



TEST REPORT

Report Number: 13129294-E3V4

Applicant : Microsoft Corporation
One Microsoft Way
Redmond, WA 98052-6399
USA

Model : 1930

FCC ID : C3K1930

IC : 3048A-1930

EUT Description : Phablet Device

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C
ISED RSS-247 ISSUE 2
ISED RSS-GEN ISSUE 5

Date Of Issue:
June 16, 2020

Prepared by:
UL Verification Services Inc.
47173 Benicia Street
Fremont, CA 94538 U.S.A.
TEL: (510) 319-4000
FAX: (510) 661-0888



REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	5/4/2020	Initial Issue	---
V2	6/5/2020	Setup Photo updated	Henry Lau
V3	6/9/2020	Updated the EUT	Grace Rincand
V4	6/16/2020	Section 6.2 Updated	Henry Lau

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Microsoft Corporation
One Microsoft Way
Redmond, WA 98052-6399
USA

EUT DESCRIPTION: Phablet Device

MODEL: 1930

SERIAL NUMBER: 900086500465, 900039701165 (Radiated)
901245700365(Conducted)

DATE TESTED: January 16, 2020 – April 27, 2020

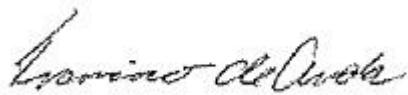
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5	Complies

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

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
UL Verification Services Inc. By:



Francisco deAnda
Operations Lead
Consumer Technology Division
UL Verification Services Inc.

Prepared By:



Jose Martinez
Test Engineer
Consumer Technology Division
UL Verification Services Inc.

Reviewed By:



Henry Lau
Project Engineer
Consumer Technology Division
UL Verification Services Inc.

2. TEST RESULTS SUMMARY

FCC Clause	ISED Clause	Requirement	Result	Comment
See Comment		Duty Cycle* **	Reporting purposes only	ANSI C63.10 Section 11.6.
-	RSS-GEN 6.7	99% OBW*	Reporting purposes only	ANSI C63.10 Section 6.9.3.
15.247 (a) (2)	RSS-247 5.2 (a)	6dB BW*	Complies	None.
15.247 (b) (3)	RSS-247 5.4 (d)	Output Power* **	Complies	None.
See Comment		Average power* **	Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (e)	RSS-247 5.2 (b)	PSD*	Complies	None.
15.247 (d)	RSS-247 5.5	Conducted Spurious Emissions*	Complies	None.
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions**	Complies	None.
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions**	Complies	None.

*Testing performed at 47173 Benicia Street Fremont, California, 94538 USA facility.

**Testing performed at 12 Laboratory Dr., Research Triangle Park, NC 27709 U.S.A. facility.

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 662911 D01 Multiple Transmitter Output v02r01, RSS-GEN Issue 5, and RSS-247 Issue 2.

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 & 47266 Benicia Street, 47658 Kato Road, Fremont, California, USA, 12 Laboratory Drive, Research Triangle Park and 2800 Perimeter Park Dr, Suite B, Morrisville, North Carolina, USA. 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.

12 Laboratory Dr.	2800 Suite Perimeter Park Dr.
<input type="checkbox"/> Chamber A RTP	<input type="checkbox"/> North Chamber
<input type="checkbox"/> Chamber C RTP	<input checked="" type="checkbox"/> South Chamber

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0

5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

5.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

5.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	U_{Lab}
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.39 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.07 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.52 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	4.88 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.24 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.37 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.17 dB

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

5.4. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

Field Strength (dB_{UV}/m) = Measured Voltage (dB_{UV}) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

$$36.5 \text{ dB}_{UV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dB}_{UV}/\text{m}$$

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

Final Voltage (dB_{UV}) = Measured Voltage (dB_{UV}) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.

$$36.5 \text{ dB}_{UV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dB}_{UV}$$

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a Phablet Device with 802.11 a/b/g/n/ac 2x2 WLAN, Bluetooth, Bluetooth LE, GSM, WCDMA, and LTE radios.

6.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

2.4GHz BAND

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2Tx			
2412 - 2472	802.11b	25.05	319.89
2412 - 2472	802.11g	25.18	329.61
2412 - 2472	802.11n HT20 CDD	25.88	387.26
2422 - 2462	802.11n HT40 CDD	25.77	377.57

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes two dual band PIFA antennas, with a maximum gain of:

Frequency Band (MHz)	Antenna 1 Antenna Gain (dBi)	Antenna 2 Antenna Gain (dBi)
2412-2472	1.1	2.3

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was Android version 10, Build Number b1 developer-generic 2020.311.4.

The test utility software used during testing was QRCT v4.0-00123.

6.5. WORST-CASE CONFIGURATION AND MODE

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

Band edge and radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at the highest power on low, middle and high channels.

For all modes, tests were performed with the EUT set at the 2Tx CDD mode with power setting equal to SISO modes as the worst case scenario thus MIMO is representative of SISO.

The EUT was investigated in three orthogonal orientations X/Y/Z. Additionally, the EUT was investigated in four configurations with both screens: folded and closed/open 90 degrees/flat 180 degrees/folded and open. It was determined that the EUT in flat 180 degrees with X (Flatbed) orientation was worst-case orientation therefore all final radiated testing was performed with the EUT in 180 degrees flat at X(Flatbed).

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

802.11b mode: 1 Mbps
802.11g mode: 6 Mbps
802.11n HT20mode: MCS0
802.11n HT40mode: MCS0

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC/DC Adapter (Laptop)	Lenovo	ADLX45NCC2A	8SSA10E75794C1SG8 5N14BE	DoC
Laptop	Lenovo	Yoga 11e	R9-0R7KPR	DoC
AC/DC Adapter (EUT)	Microsoft	1847	0D13V05VTD9C	DoC

I/O CABLES(CONDUCTED)

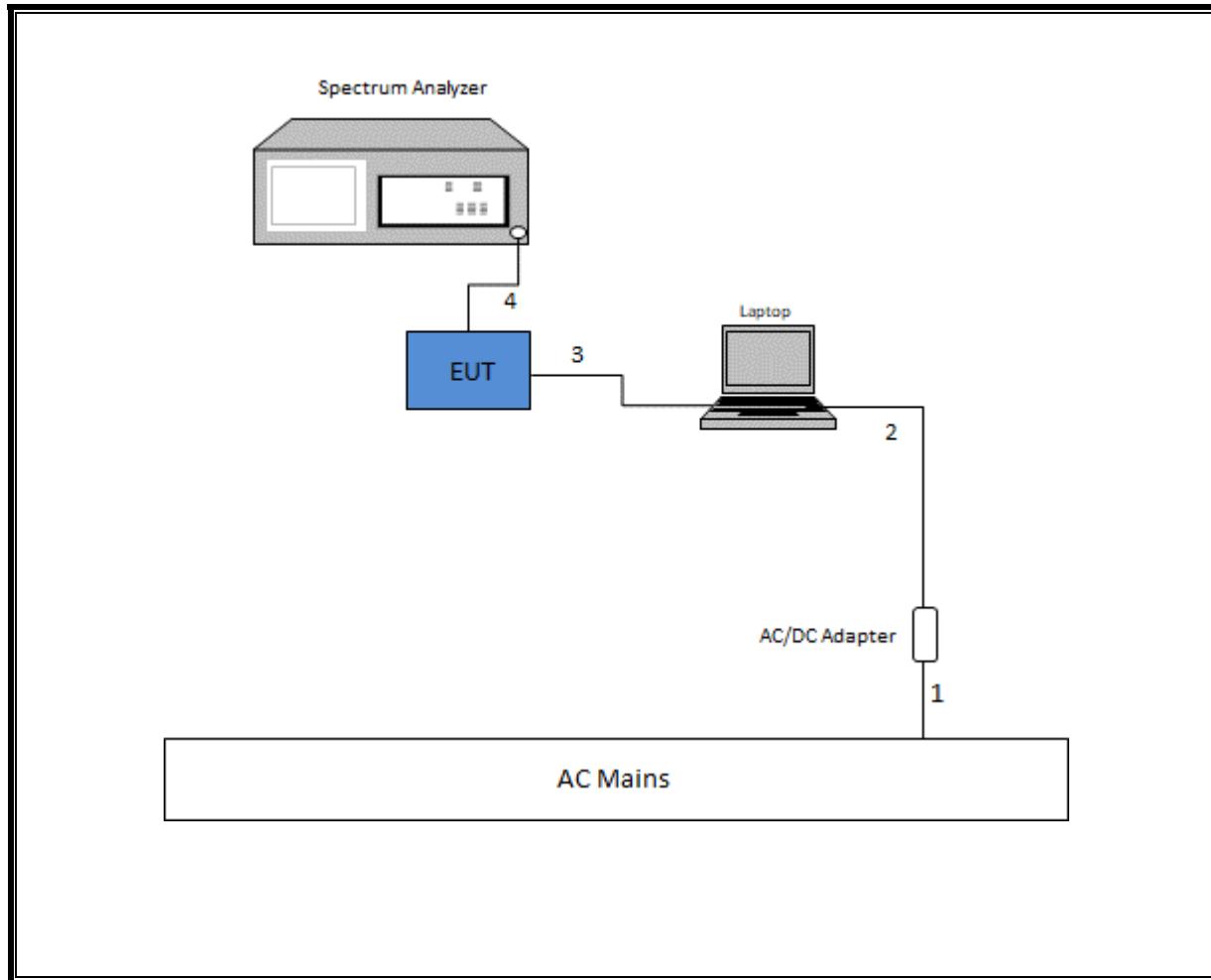
I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Un-Shielded	1	to AC/DC Adapter
2	DC	1	DC	Shielded	1	to Laptop
3	USB	1	Type C	Shielded	0.1	to EUT
4	Antenna	1	SMA	Un-Shielded	0.2	to Analyzer

