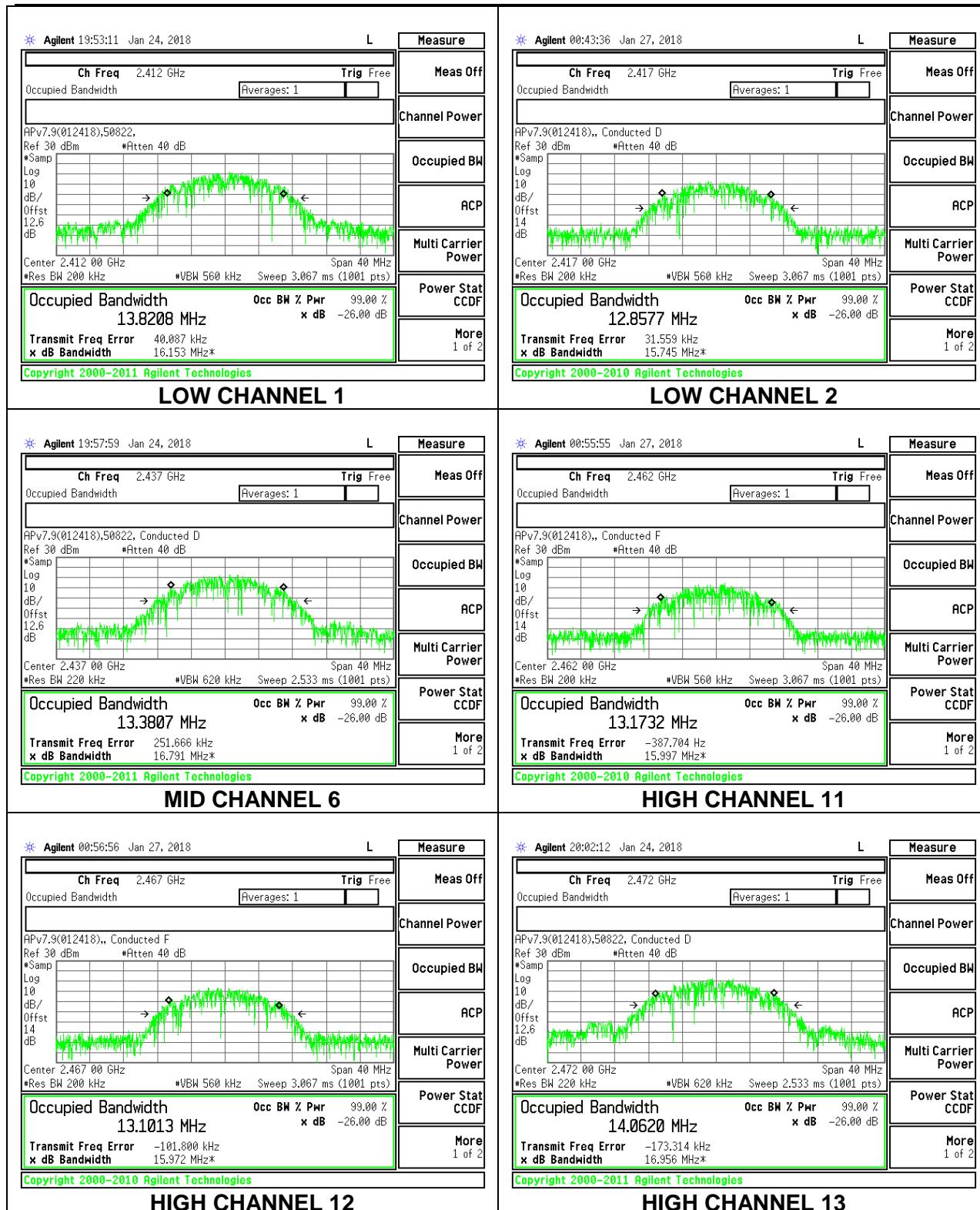
None; for reporting purposes only.

RESULTS

8.2.1. 802.11b MODE

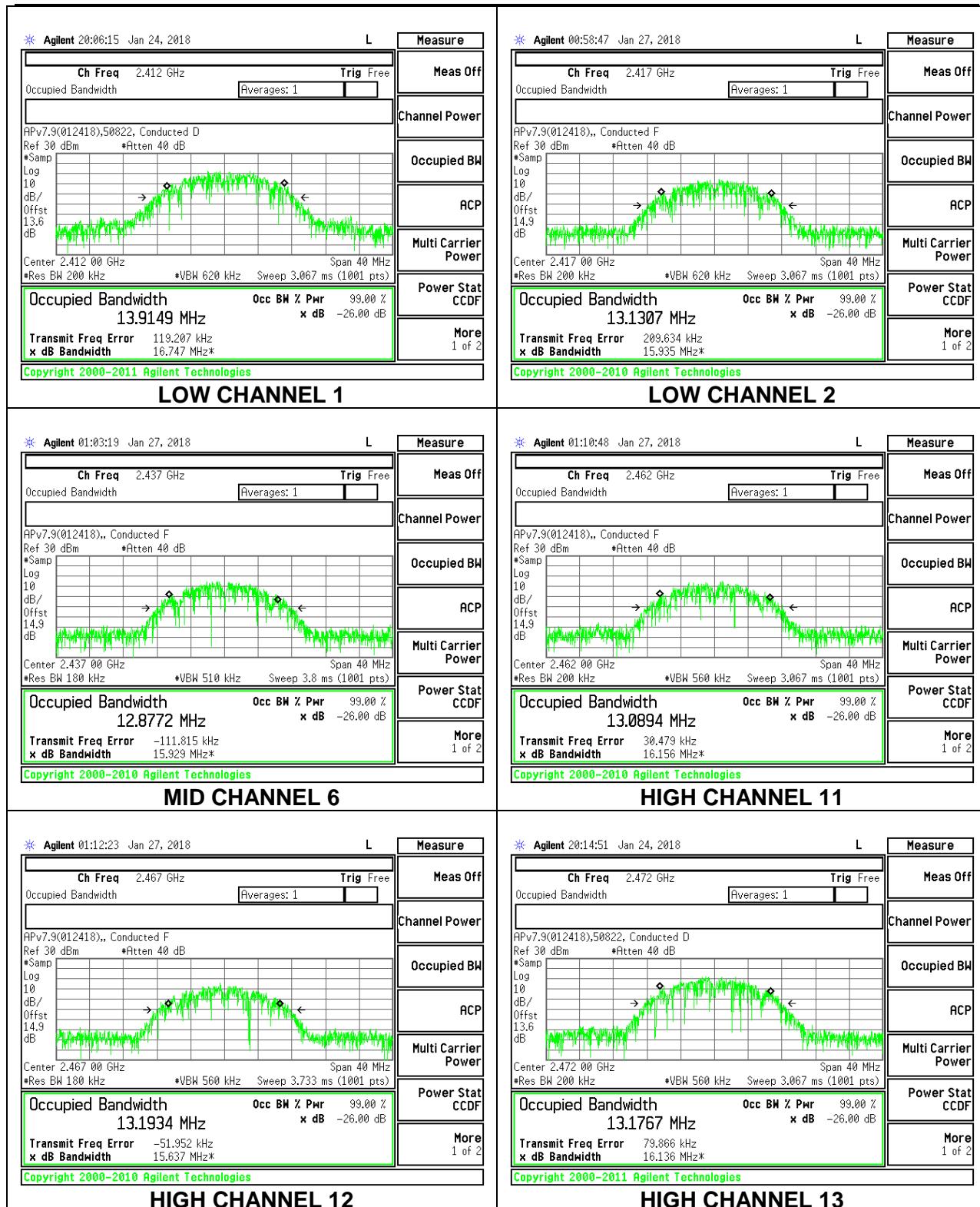
1TX Antenna 4

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	13.821
Low 2	2417	12.858
Mid 6	2437	13.381
High 11	2462	13.173
High 12	2467	13.101
High 13	2472	14.062



1TX Antenna 3

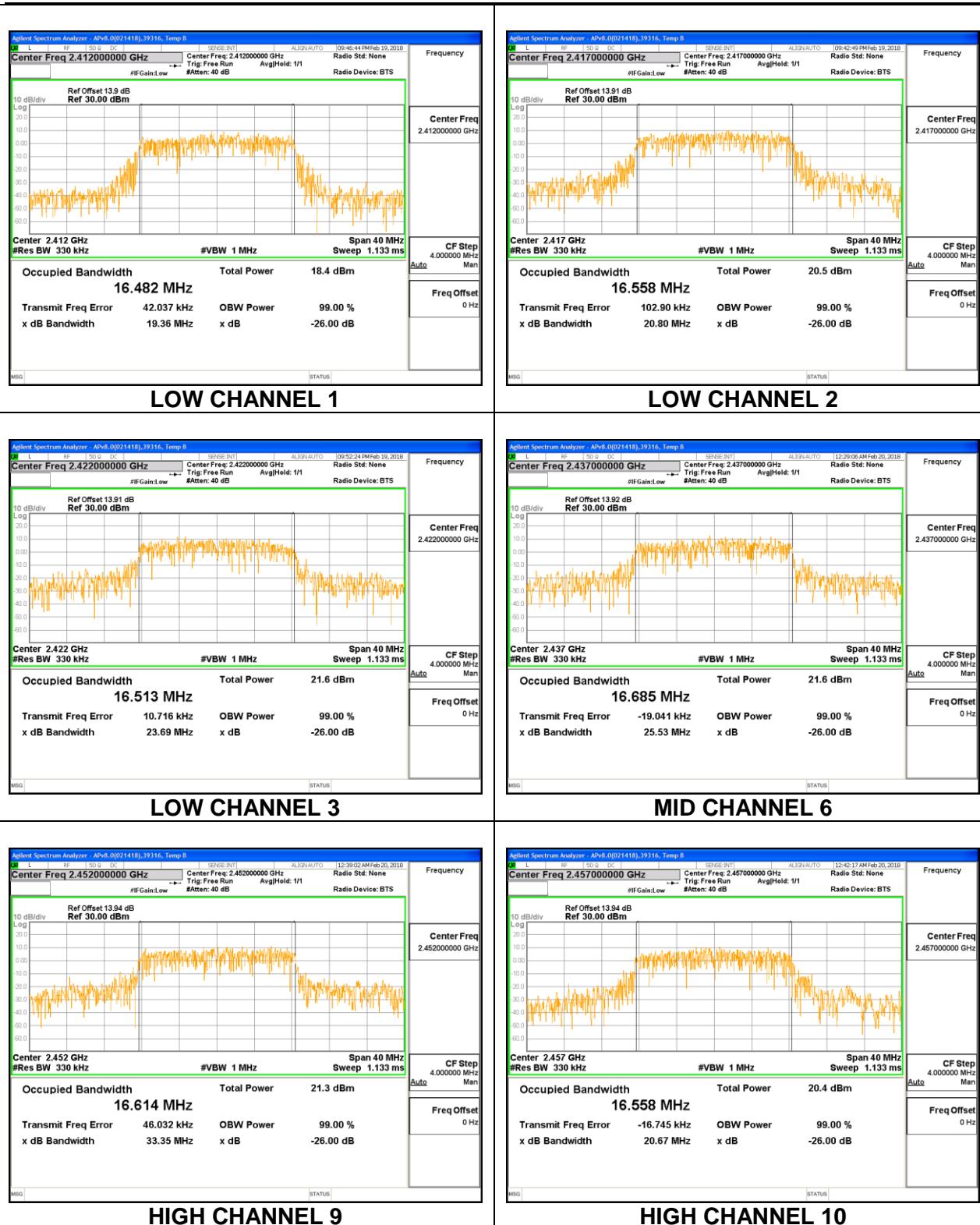
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	13.915
Low 2	2417	13.131
Mid 6	2437	12.877
High 11	2462	13.089
High 12	2467	13.193
High 13	2472	13.177