I/O CABLES(RADIATED & AC LINE CONDUCTED)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	USB	1	Type C	Shielded	0.1	to EUT

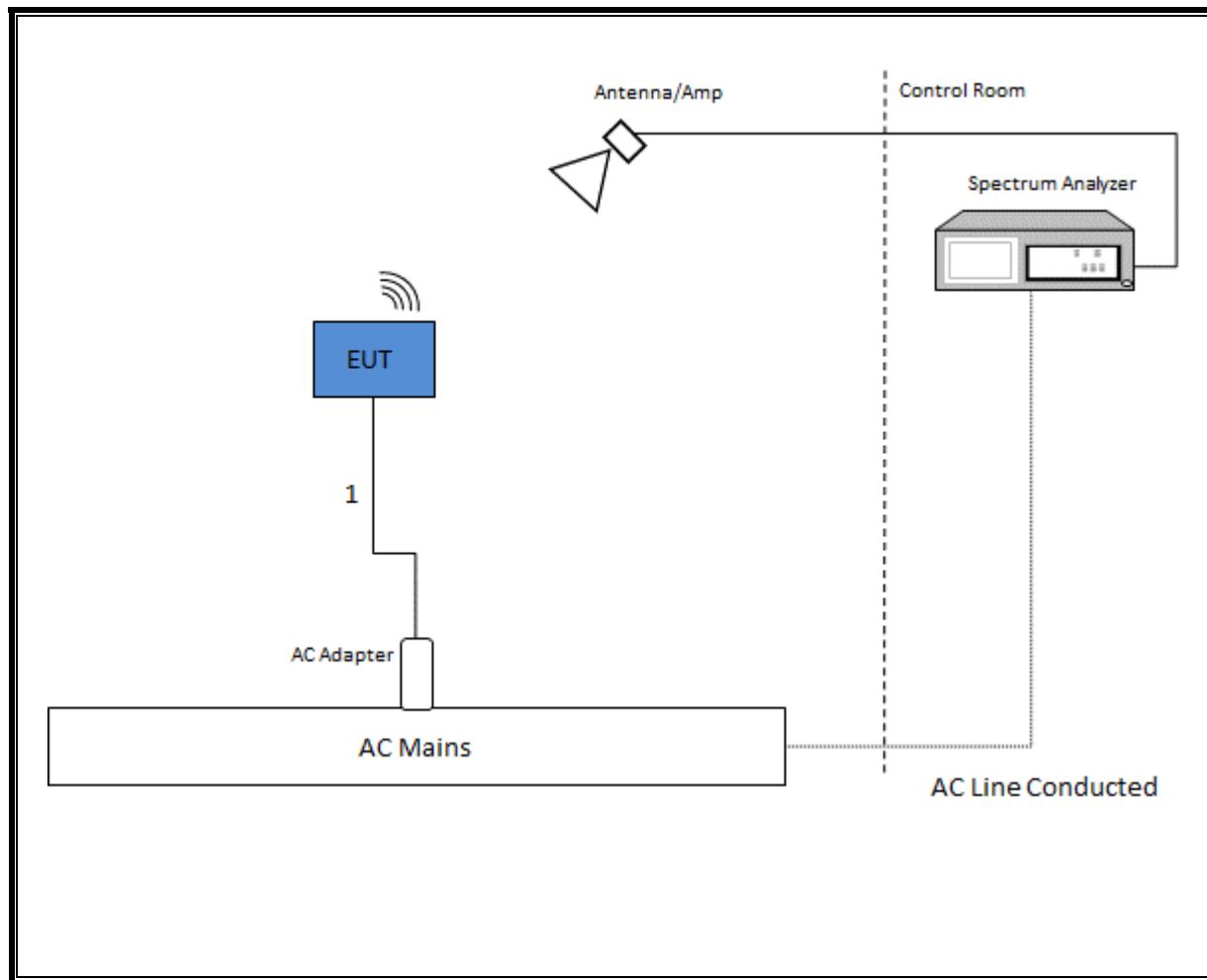
CONDUCTED TEST SETUP DIAGRAM

The EUT is connected to a test laptop computer during the tests. Test software exercised the radio card.



RADIATED AND AC LINE CONDUCTED TEST SETUP DIAGRAM

EUT is connected to all support equipment. The test software exercises the radio. Support laptop was removed after EUT was configured.



7. MEASUREMENT METHOD

On Time and Duty Cycle: ANSI C63.10 Section 11.6

Occupied BW (99%): ANSI C63.10-2013 Section 6.9.3

6 dB BW: ANSI C63.10 Subclause -11.8.1

Output Power: ANSI C63.10 Subclause -11.9.1.3 Method PKPM1 Peak-reading power meter
Output Power: ANSI C63.10 Subclause -11.9.2.3.2 Method AVGPM-G (Measurement using a gated RF average-reading power meter)

PSD: ANSI C63.10 Subclause -11.10.2 Method PKPSD (peak PSD)

Radiated emissions non-restricted frequency bands: ANSI C63.10 Subclause -11.11

Radiated emissions restricted frequency bands: ANSI C63.10 Subclause -11.12.1

Conducted emissions in restricted frequency bands: ANSI C63.10 Subclause -11.12.2

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

Radiated Spurious Emissions Below 30MHz: ANSI C63.10-2013 Section 6.4

8. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Asset	Cal Due
Spectrum Analyzer, PSA, 3Hz to 44GHz	Keysight Technologies Inc	E4446A	T146	01/29/2021
Spectrum Analyzer, PSA, 3Hz to 44GHz	Keysight Technologies Inc	N9030A	T917	01/21/2021
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	T1264	01/21/2021
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	T1223	02/25/2020*

UL AUTOMATION SOFTWARE			
Antenna Port Software	UL	UL RF	Ver 2020.1.8

*Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - South Chamber)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	0.009-30MHz	(Loop Ant.)			
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2019-08-08	2020-08-08
	30-1000 MHz				
AT0074	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2019-07-16	2020-07-16
	1-18 GHz				
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2019-04-22	2020-04-22*
	18-26 GHz				
AT0076	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2019-11-07	2020-11-07
	Gain-Loss Chains				
S-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2019-05-02	2020-05-02
S-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2019-05-02	2020-05-02
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2020-03-17	2021-03-17
S-SAC04	Gain-loss string: 18-40GHz	Various	Various	2020-03-23	2021-03-23
	Receiver & Software				
SA0027	Spectrum Analyzer	Agilent	N9030A	2019-05-15	2020-05-15
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Additional Equipment used				
s/n 181474409	Environmental Meter	Fisher Scientific	15-077-963	2018-07-27	2020-07-27

*Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - North Chamber)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	30-1000 MHz				
AT0073	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2019-08-08	2020-08-08
	1-18 GHz				
AT0069	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2019-05-15	2020-05-15
	Gain-Loss Chains				
N-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2019-05-02	2020-05-02
N-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2019-05-02	2020-05-02
N-SAC03	Gain-loss string: 1-18GHz	Various	Various	2020-03-15	2021-03-15
	Receiver & Software				
SA0026 (Out of service @ noon on 03/28/2020)	Spectrum Analyzer	Agilent	N9030A	2019-03-19	2020-03-30
SA0025 (In service @ noon on 03/28/2020)	Spectrum Analyzer	Agilent	N9030A	2020-03-17	2021-03-17
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Additional Equipment used				
s/n 181474341	Environmental Meter	Fisher Scientific	15-077-963	2018-07-27	2020-07-27
T959	Wideband Radio Communications Tester	Rohde and Schwartz	CMW500	2020-02-19	2021-02-19
T978	Wideband Radio Communications Tester	Rohde and Schwartz	CMW500	2020-02-20	2021-02-20
T374	Wideband Radio Communications Tester	Rohde and Schwartz	CMW500	2019-07-08	2020-07-08
HPF009	1GHz high-pass filter, 2W, $F_{high} = 10GHz$	Micro-Tronics	HPM17672	2020-02-19	2021-02-19
HPF015	4GHz high-pass filter, 2W, $F_{high} = 18GHz$	Micro-Tronics	HPM13351	2020-02-19	2021-02-19
LPF008	DC-1000MHz low-pass filter	Pasternack	PE8720	2020-02-19	2021-02-19
BRF001	900MHz notch filter, 2W, $F_{high} = 6GHz$	Micro-Tronics	BRM50706	2020-02-19	2021-02-19

*Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Common Equipment				
	Conducted Room 2				
T177 (PRE0079253)	Spectrum Analyzer	Agilent Technologies	E4446A	2019-04-22	2020-04-22
PWM002 (PRE0137344)	RF Power Meter	Keysight Technologies	N1911A	2019-08-23	2020-08-23
PWS003 (PRE0126443)	Peak and Avg Power Sensor, 50MHz to 6GHz	Keysight Technologies	E9323A	2019-08-23	2020-08-23
76023 (EC0225)	Temp/Humid Chamber	Cincinnati Sub-Zero	ZPH-8-3.5-SCT/AC	2019-06-14	2020-06-14
SN 181474341	Environmental Meter	Fisher Scientific	15-077-963	2018-07-27	2020-07-27
76021	DC Regulated Power Supply	CircuitSpecialists.Com	CSI3005X5	N/A	N/A
SOFTEMI	EMC Software	UL	Version 10.3 (2019-09-24)	NA	NA

Test Equipment Used - Line-Conducted Emissions – Voltage (Morrisville – Conducted 1)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
CBL087	Coax cable, RG223, N-male to BNC-male, 20-ft.	Pasternack	PE3W06143-240	2020-03-26	2021-03-26
s/n 181562858	Environmental Meter	Fisher Scientific	14-650-118	2018-09-04	2020-09-04
LISN003	LISN, 50-ohm/50-uH, 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50-25-2-01-550V	2019-08-19	2020-08-19
75141 (PRE0101521)	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2019-08-20	2020-08-20
ATA222	Transient Limiter, 0.009-100MHz	Electro-Metrics	EM-7600	2020-03-26	2021-03-26
PS214	AC Power Source	Elgar	CW2501M (s/n 1523A02396)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Miscellaneous (if needed)				
CDECABLE001	ANSI C63.4 1m extension cable.	UL	Per Annex B of ANSI C63.4	2019-07-10	2020-07-10

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

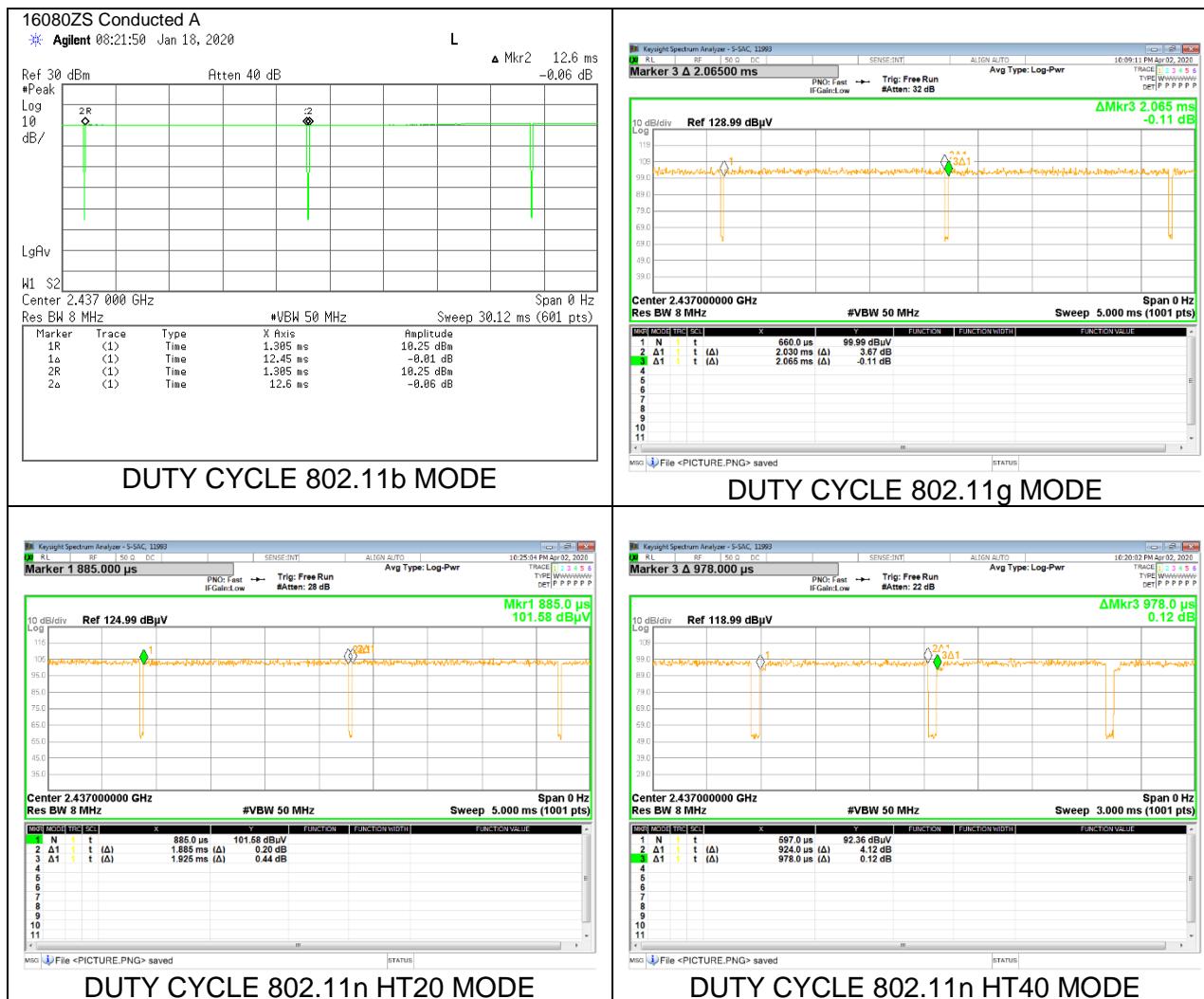
PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

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	12.45	12.60	0.988	98.81%	0.00	0.010
802.11g	2.030	2.065	0.983	98.31%	0.00	0.010
802.11n HT20	1.885	1.925	0.979	97.92%	0.18	0.531
802.11n HT40	0.924	0.978	0.945	94.48%	0.5	1.082