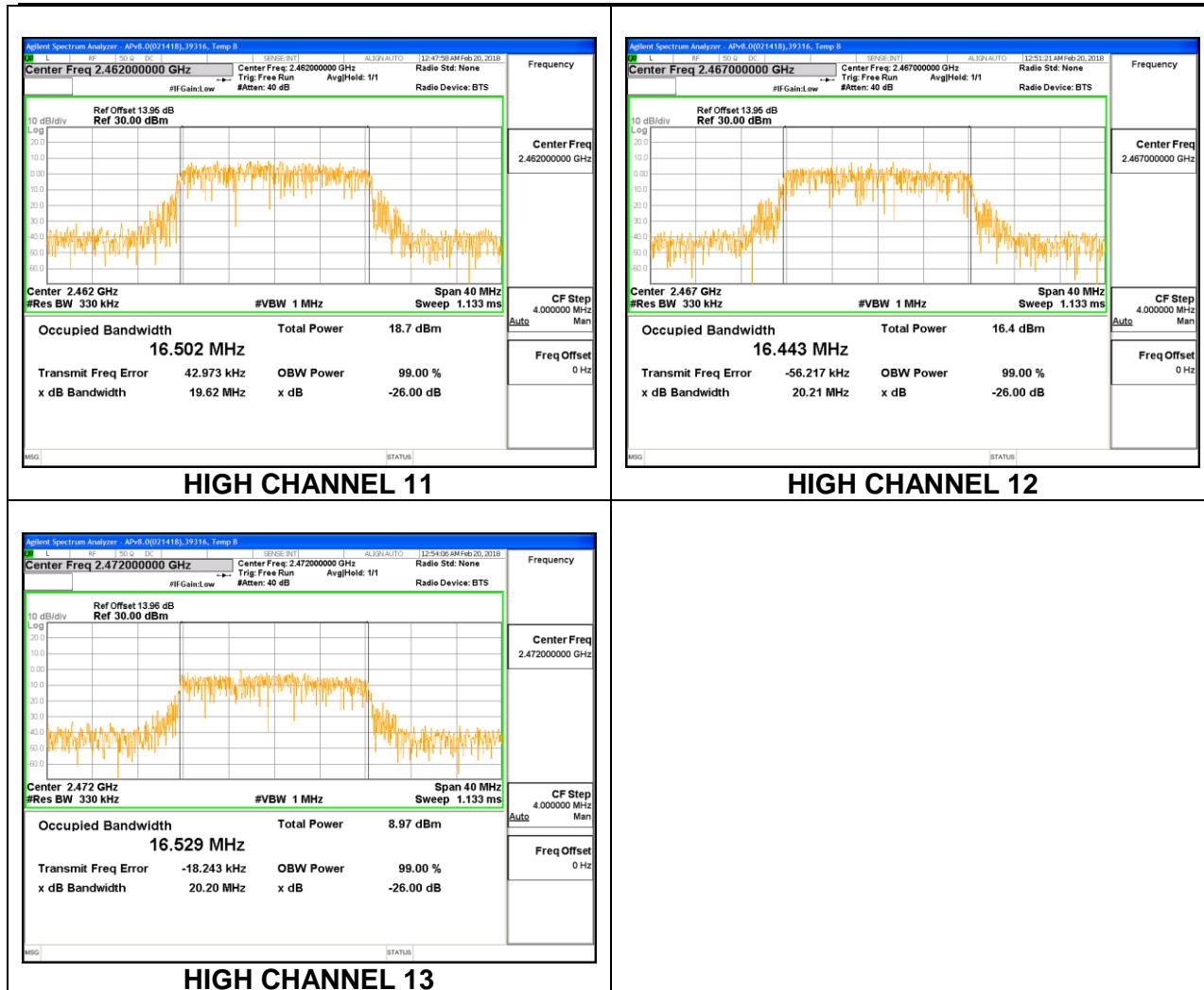


8.2.2. 802.11n HT20 MODE

1TX Antenna 4

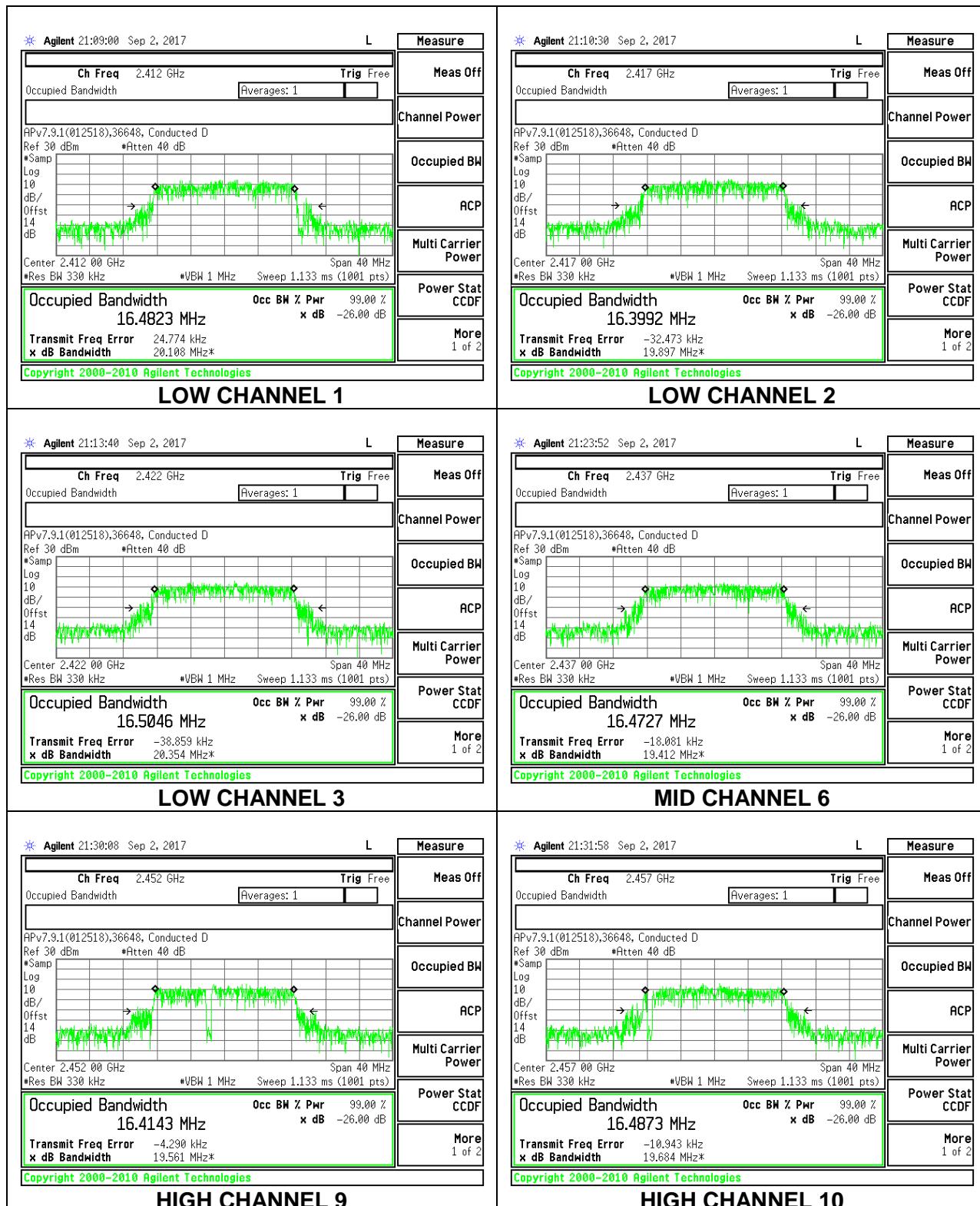
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	16.482
Low 2	2417	16.558
Low 3	2422	16.513
Mid 6	2437	16.685
High 9	2452	16.614
High 10	2457	16.558
High 11	2462	16.502
High 12	2467	16.443
High 13	2472	16.529

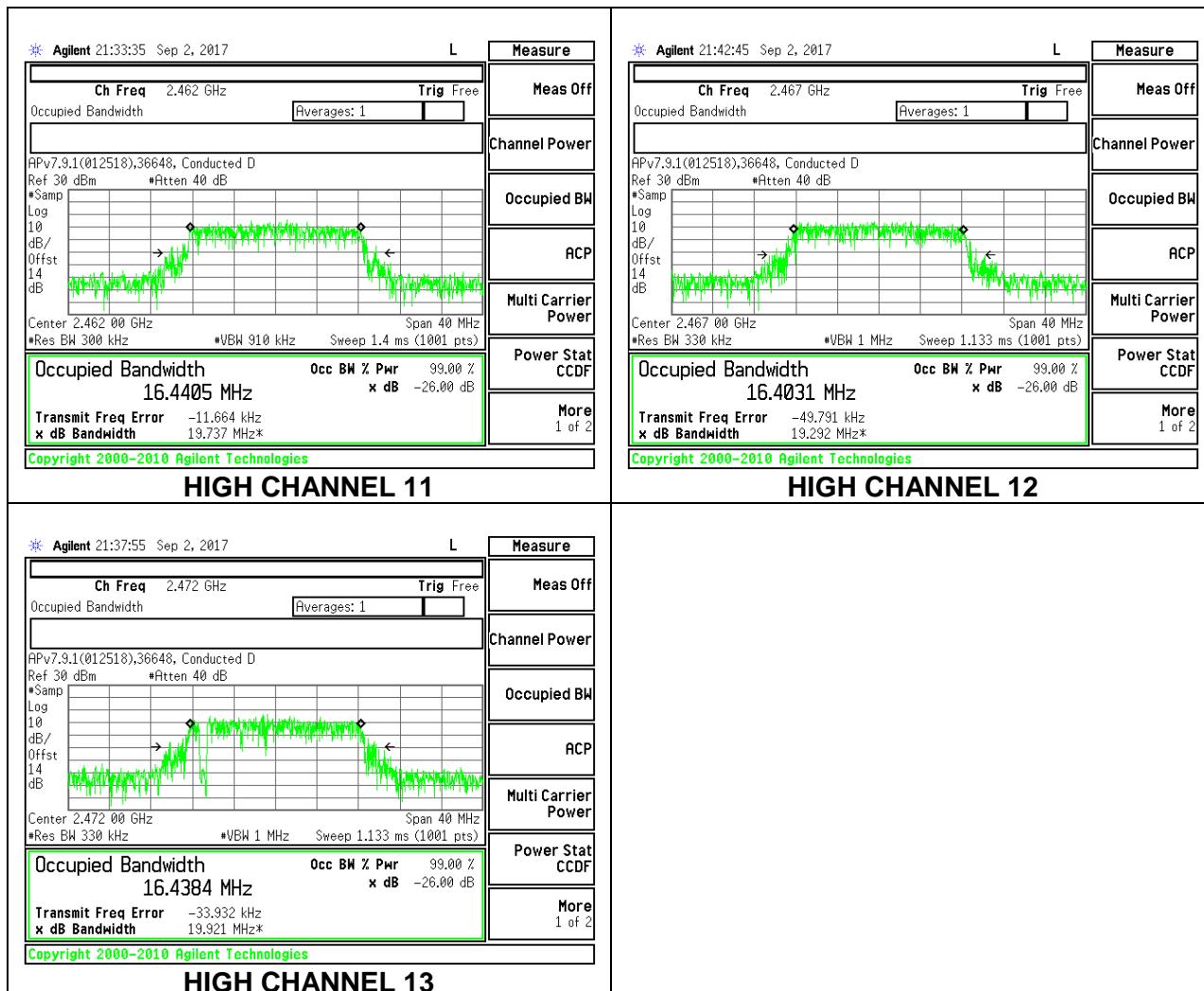




1TX Antenna 3

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	16.482
Low 2	2417	16.399
Low 3	2422	16.505
Mid 6	2437	16.473
High 9	2452	16.414
High 10	2457	16.487
High 11	2462	16.440
High 12	2467	16.403
High 13	2472	16.438

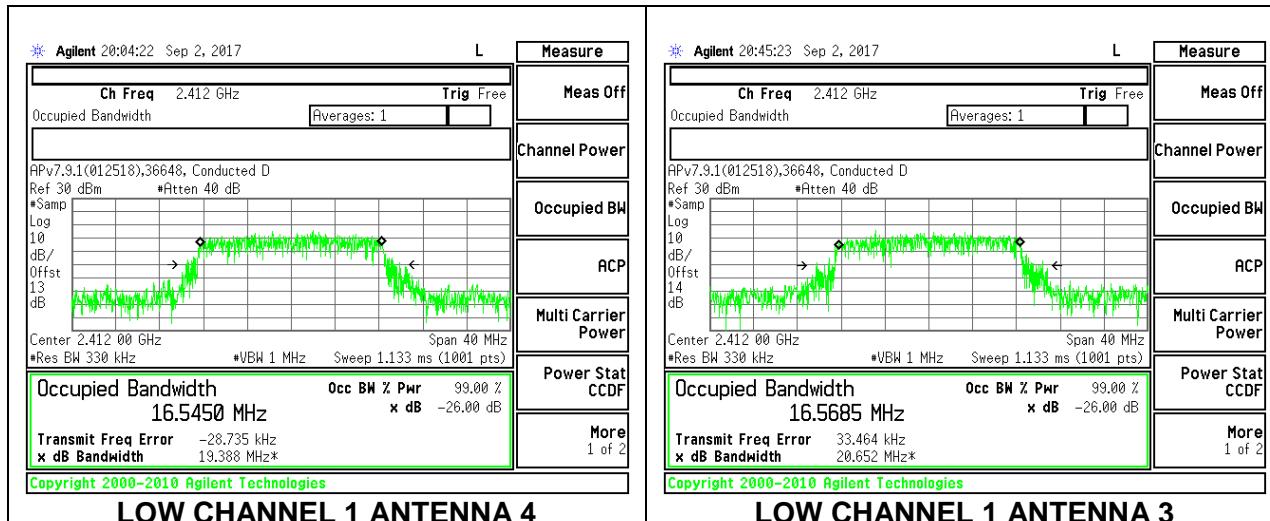




8.2.3. 2TX Antenna 4 + Antenna 3 CDD MODE

Channel	Frequency (MHz)	99% Bandwidth ANT 4 (MHz)	99% Bandwidth ANT 3 (MHz)
Low 1	2412	16.545	16.568
Low 2	2417	16.440	16.534
Low 3	2422	16.494	16.485
Low 4	2427	16.515	16.417
Mid 6	2437	16.551	16.468
High 8	2447	16.504	16.517
High 9	2452	16.412	16.515
High 10	2457	16.413	16.486
High 11	2462	16.517	16.493
High 12	2467	16.487	16.465
High 13	2472	16.520	16.502