DUTY CYCLE PLOTS



9.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

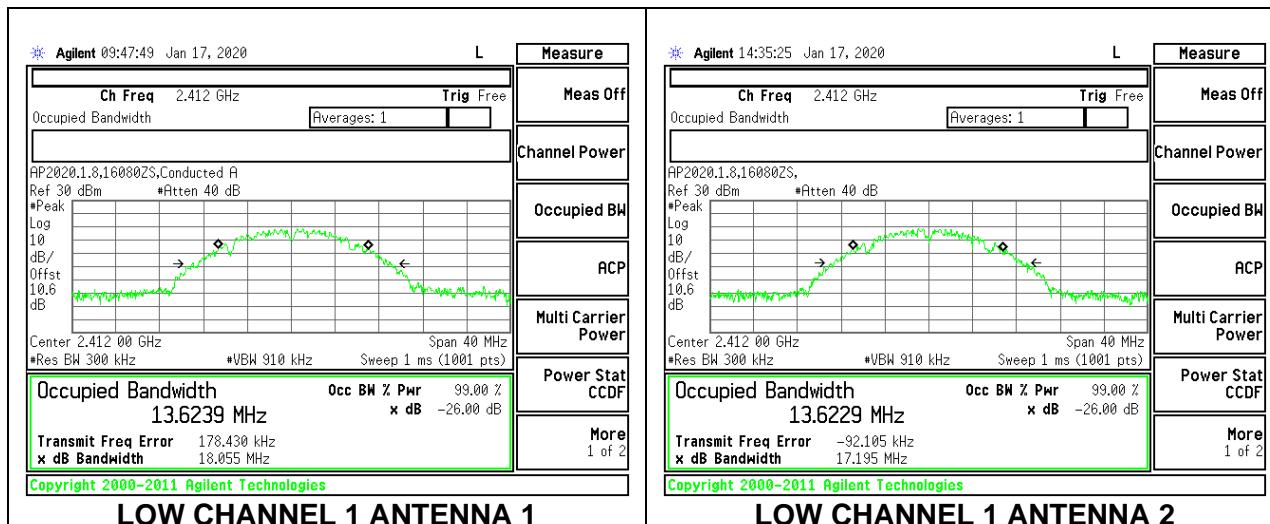
RESULTS

9.2.1. 802.11b MODE

2TX Antenna 1 + Antenna 2 CDD MODE

Channel	Frequency (MHz)	99% Bandwidth Antenna 1 (MHz)	99% Bandwidth Antenna 2 (MHz)
Low 1	2412	13.6239	13.6229
Low 2	2417	13.5143	13.4547
Mid 6	2437	13.6425	13.4760
High 10	2457	13.3691	13.5986
High 11	2462	13.5198	13.5608
High 12	2467	13.9743	13.4613
High 13	2472	13.7827	13.7345