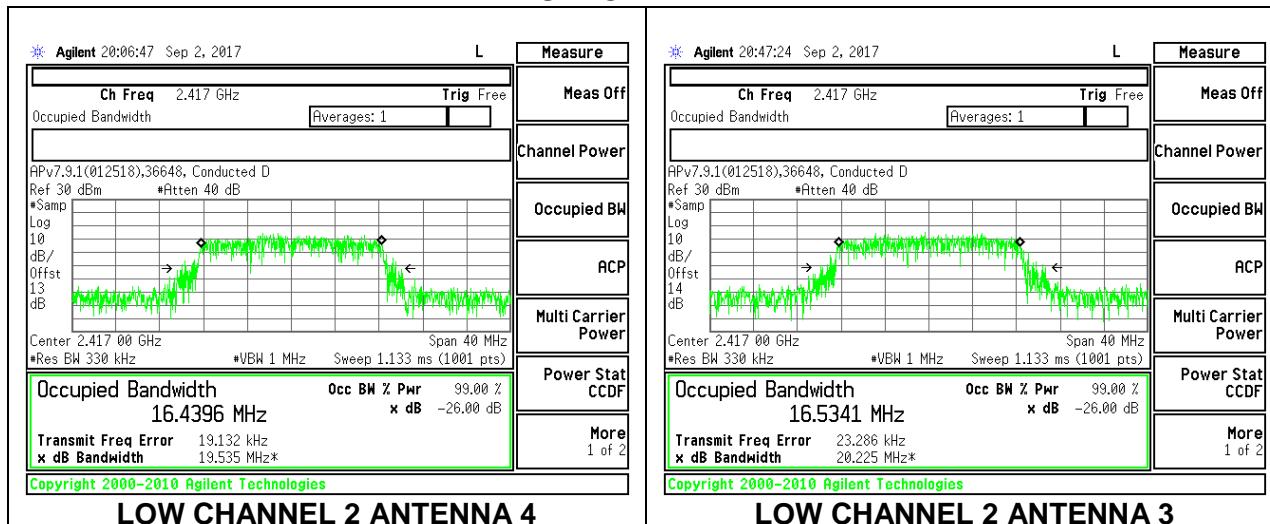
LOW CHANNEL 1



LOW CHANNEL 1 ANTENNA 4

LOW CHANNEL 1 ANTENNA 3

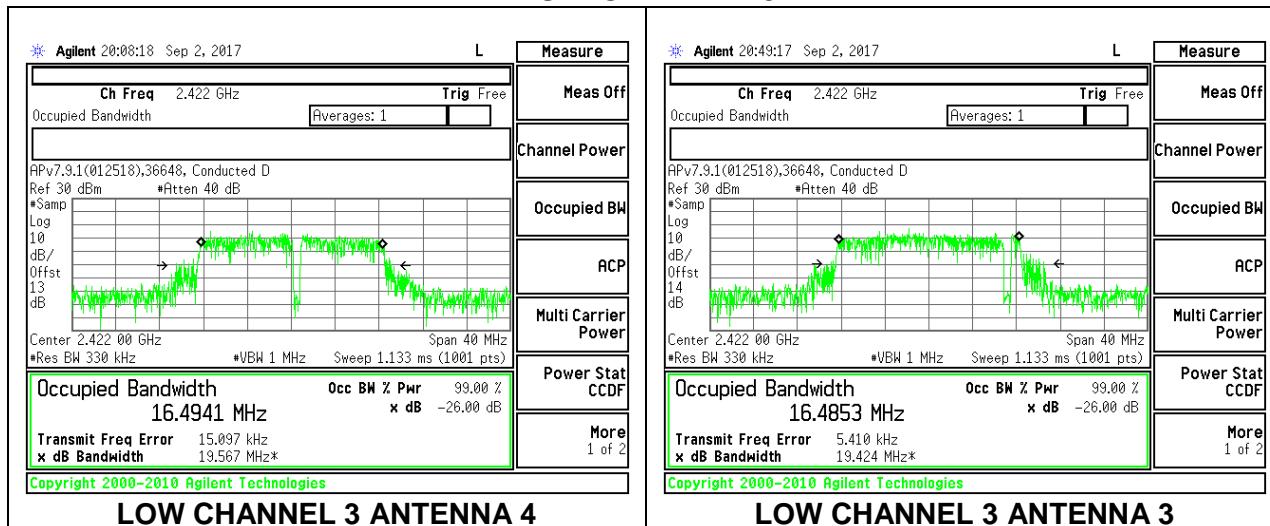
LOW CHANNEL 2



LOW CHANNEL 2 ANTENNA 4

LOW CHANNEL 2 ANTENNA 3

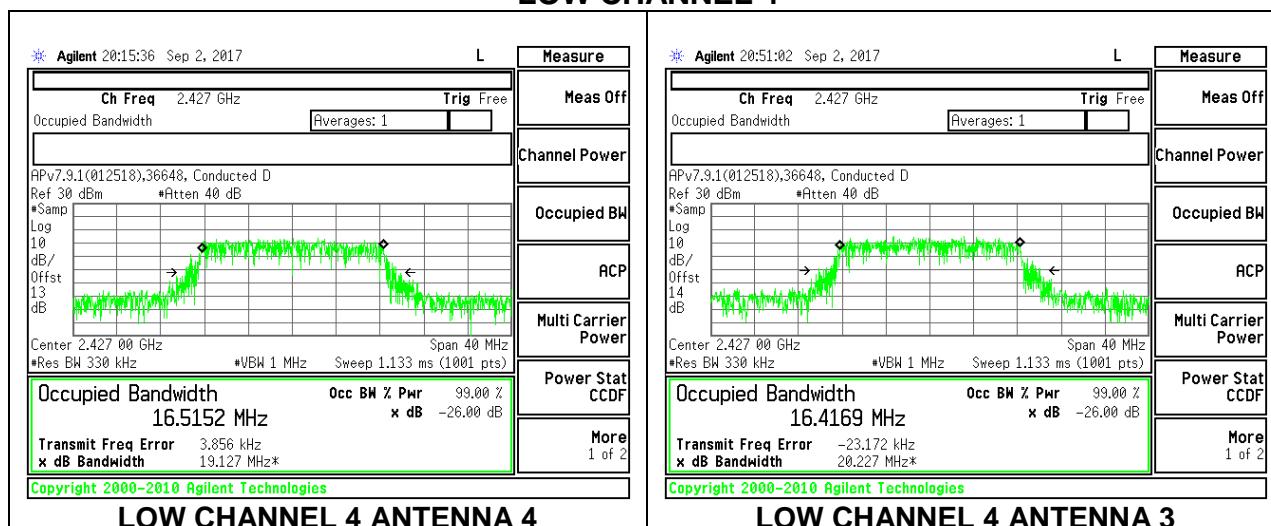
LOW CHANNEL 3



LOW CHANNEL 3 ANTENNA 4

LOW CHANNEL 3 ANTENNA 3

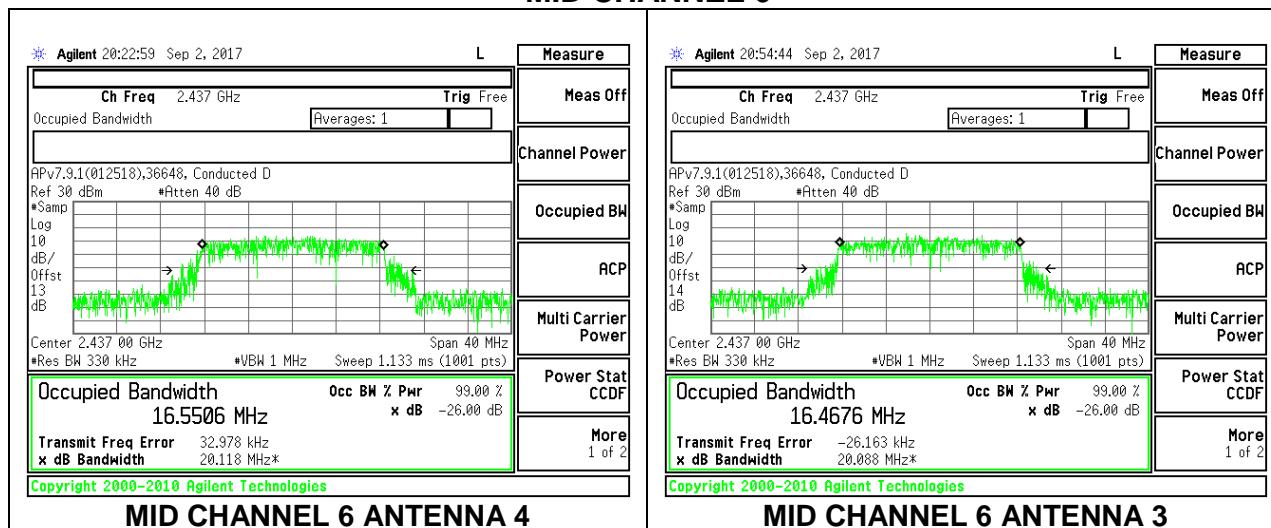
LOW CHANNEL 4



LOW CHANNEL 4 ANTENNA 4

LOW CHANNEL 4 ANTENNA 3

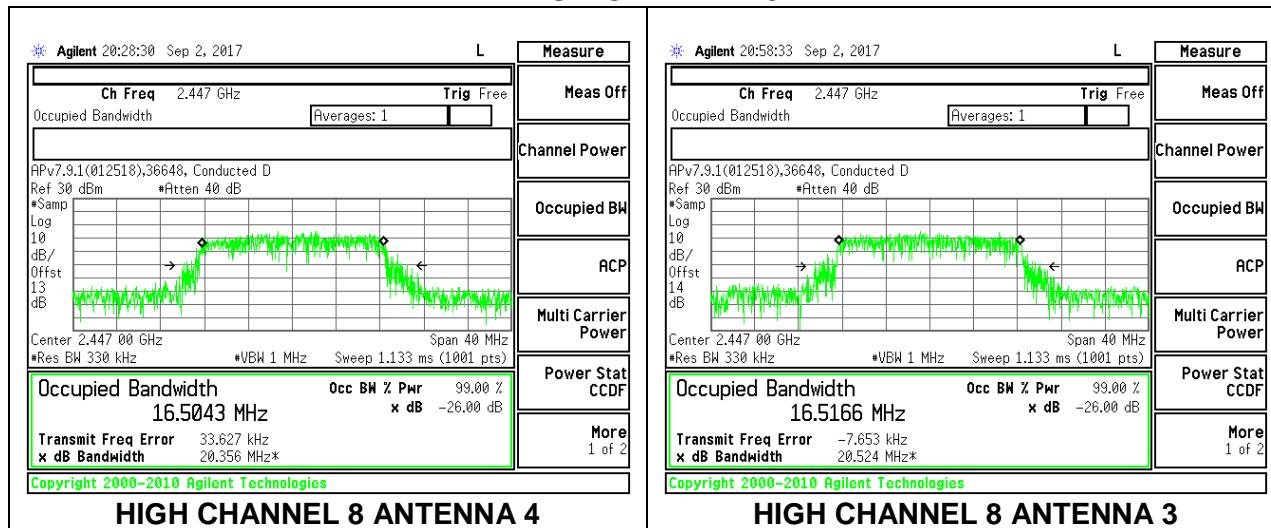
MID CHANNEL 6



MID CHANNEL 6 ANTENNA 4

MID CHANNEL 6 ANTENNA 3

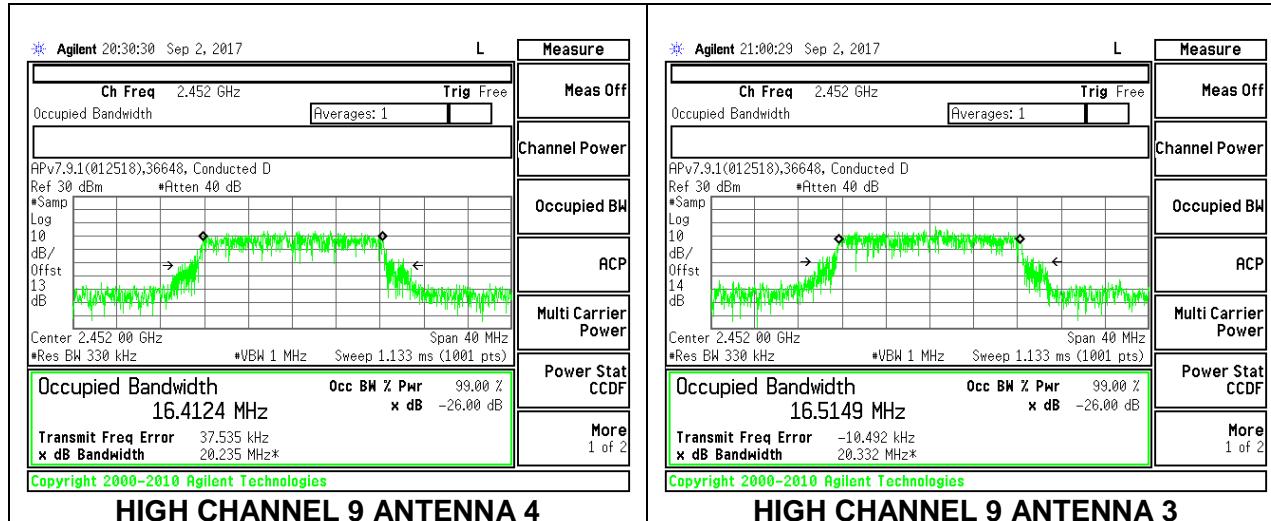
HIGH CHANNEL 8



HIGH CHANNEL 8 ANTENNA 4

HIGH CHANNEL 8 ANTENNA 3

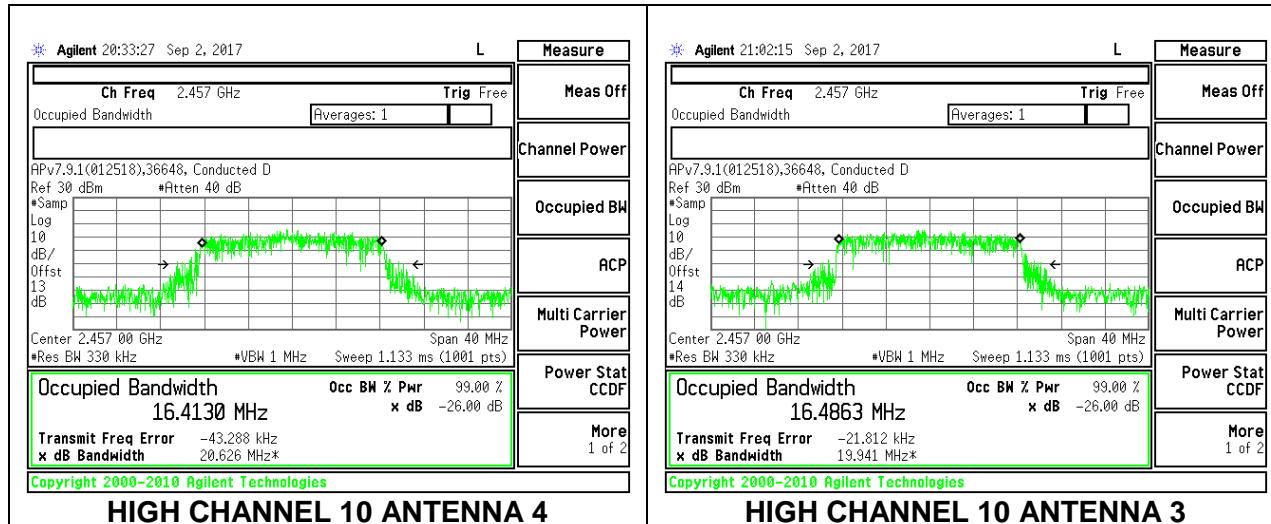
HIGH CHANNEL 9



HIGH CHANNEL 9 ANTENNA 4

HIGH CHANNEL 9 ANTENNA 3

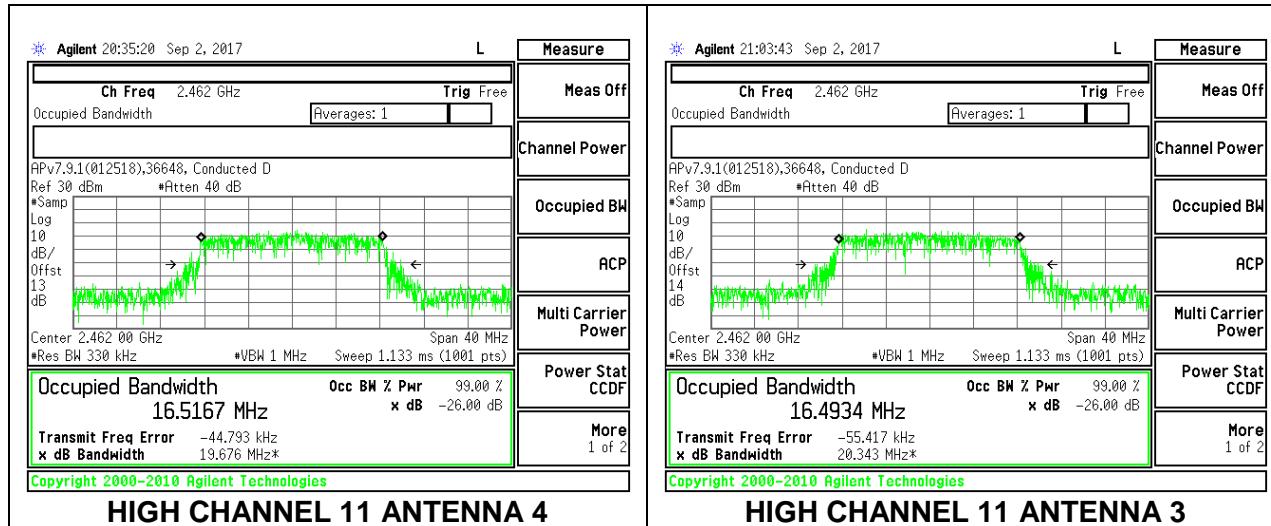
HIGH CHANNEL 10



HIGH CHANNEL 10 ANTENNA 4

HIGH CHANNEL 10 ANTENNA 3

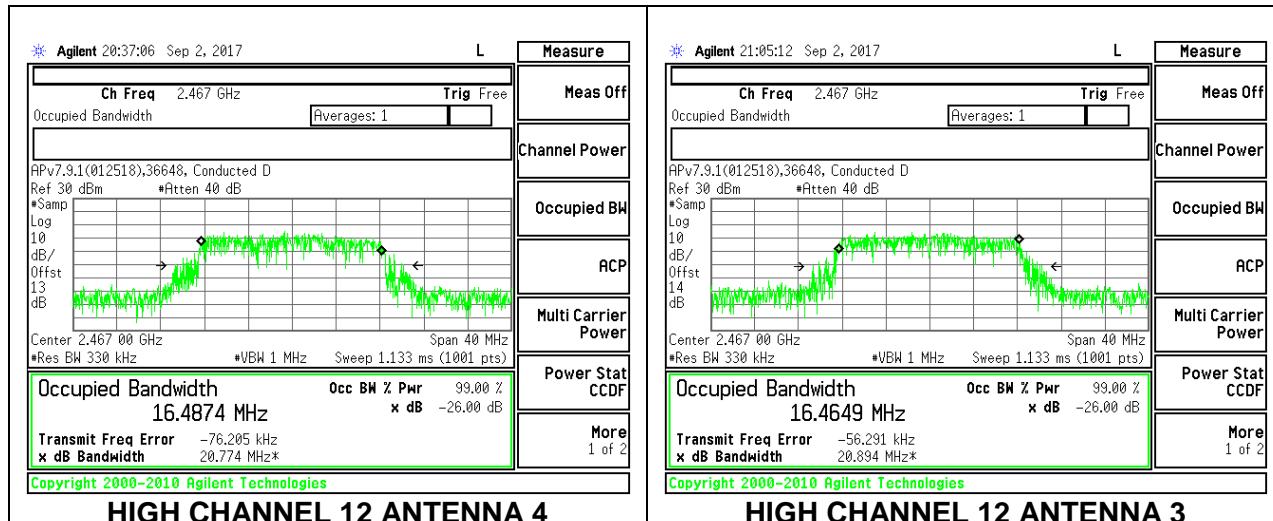
HIGH CHANNEL 11



HIGH CHANNEL 11 ANTENNA 4

HIGH CHANNEL 11 ANTENNA 3

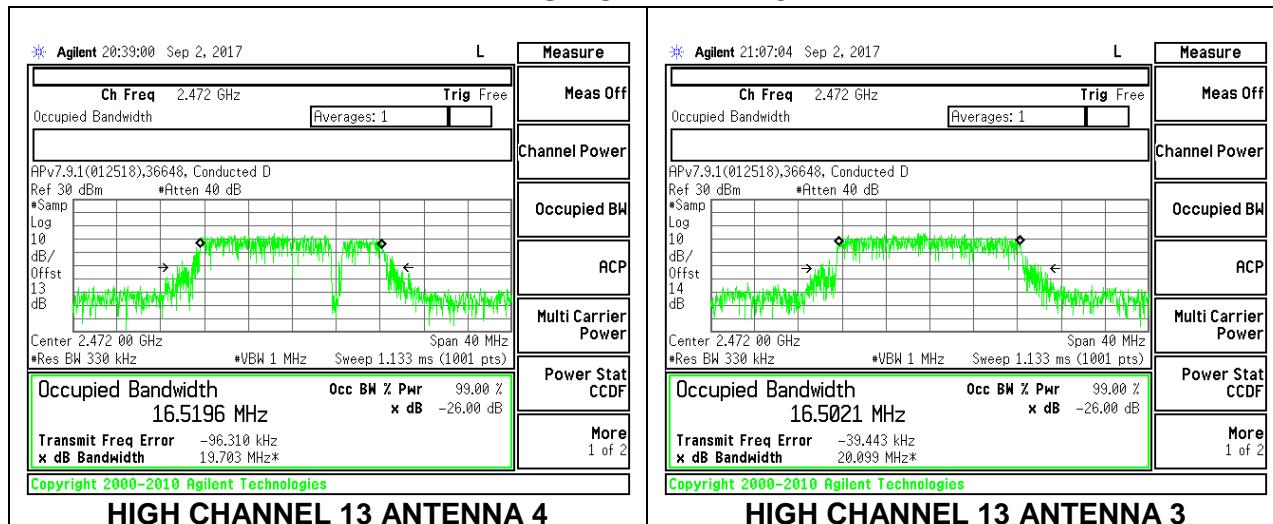
HIGH CHANNEL 12



HIGH CHANNEL 12 ANTENNA 4

HIGH CHANNEL 12 ANTENNA 3

HIGH CHANNEL 13



HIGH CHANNEL 13 ANTENNA 4

HIGH CHANNEL 13 ANTENNA 3

8.3. 6 dB BANDWIDTH

LIMITS

FCC §15.407 (e)

RSS-247 5.2 (a)

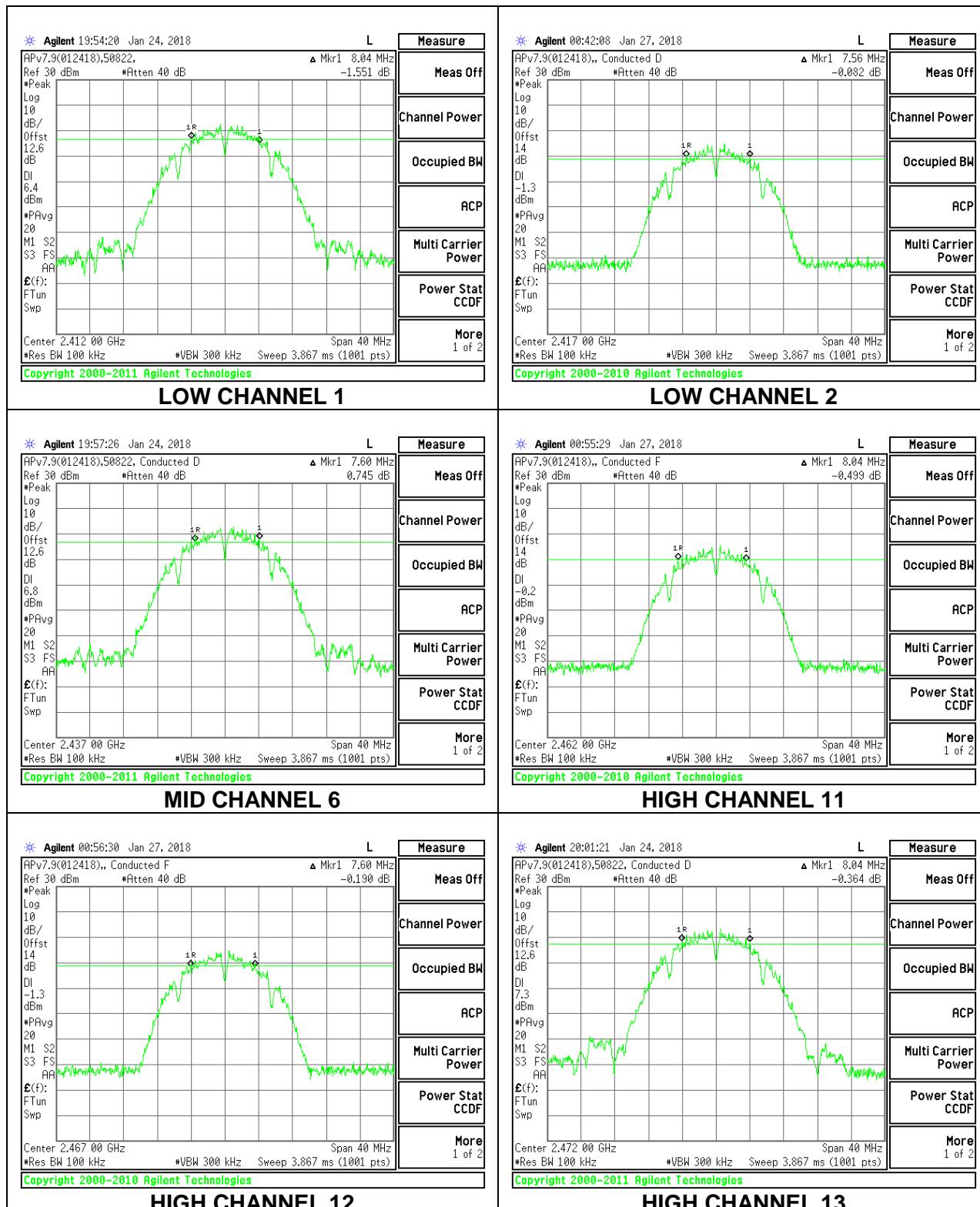
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

8.3.1. 802.11b MODE

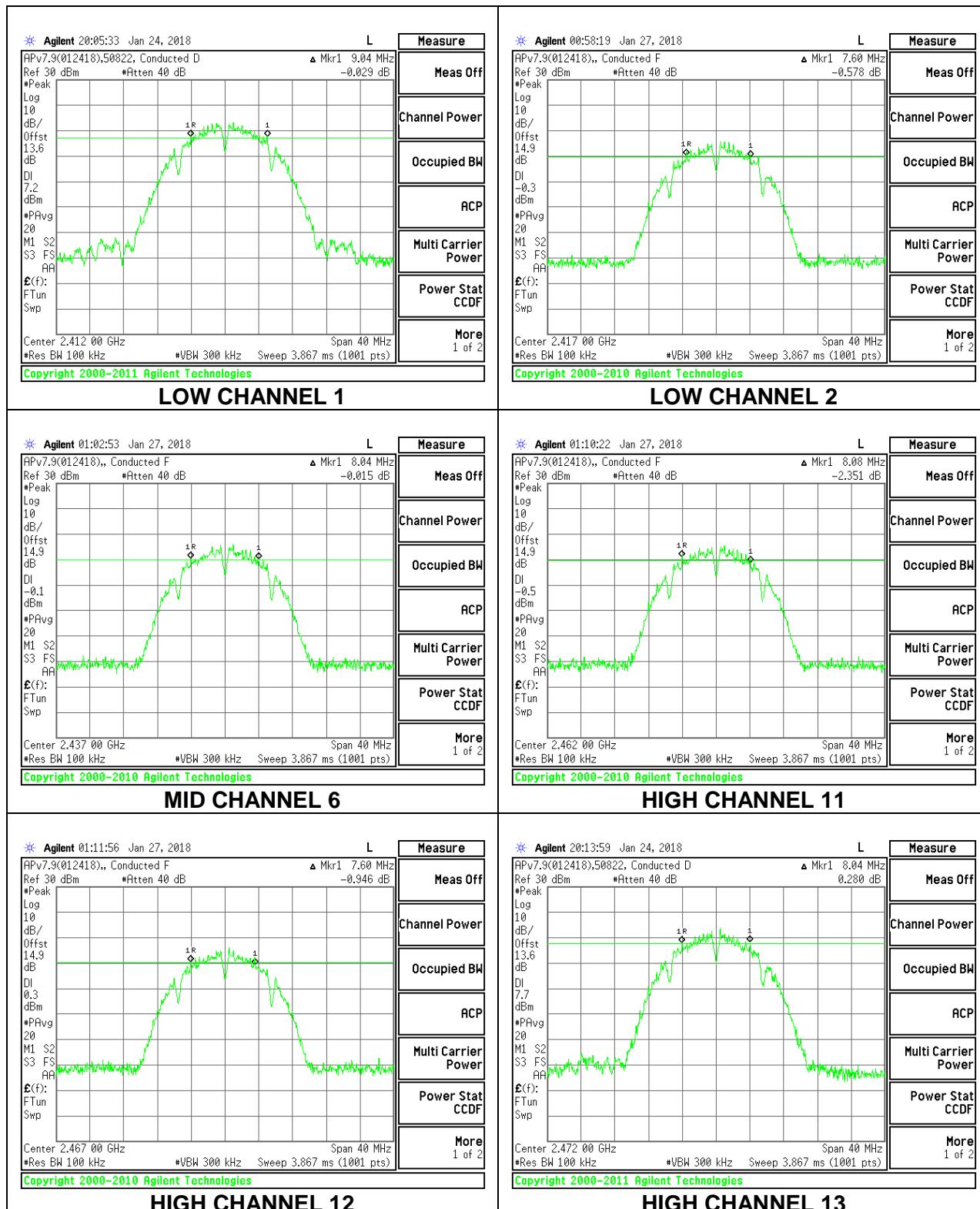
1TX Antenna 4

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low 1	2412	8.04	0.5
Low 2	2417	7.56	0.5
Mid 6	2437	7.60	0.5
High 11	2462	8.04	0.5
High 12	2467	7.60	0.5
High 13	2472	8.04	0.5