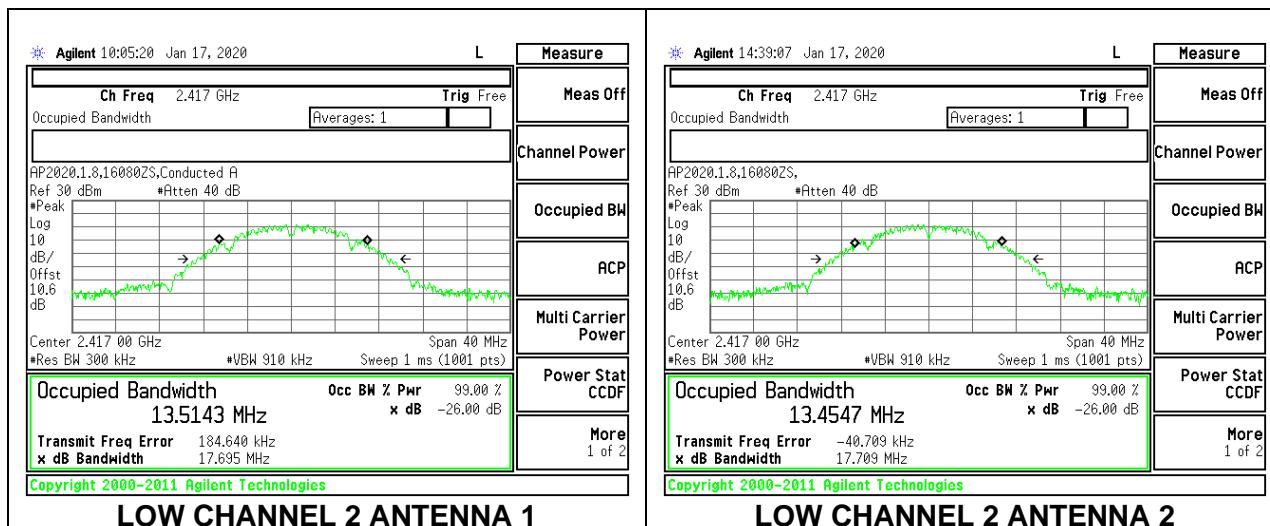
LOW CHANNEL 1



LOW CHANNEL 1 ANTENNA 1

LOW CHANNEL 1 ANTENNA 2

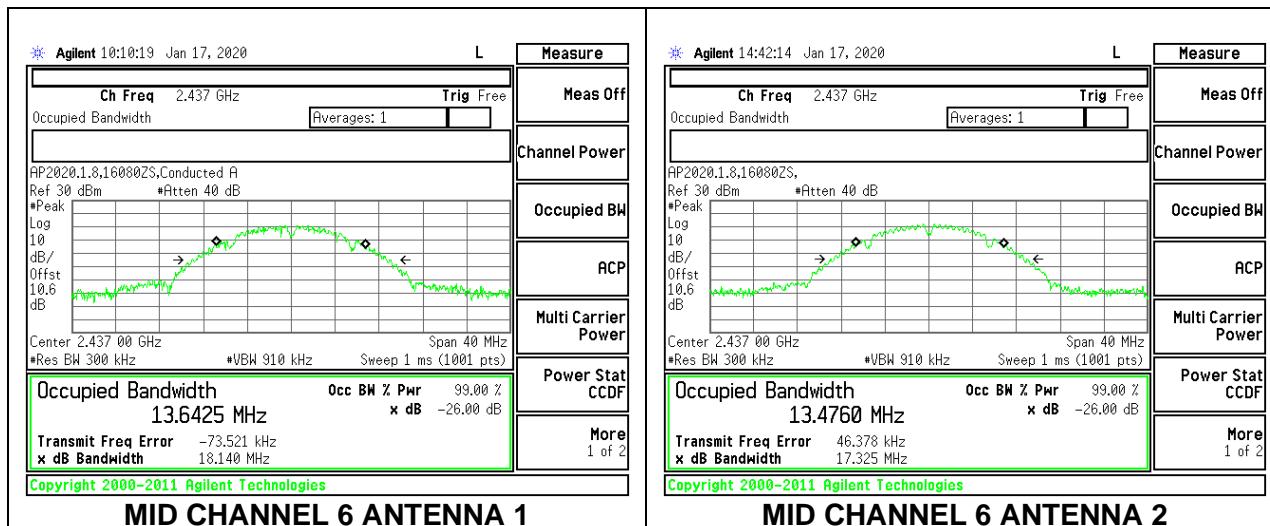
LOW CHANNEL 2



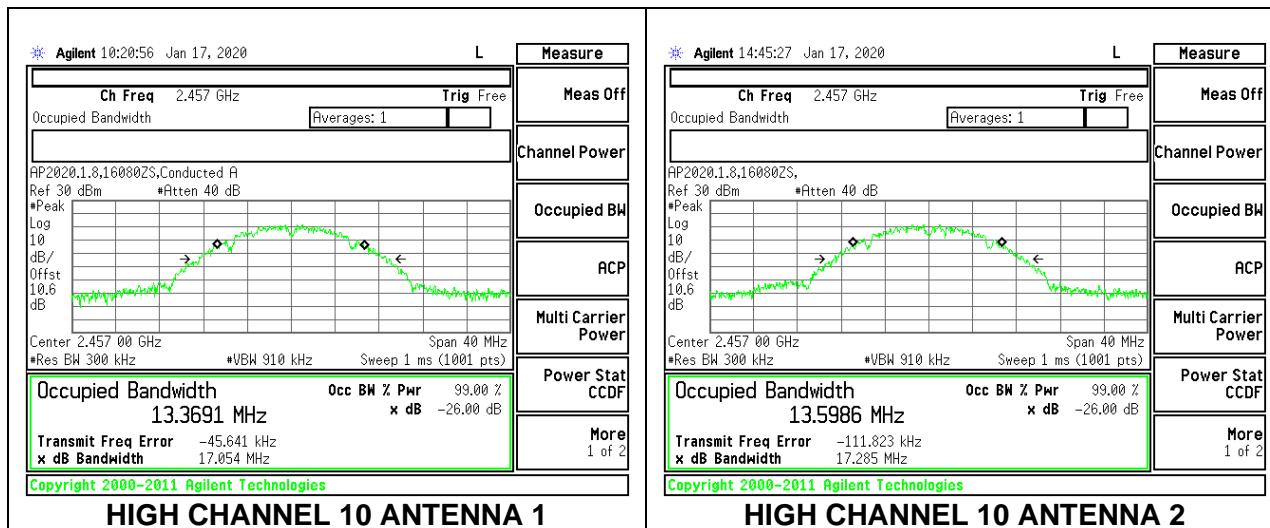
LOW CHANNEL 2 ANTENNA 1

LOW CHANNEL 2 ANTENNA 2

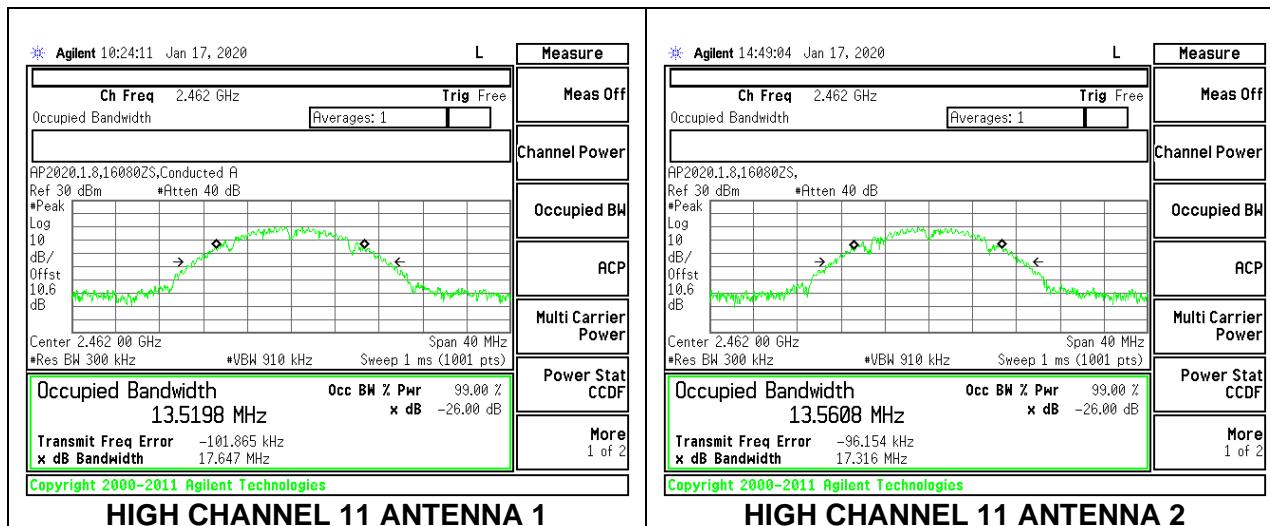
MID CHANNEL 6



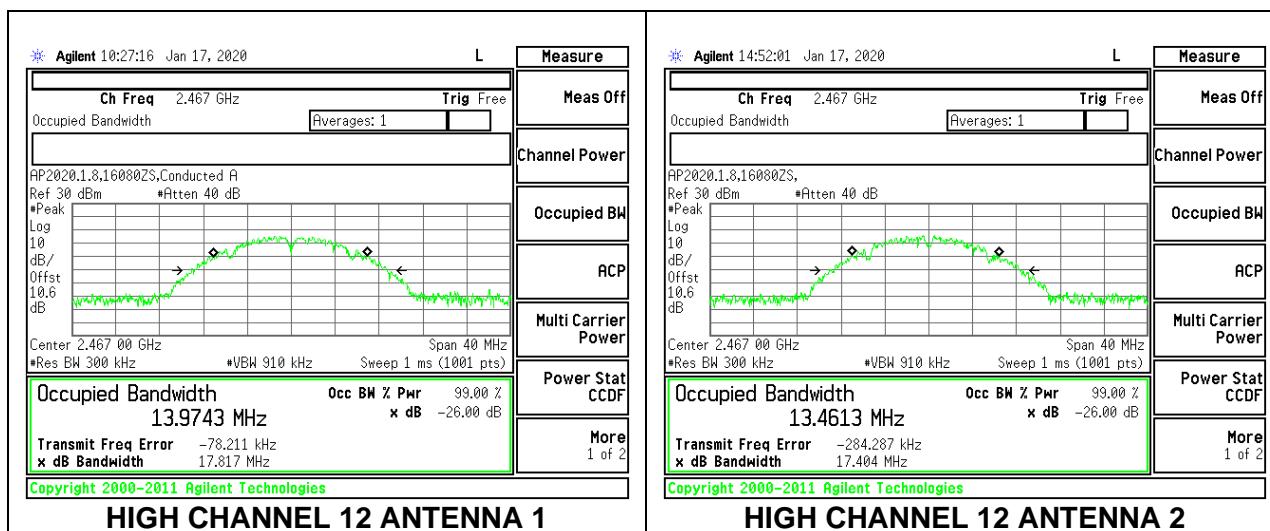
HIGH CHANNEL 10



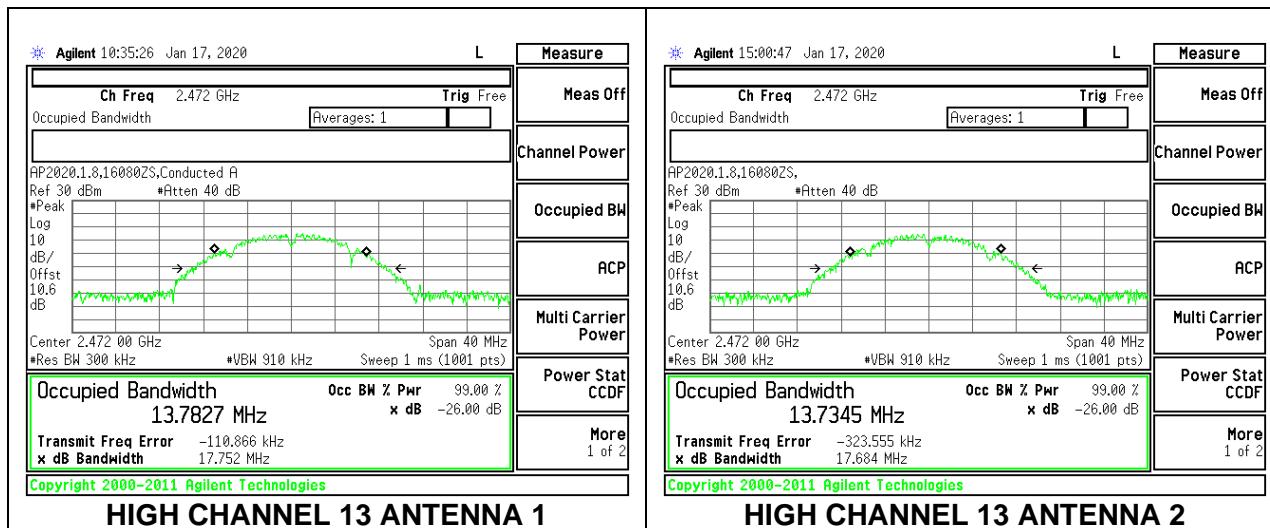
HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13

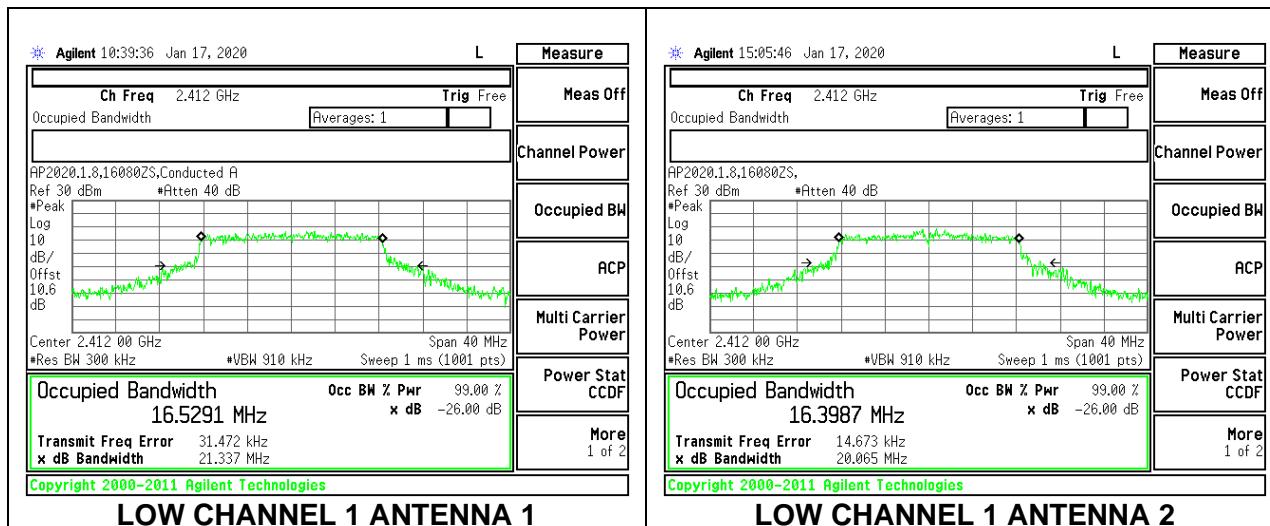


9.2.2. 802.11g MODE

2TX Antenna 1 + Antenna 2 CDD MODE

Channel	Frequency (MHz)	99% Bandwidth Antenna 1 (MHz)	99% Bandwidth Antenna 2 (MHz)
Low 1	2412	16.5291	16.3987
Low 2	2417	16.4922	16.5061
Mid 6	2437	16.5362	16.5469
High 10	2457	16.5199	16.5434
High 11	2462	16.4720	16.4872
High 12	2467	16.5235	16.5093
High 13	2472	16.4779	16.5077