1TX Antenna 3

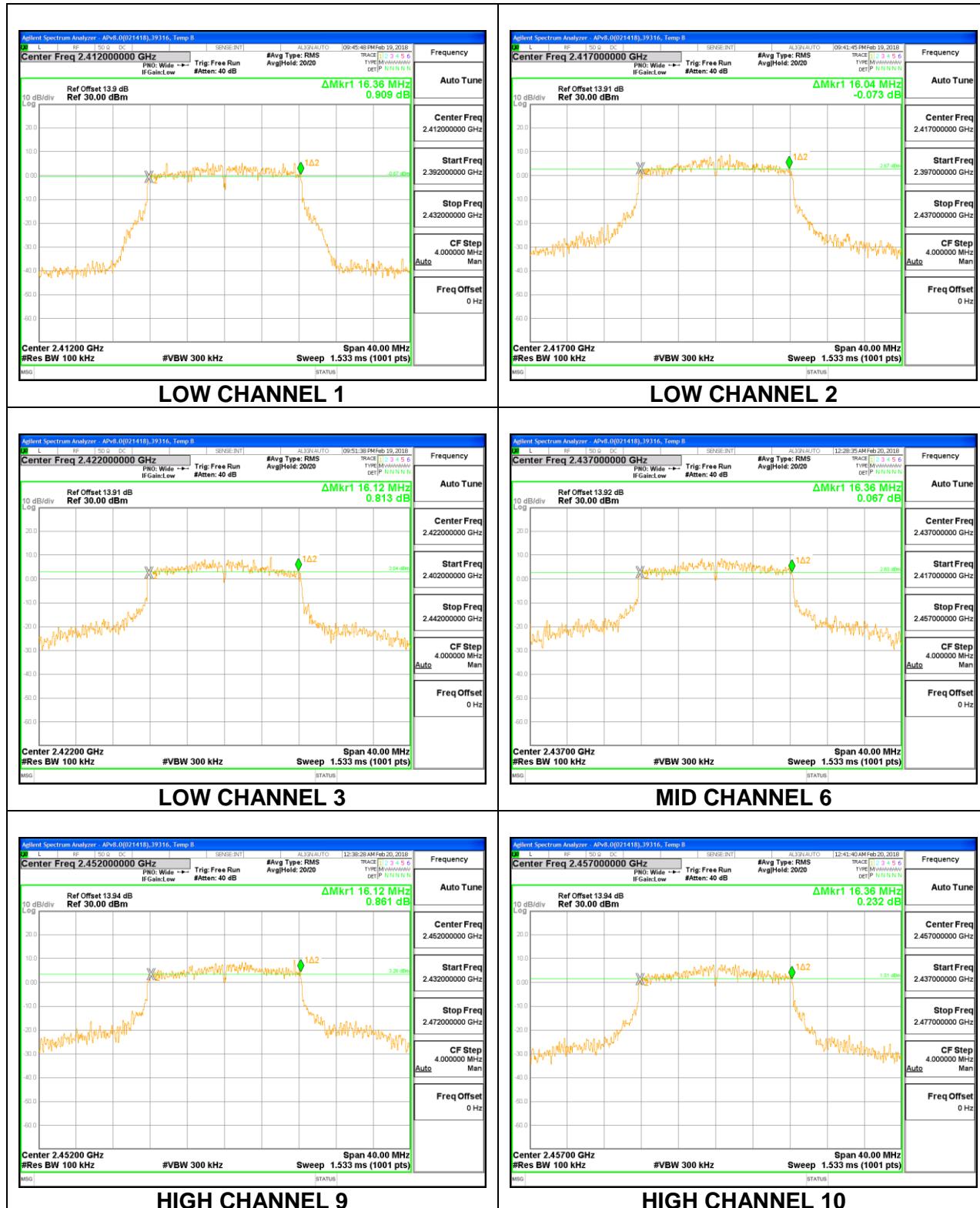
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low 1	2412	9.04	0.5
Low 2	2417	7.60	0.5
Mid 6	2437	8.04	0.5
High 11	2462	8.08	0.5
High 12	2467	7.60	0.5
High 13	2472	8.04	0.5

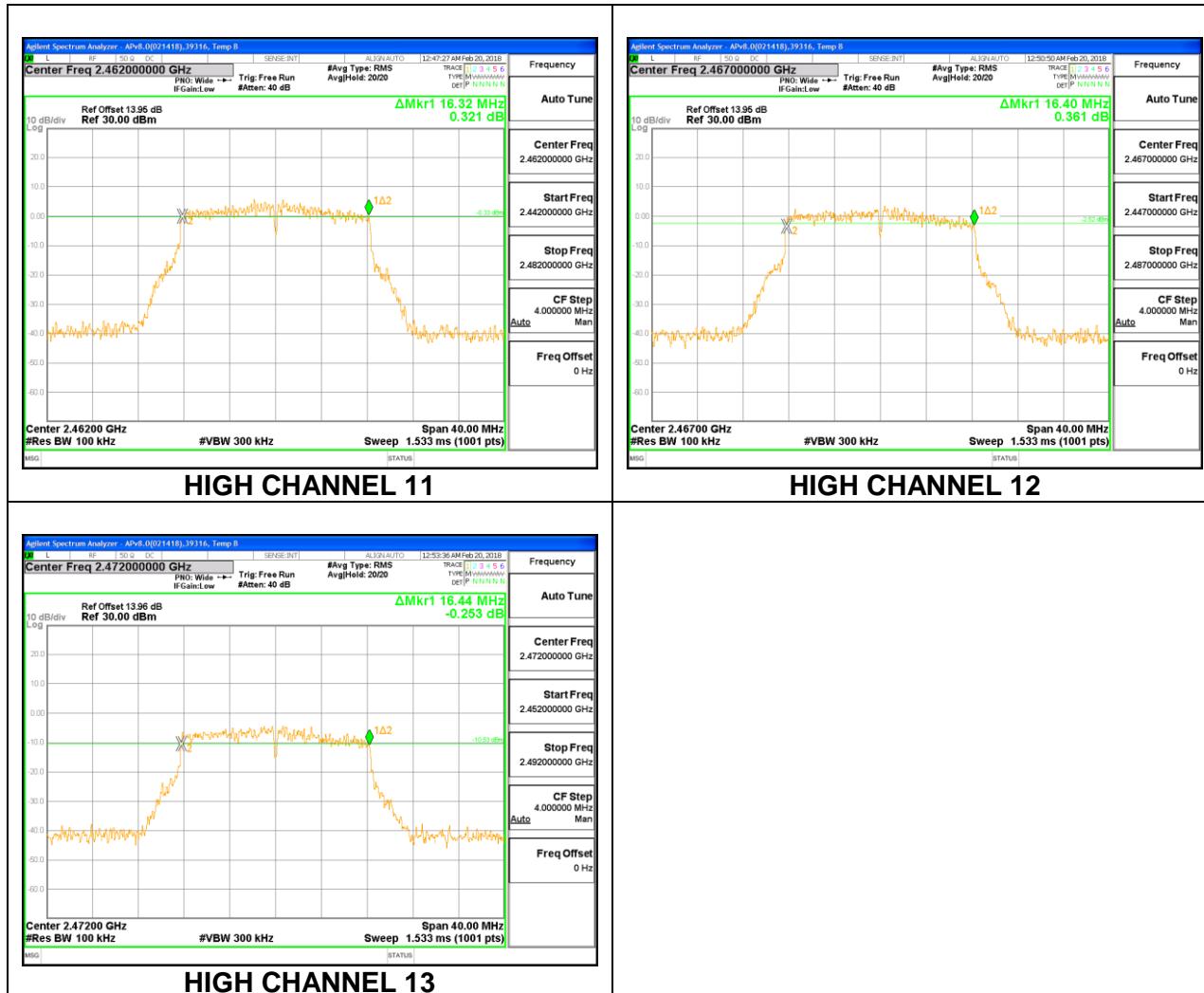


8.3.2. 802.11n HT20 MODE

1TX Antenna 4

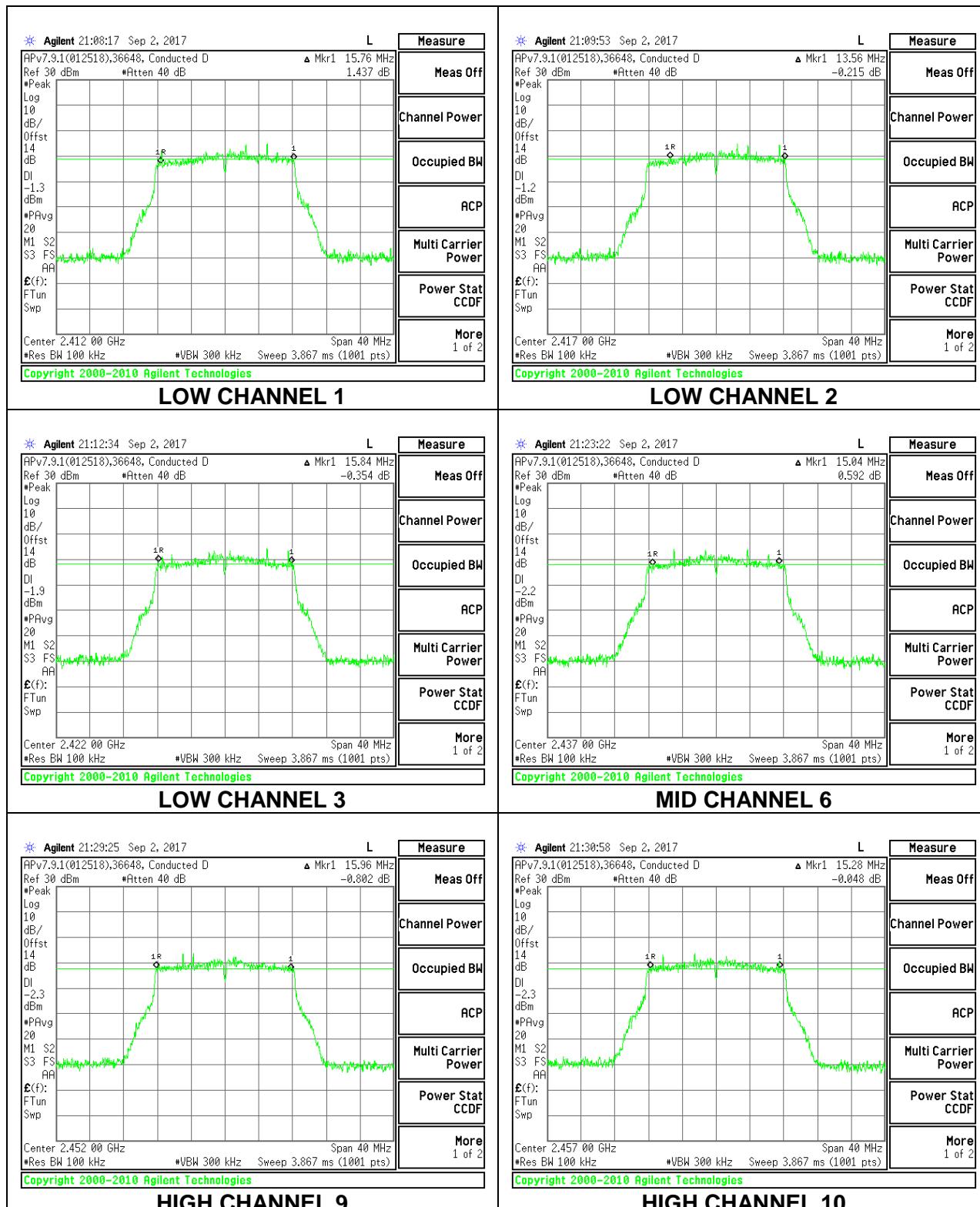
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low 1	2412	16.36	0.5
Low 2	2417	16.04	0.5
Low 3	2422	16.12	0.5
Mid 6	2437	16.36	0.5
High 9	2452	16.12	0.5
High 10	2457	16.36	0.5
High 11	2462	16.32	0.5
High 12	2467	16.40	0.5
High 13	2472	16.44	0.5

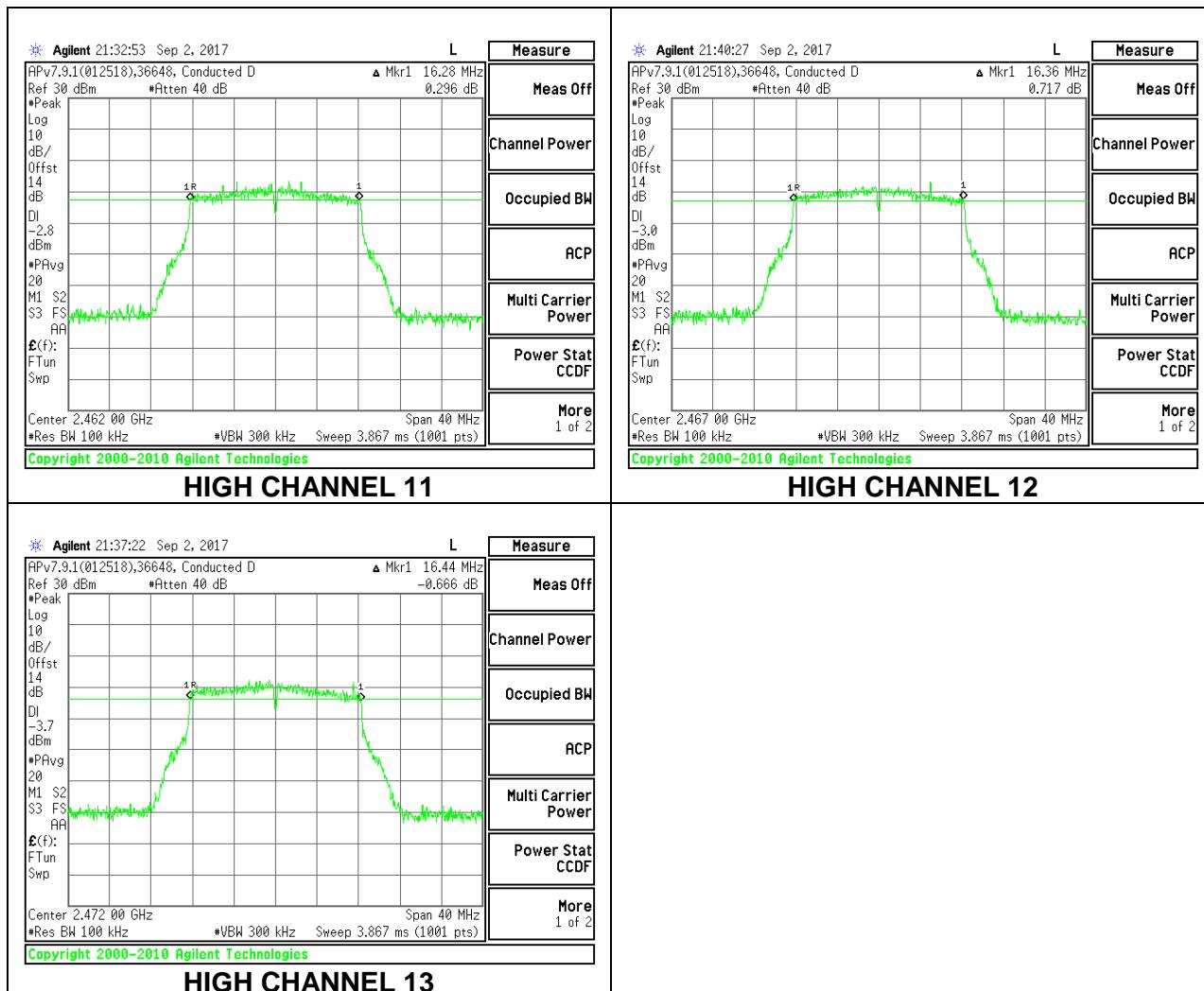




1TX Antenna 3

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low 1	2412	15.76	0.5
Low 2	2417	13.56	0.5
Low 3	2422	15.84	0.5
Mid 6	2437	15.04	0.5
High 9	2452	15.96	0.5
High 10	2457	15.28	0.5
High 11	2462	16.28	0.5
High 12	2467	16.36	0.5
High 13	2472	16.44	0.5

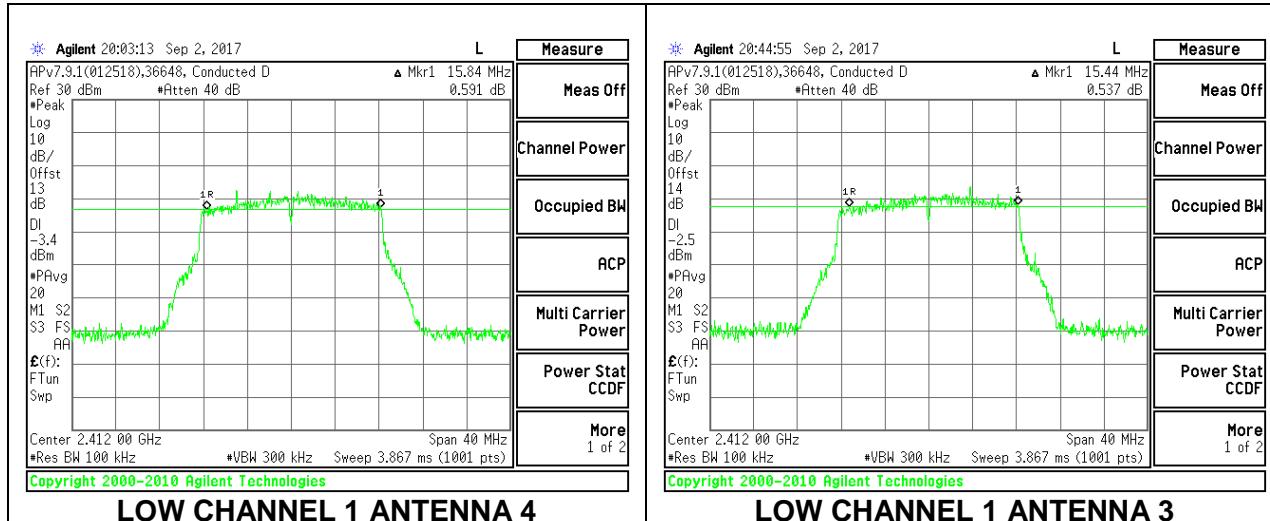




8.3.3. 2TX Antenna 4 + Antenna 3 CDD MODE

Channel	Frequency (MHz)	6 dB BW ANT 4 (MHz)	6 dB BW ANT 3 (MHz)	Minimum Limit (MHz)
Low 1	2412	15.84	15.44	0.5
Low 2	2417	16.28	16.12	0.5
Low 3	2422	14.44	15.36	0.5
Low 4	2427	15.72	15.28	0.5
Mid 6	2437	16.04	15.08	0.5
High 8	2447	14.88	16.36	0.5
High 9	2452	14.40	16.36	0.5
High 10	2457	16.32	16.36	0.5
High 11	2462	11.92	16.36	0.5
High 12	2467	13.16	15.68	0.5
High 13	2472	14.36	16.44	0.5