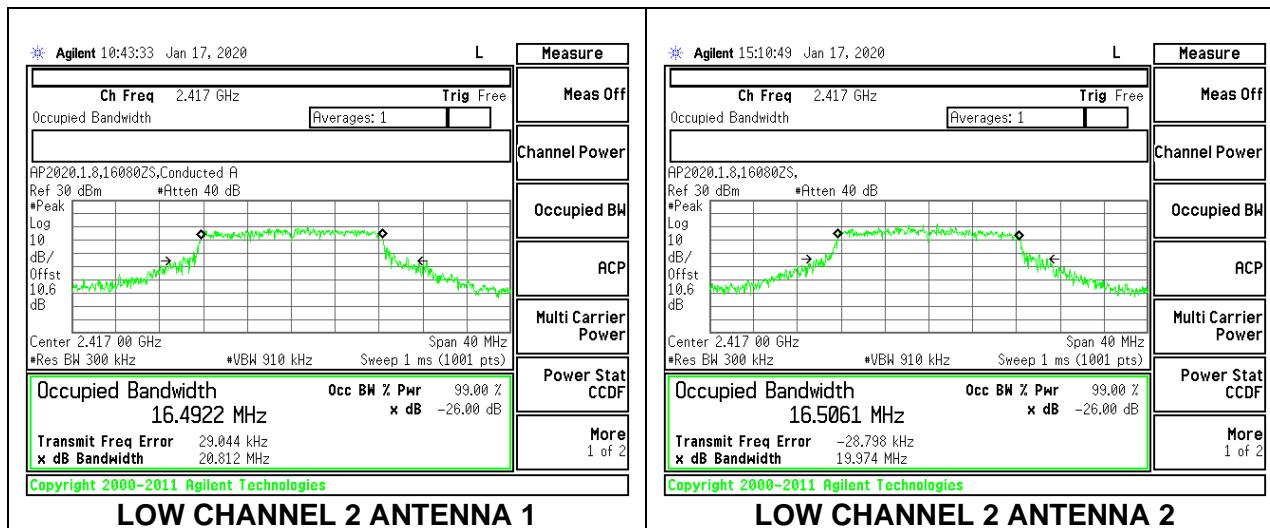
LOW CHANNEL 1



LOW CHANNEL 1 ANTENNA 1

LOW CHANNEL 1 ANTENNA 2

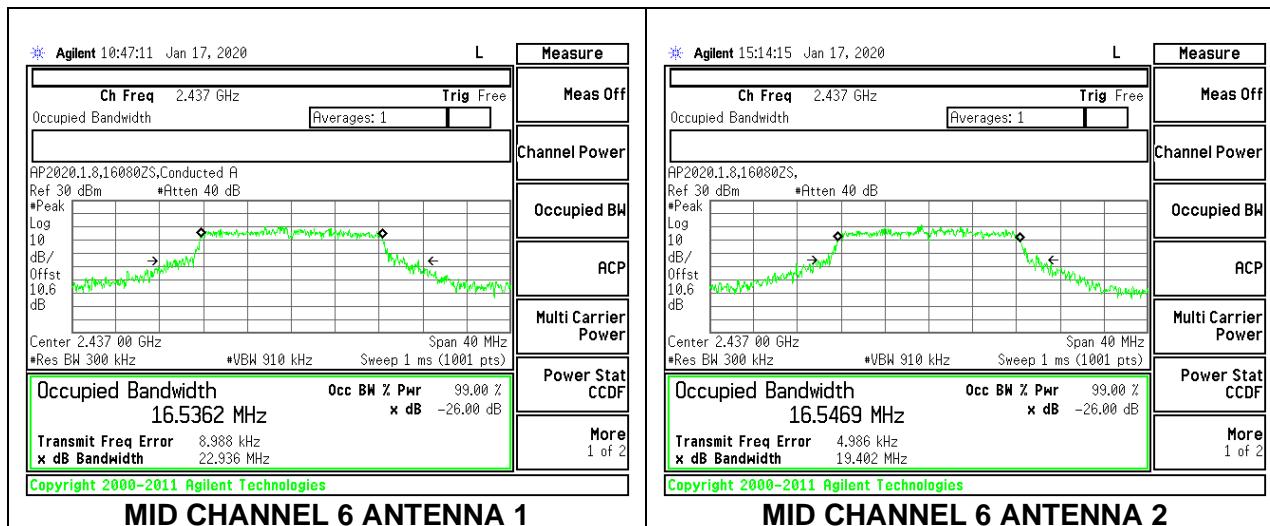
LOW CHANNEL 2



LOW CHANNEL 2 ANTENNA 1

LOW CHANNEL 2 ANTENNA 2

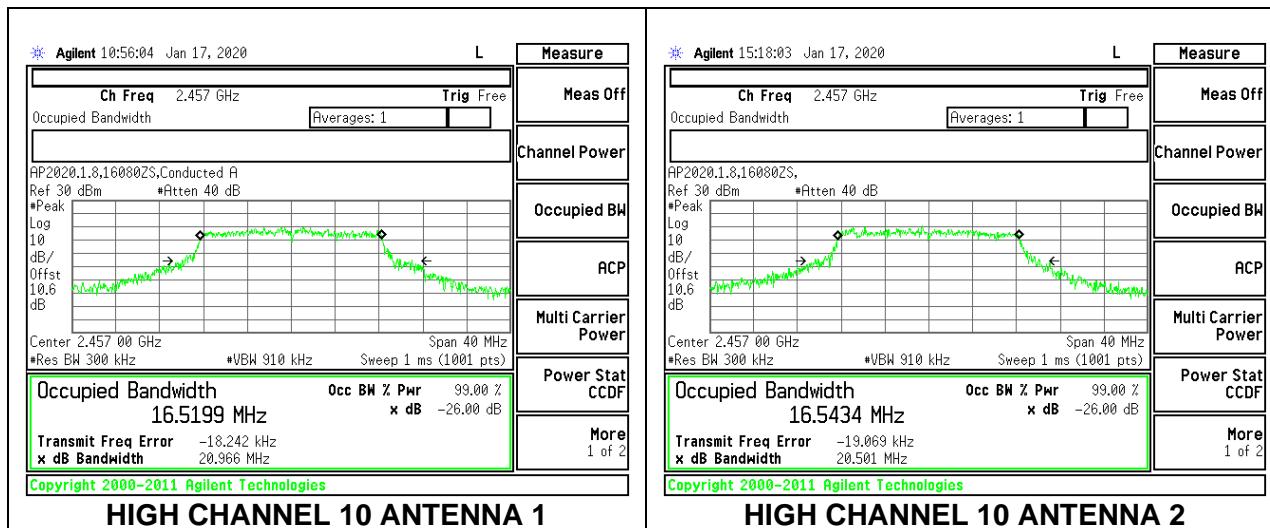
MID CHANNEL 6



MID CHANNEL 6 ANTENNA 1

MID CHANNEL 6 ANTENNA 2

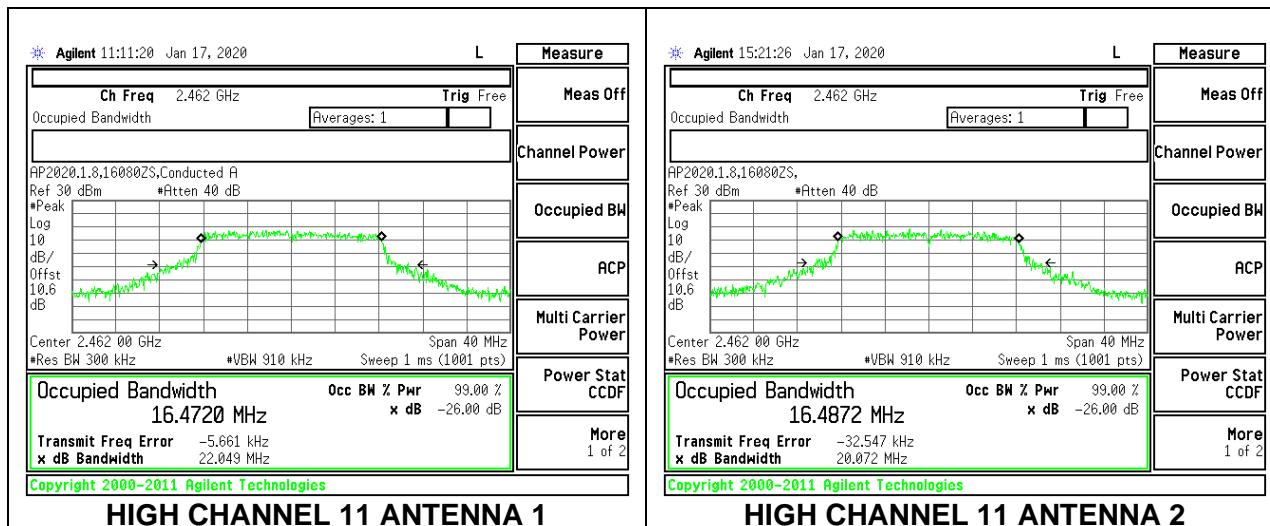
HIGH CHANNEL 10



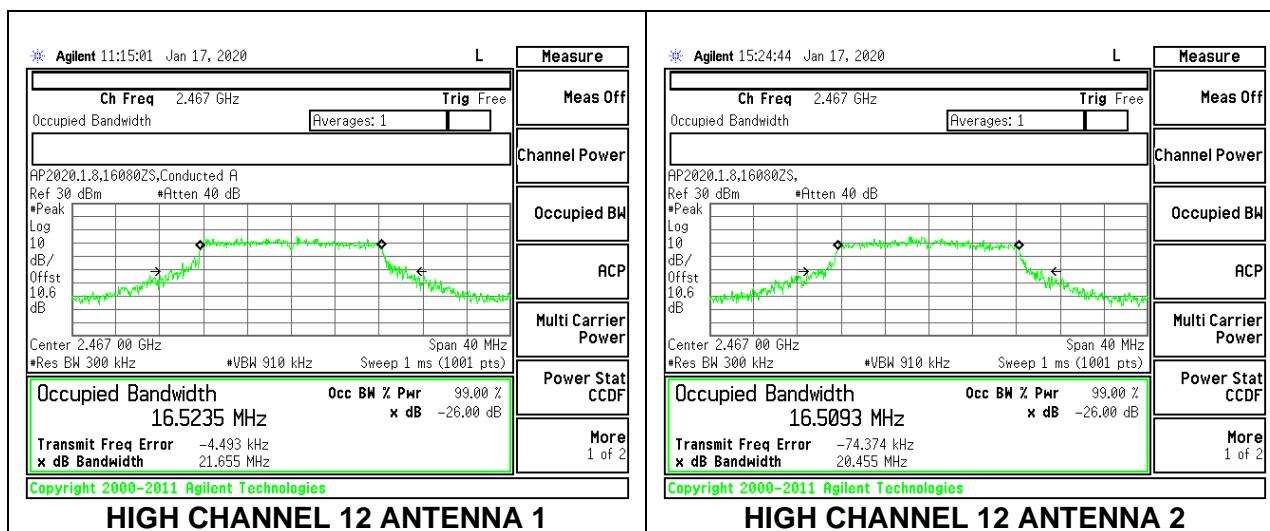
HIGH CHANNEL 10 ANTENNA 1

HIGH CHANNEL 10 ANTENNA 2

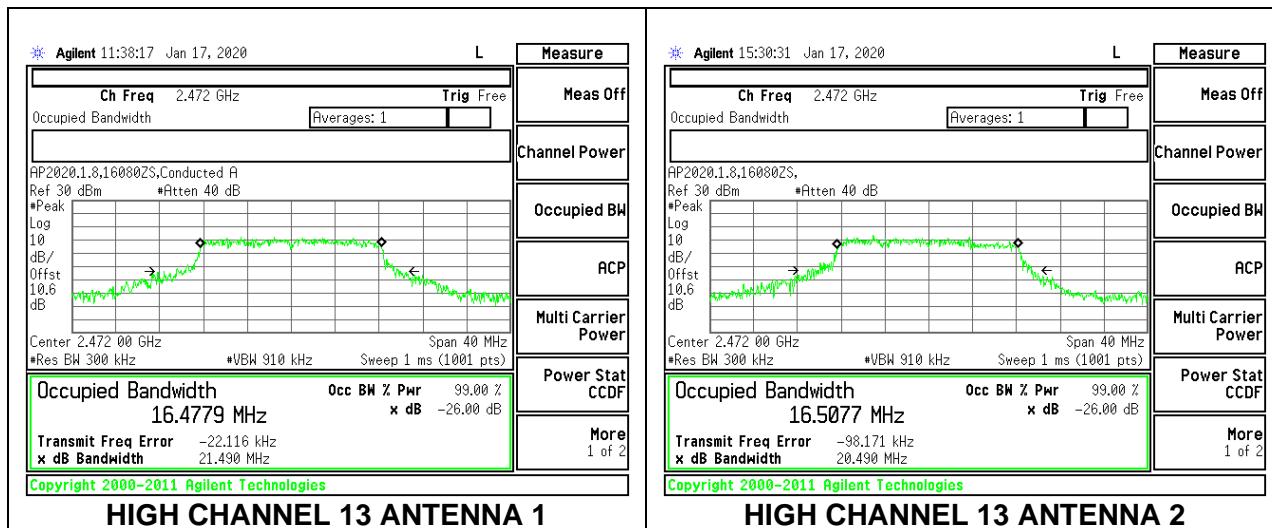
HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13