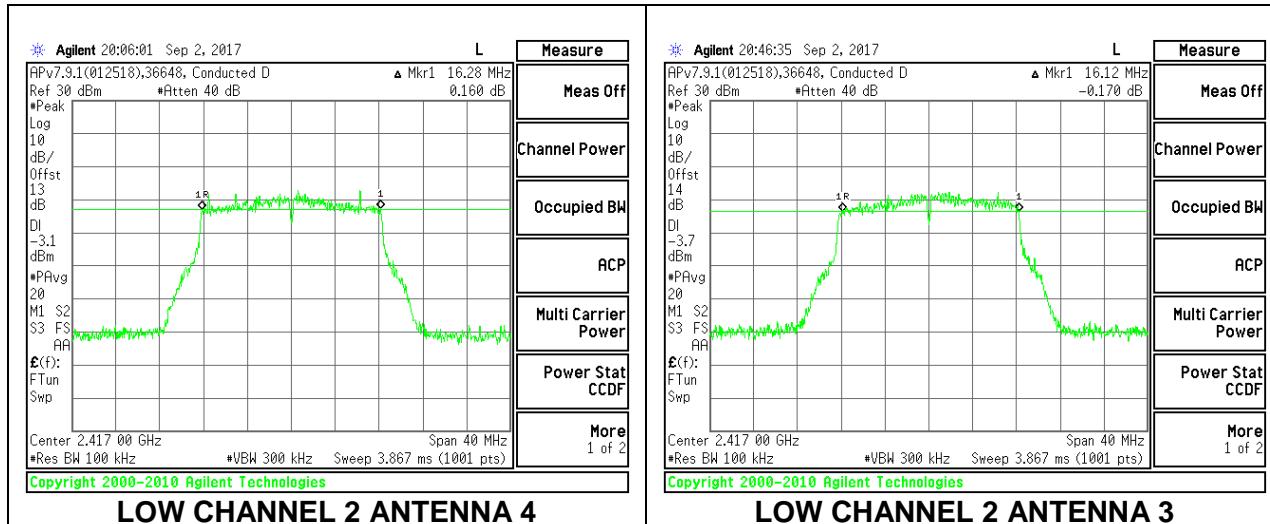
LOW CHANNEL 1



LOW CHANNEL 1 ANTENNA 4

LOW CHANNEL 1 ANTENNA 3

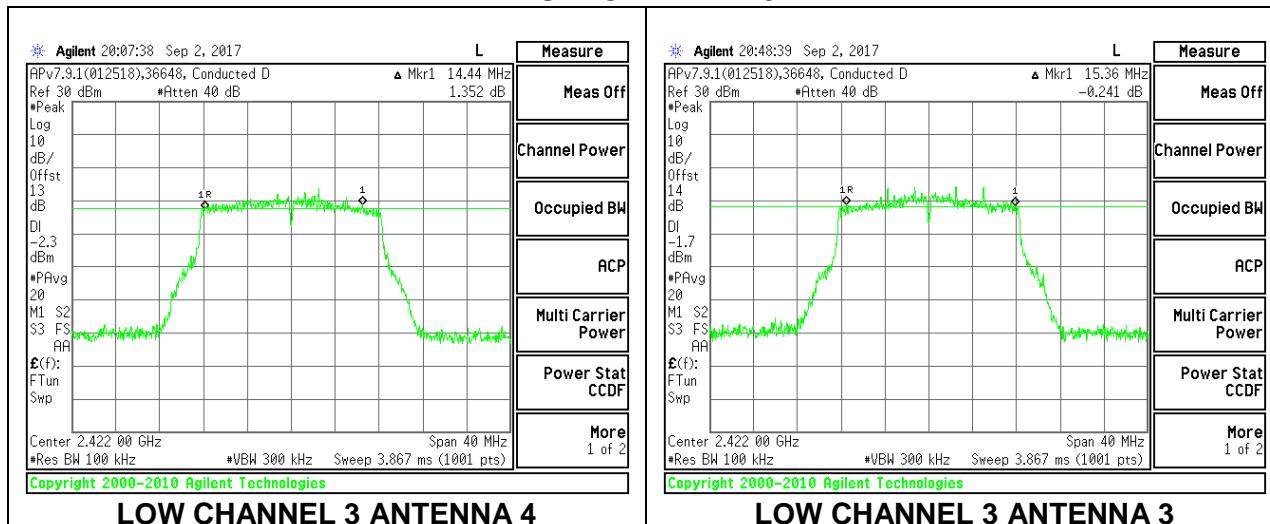
LOW CHANNEL 2



LOW CHANNEL 2 ANTENNA 4

LOW CHANNEL 2 ANTENNA 3

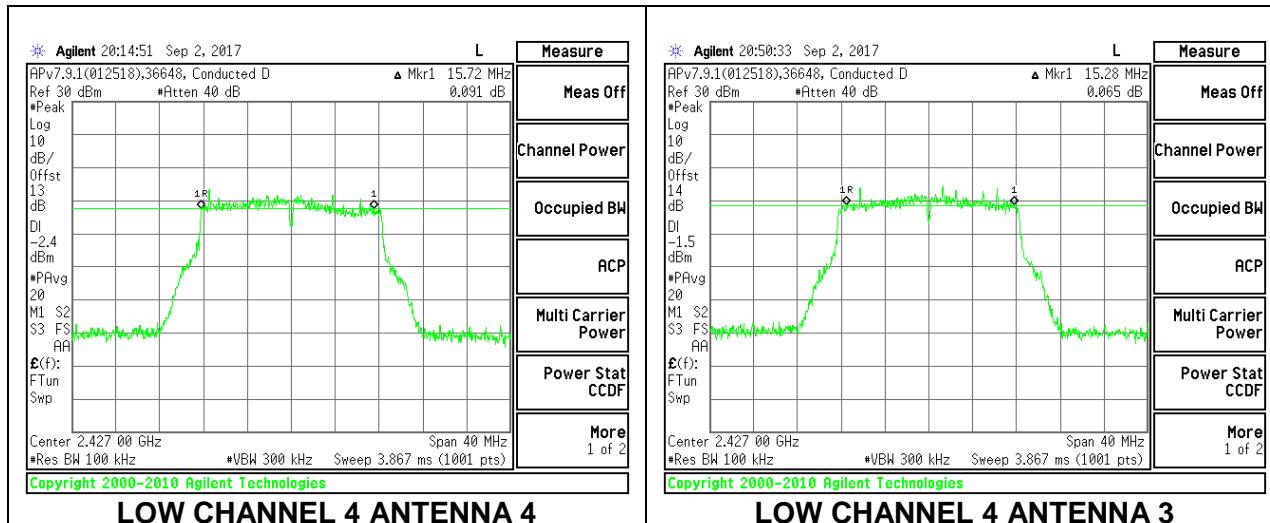
LOW CHANNEL 3



LOW CHANNEL 3 ANTENNA 4

LOW CHANNEL 3 ANTENNA 3

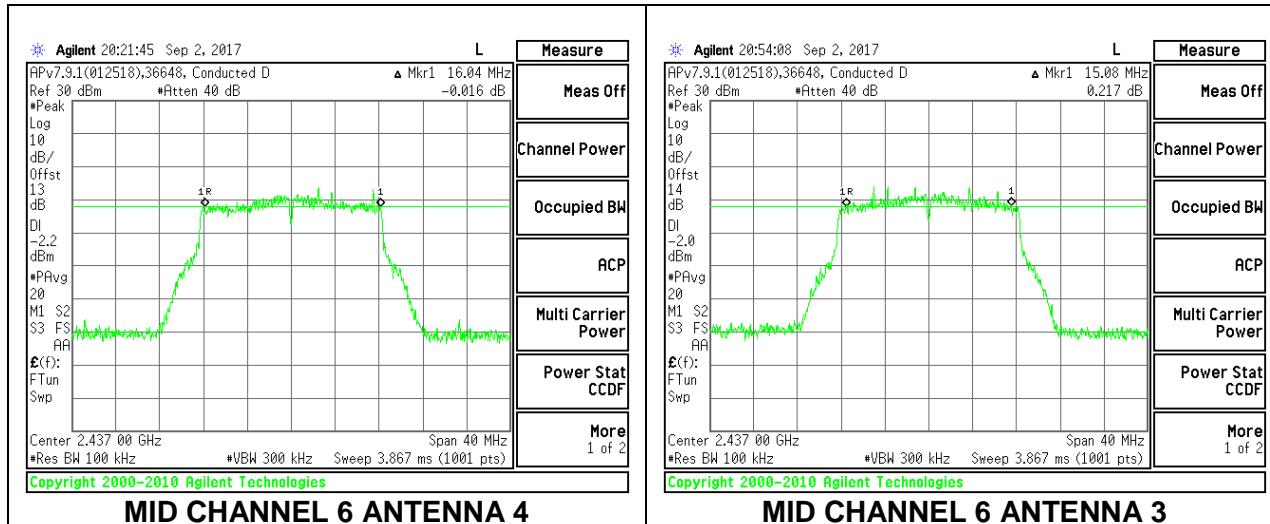
LOW CHANNEL 4



LOW CHANNEL 4 ANTENNA 4

LOW CHANNEL 4 ANTENNA 3

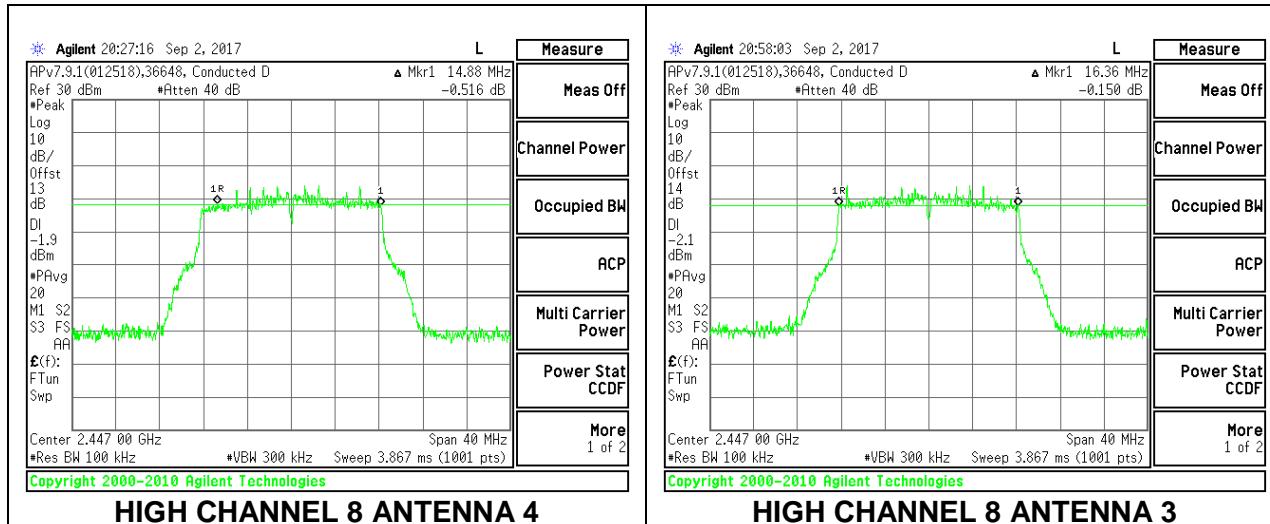
MID CHANNEL 6



MID CHANNEL 6 ANTENNA 4

MID CHANNEL 6 ANTENNA 3

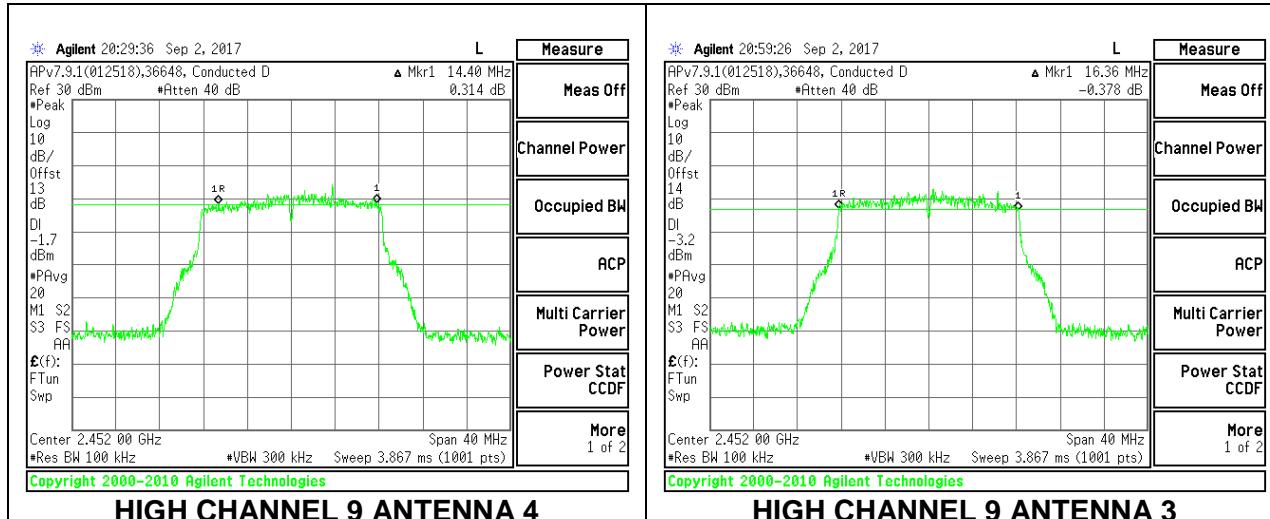
HIGH CHANNEL 8



HIGH CHANNEL 8 ANTENNA 4

HIGH CHANNEL 8 ANTENNA 3

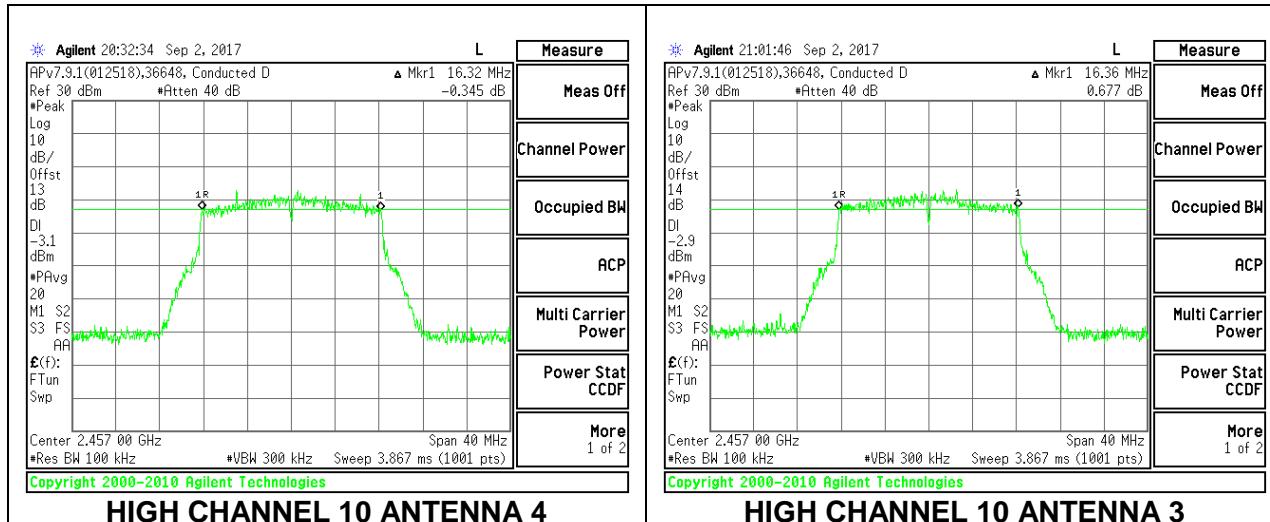
HIGH CHANNEL 9



HIGH CHANNEL 9 ANTENNA 4

HIGH CHANNEL 9 ANTENNA 3

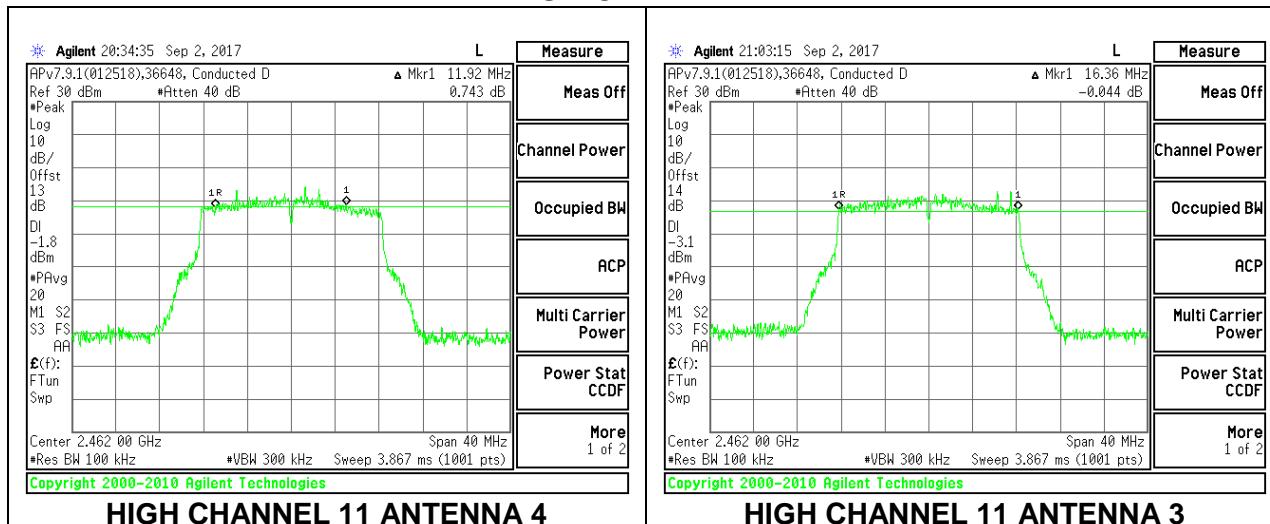
HIGH CHANNEL 10



HIGH CHANNEL 10 ANTENNA 4

HIGH CHANNEL 10 ANTENNA 3

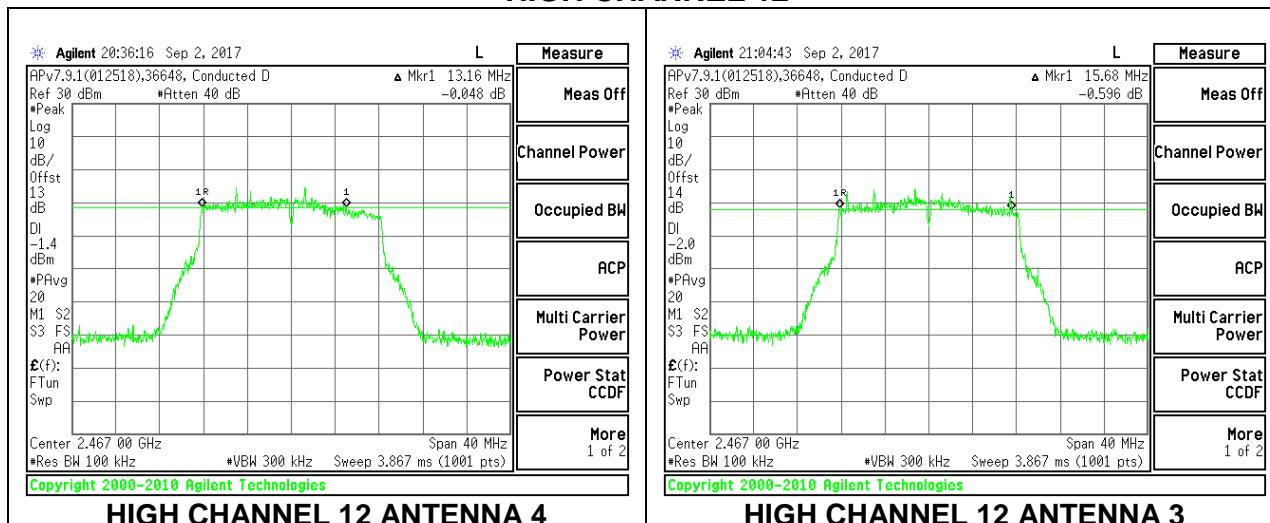
HIGH CHANNEL 11



HIGH CHANNEL 11 ANTENNA 4

HIGH CHANNEL 11 ANTENNA 3

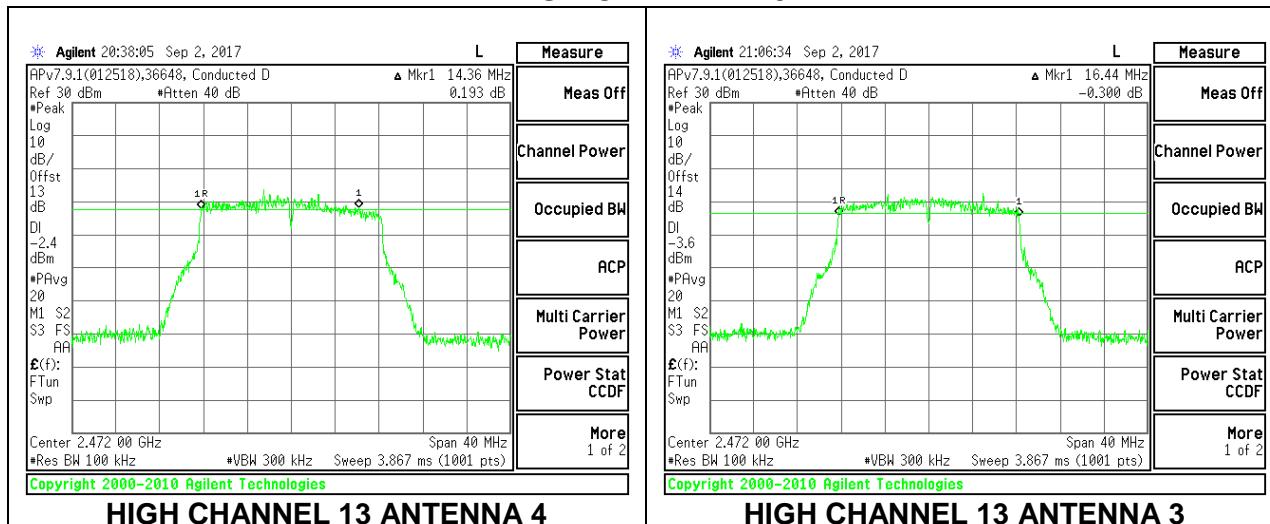
HIGH CHANNEL 12



HIGH CHANNEL 12 ANTENNA 4

HIGH CHANNEL 12 ANTENNA 3

HIGH CHANNEL 13



HIGH CHANNEL 13 ANTENNA 4

HIGH CHANNEL 13 ANTENNA 3

8.4. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

RSS-247 5.4 (d)

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

The transmitter output is connected to a broadband power meter

The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for a gated average reading of power.

DIRECTIONAL ANTENNA GAIN

For 1 TX:

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

For 2 TX:

Tx chains are uncorrelated for power and correlated for PSD due to the device supporting CDD in all MIMO modes. The directional gains are as follows:

Band (GHz)	Antenna 4	Antenna 3	Uncorrelated Chains	Correlated Chains
	Gain (dBi)	Gain (dBi)	Directional Gain (dBi)	Directional Gain (dBi)
2.4	-2.80	-4.10	-3.40	-0.42

RESULTS

8.4.1. 802.11b MODE

ID:	44366	Date:	6/26/2018
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1TX ANT. 4

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low_1	2412	-2.80	30.00	30	36	30.00
Low_2	2417	-2.80	30.00	30	36	30.00
Mid	2437	-2.80	30.00	30	36	30.00
High_11	2462	-2.80	30.00	30	36	30.00
High_12	2467	-2.80	30.00	30	36	30.00
High_13	2472	-2.80	30.00	30	36	30.00

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power
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Results

Channel	Frequency (MHz)	Measured Peak Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low_1	2412	19.32	19.32	30.00	-10.68
Low_2	2417	19.45	19.45	30.00	-10.55
Mid	2437	19.46	19.46	30.00	-10.54
High_11	2462	19.39	19.39	30.00	-10.61
High_12	2467	19.42	19.42	30.00	-10.58
High_13	2472	18.92	18.92	30.00	-11.08

ID:	44366	Date:	6/26/2018
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1TX ANT. 3

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low_1	2412	-4.10	30.00	30	36	30.00
Low_2	2417	-4.10	30.00	30	36	30.00
Mid	2437	-4.10	30.00	30	36	30.00
High_11	2462	-4.10	30.00	30	36	30.00
High_12	2467	-4.10	30.00	30	36	30.00
High_13	2472	-4.10	30.00	30	36	30.00

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power
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Results

Channel	Frequency (MHz)	Measured Peak Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low_1	2412	20.46	20.46	30.00	-9.54
Low_2	2417	21.94	21.94	30.00	-8.06
Mid	2437	21.89	21.89	30.00	-8.11
High_11	2462	21.75	21.75	30.00	-8.25
High_12	2467	20.31	20.31	30.00	-9.69
High_13	2472	18.97	18.97	30.00	-11.03

8.4.2. 802.11n HT20 MODE

ID:	44366	Date:	6/26/2018
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1TX ANT. 4

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low_1	2412	-2.80	30.00	30	36	30.00
Low_2	2417	-2.80	30.00	30	36	30.00
Low_3	2422	-2.80	30.00	30	36	30.00
Mid_6	2437	-2.80	30.00	30	36	30.00
High_9	2452	-2.80	30.00	30	36	30.00
High_10	2457	-2.80	30.00	30	36	30.00
High_11	2462	-2.80	30.00	30	36	30.00
High_12	2467	-2.80	30.00	30	36	30.00
High_13	2472	-2.80	30.00	30	36	30.00

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power
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Results

Channel	Frequency (MHz)	Measured Peak Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low_1	2412	17.27	17.27	30.00	-12.73
Low_2	2417	19.47	19.47	30.00	-10.53
Low_3	2422	19.42	19.42	30.00	-10.58
Mid_6	2437	19.46	19.46	30.00	-10.54
High_9	2452	19.44	19.44	30.00	-10.56
High_10	2457	19.31	19.31	30.00	-10.69
High_11	2462	17.46	17.46	30.00	-12.54
High_12	2467	15.32	15.32	30.00	-14.68
High_13	2472	7.87	7.87	30.00	-22.13

ID:	44366	Date:	6/26/2018
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1TX ANT. 3

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low_1	2412	-4.10	30.00	30	36	30.00
Low_2	2417	-4.10	30.00	30	36	30.00
Low_3	2422	-4.10	30.00	30	36	30.00
Mid_6	2437	-4.10	30.00	30	36	30.00
High_9	2452	-4.10	30.00	30	36	30.00
High_10	2457	-4.10	30.00	30	36	30.00
High_11	2462	-4.10	30.00	30	36	30.00
High_12	2467	-4.10	30.00	30	36	30.00
High_13	2472	-4.10	30.00	30	36	30.00

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power
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Results

Channel	Frequency (MHz)	Measured Peak Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low_1	2412	17.27	17.27	30.00	-12.73
Low_2	2417	19.47	19.47	30.00	-10.53
Low_3	2422	21.87	21.87	30.00	-8.13
Mid_6	2437	21.89	21.89	30.00	-8.11
High_9	2452	21.84	21.84	30.00	-8.16
High_10	2457	19.36	19.36	30.00	-10.64
High_11	2462	17.37	17.37	30.00	-12.63
High_12	2467	15.34	15.34	30.00	-14.66
High_13	2472	7.81	7.81	30.00	-22.19

8.4.3. 2TX ANT. 4 + ANT. 3 CDD MODE

ID:	44366	Date:	6/26/2018
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Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low_1	2412	-3.40	30.00	30	36	30.00
Low_2	2417	-3.40	30.00	30	36	30.00
Low_3	2422	-3.40	30.00	30	36	30.00
Low_4	2427	-3.40	30.00	30	36	30.00
Mid	2437	-3.40	30.00	30	36	30.00
High_8	2447	-3.40	30.00	30	36	30.00
High_9	2452	-3.40	30.00	30	36	30.00
High_10	2457	-3.40	30.00	30	36	30.00
High_11	2462	-3.40	30.00	30	36	30.00
High_12	2467	-3.40	30.00	30	36	30.00
High_13	2472	-3.40	30.00	30	36	30.00

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power
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Results

Channel	Frequency (MHz)	Ant 4	Ant 3	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
		Measured Peak Power (dBm)	Measured Peak Power (dBm)			
Low_1	2412	16.23	16.40	19.33	30.00	-10.67
Low_2	2417	18.35	18.46	21.42	30.00	-8.58
Low_3	2422	19.39	19.88	22.65	30.00	-7.35
Low_4	2427	19.45	21.92	23.87	30.00	-6.13
Mid	2437	19.42	21.94	23.87	30.00	-6.13
High_8	2447	19.35	21.83	23.77	30.00	-6.23
High_9	2452	19.34	19.77	22.57	30.00	-7.43
High_10	2457	18.24	18.30	21.28	30.00	-8.72
High_11	2462	16.27	16.20	19.25	30.00	-10.75
High_12	2467	14.42	14.27	17.36	30.00	-12.64
High_13	2472	6.87	6.97	9.93	30.00	-20.07

8.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

RSS-247 (5.2) (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

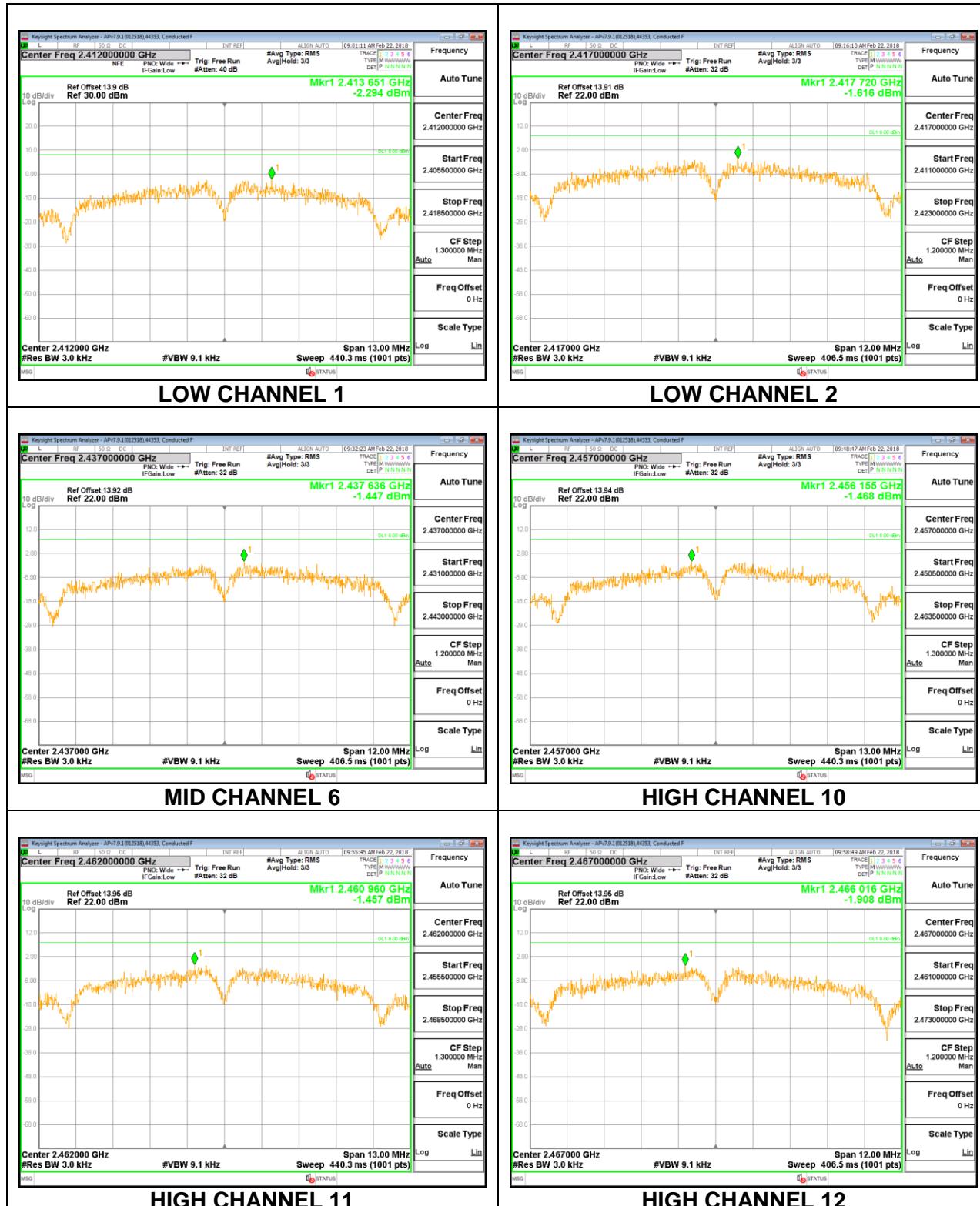
Note: For worst case, peak detector was used to perform the PSD test.

RESULTS

8.5.1. 802.11b MODE

1TX Antenna 4

Duty Cycle CF (dB)		0.00	Included in Calculations of Corr'd PSD		
PSD Results					
Channel	Frequency (MHz)	Ant 4 Meas (dBm/3kHz)	Total Corr'd PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low 1	2412	-2.29	-2.29	8.0	-10.3
Low 2	2417	-1.62	-1.62	8.0	-9.6
Mid 6	2437	-1.45	-1.45	8.0	-9.5
High 10	2457	-1.47	-1.47	8.0	-9.5
High 11	2462	-1.46	-1.46	8.0	-9.5
High 12	2467	-1.91	-1.91	8.0	-9.9
High 13	2472	-3.61	-3.61	8.0	-11.6



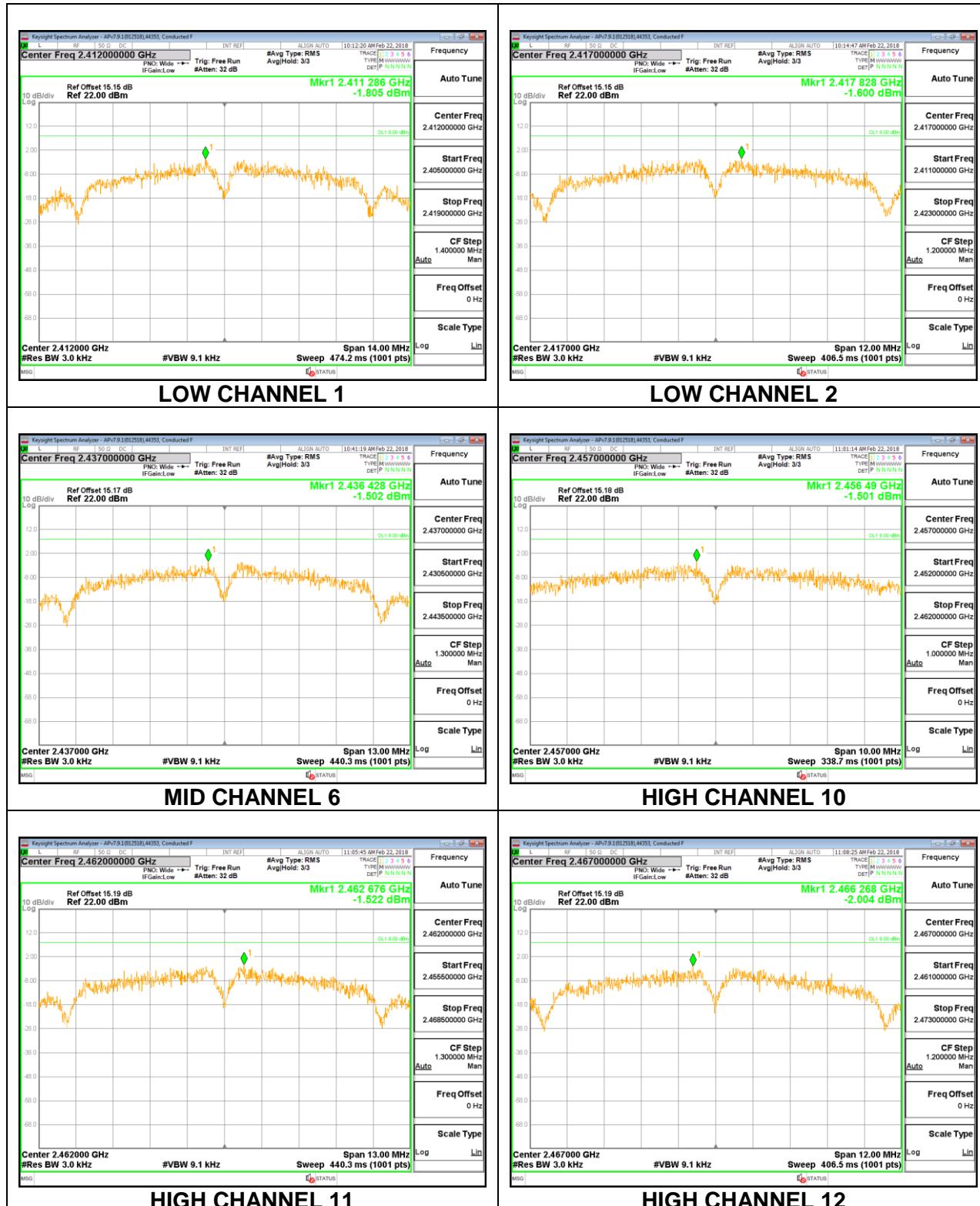


1TX Antenna 3

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

Channel	Frequency (MHz)	Ant 3 Meas (dBm/3kHz)	Total Corr'd PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low 1	2412	-1.80	-1.80	8.0	-9.8
Low 2	2417	-1.60	-1.60	8.0	-9.6
Mid 6	2437	-1.50	-1.50	8.0	-9.5
High 10	2457	-1.50	-1.50	8.0	-9.5
High 11	2462	-1.52	-1.52	8.0	-9.5
High 12	2467	-2.00	-2.00	8.0	-10.0
High 13	2472	-2.75	-2.75	8.0	-10.8





8.5.2. 802.11n HT20 MODE

1TX Antenna 4

Duty Cycle CF (dB)		0.00	Included in Calculations of Corr'd PSD		
PSD Results					
Channel	Frequency (MHz)	Ant 4 Meas (dBm/3kHz)	Total Corr'd PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low 1	2412	-6.82	-6.82	8.0	-14.8
Low 2	2417	-5.40	-5.40	8.0	-13.4
Low 3	2422	-3.83	-3.83	8.0	-11.8
Mid 6	2437	-3.76	-3.76	8.0	-11.8
High 9	2452	-3.78	-3.78	8.0	-11.8
High 10	2457	-4.44	-4.44	8.0	-12.4
High 11	2462	-6.79	-6.79	8.0	-14.8
High 12	2467	-8.82	-8.82	8.0	-16.8
High 13	2472	-16.46	-16.46	8.0	-24.5