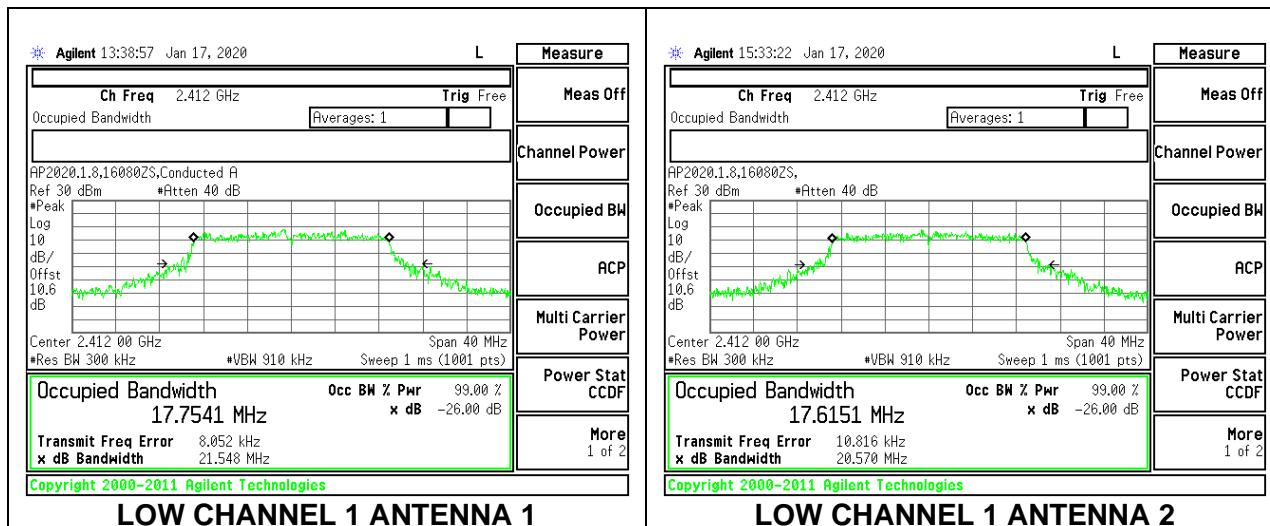


9.2.3. 802.11n HT20 MODE

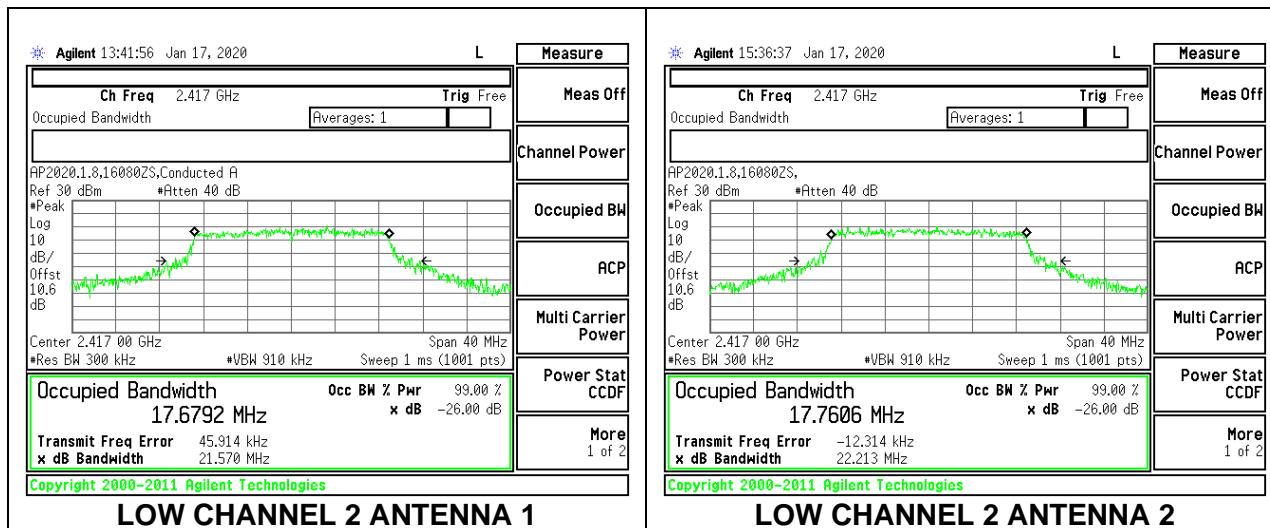
2TX Antenna 1 + Antenna 2 CDD MODE

Channel	Frequency (MHz)	99% Bandwidth Antenna 1 (MHz)	99% Bandwidth Antenna 2 (MHz)
Low 1	2412	17.7541	17.6151
Low 2	2417	17.6792	17.7606
Mid 6	2437	17.7710	17.6546
High 10	2457	17.6799	17.7110
High 11	2462	17.7090	17.7069
High 12	2467	17.8072	17.6439
High 13	2472	17.6910	17.6865

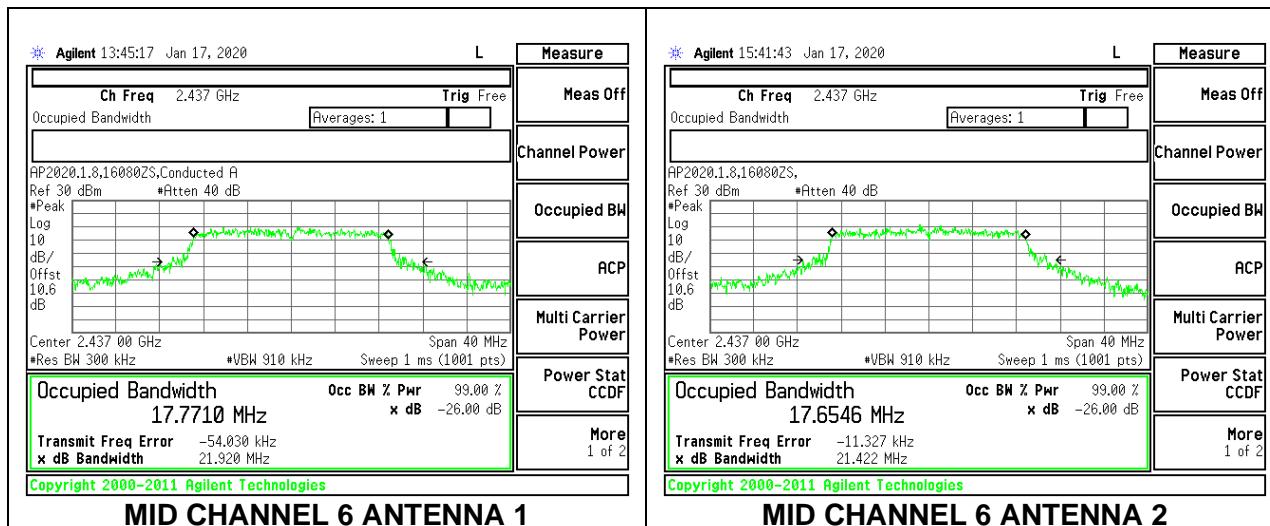
LOW CHANNEL 1



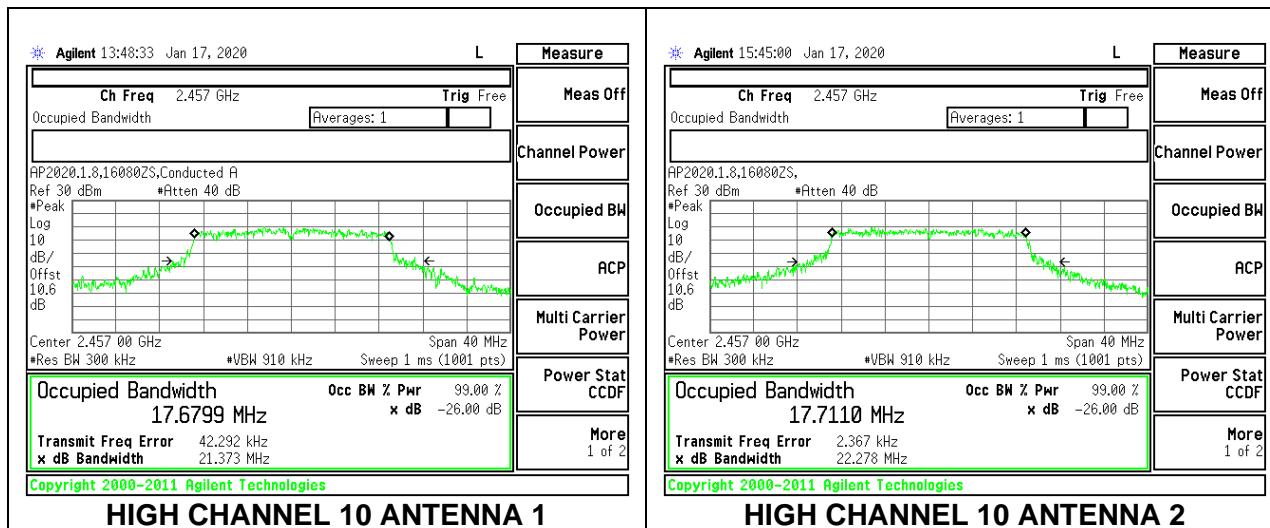
LOW CHANNEL 2



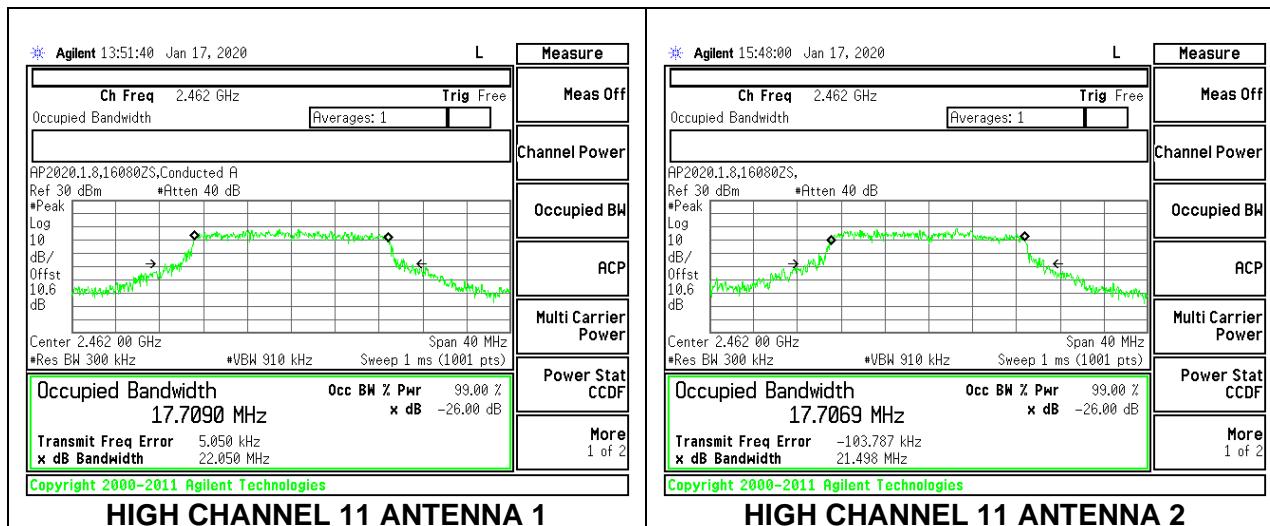
MID CHANNEL 6



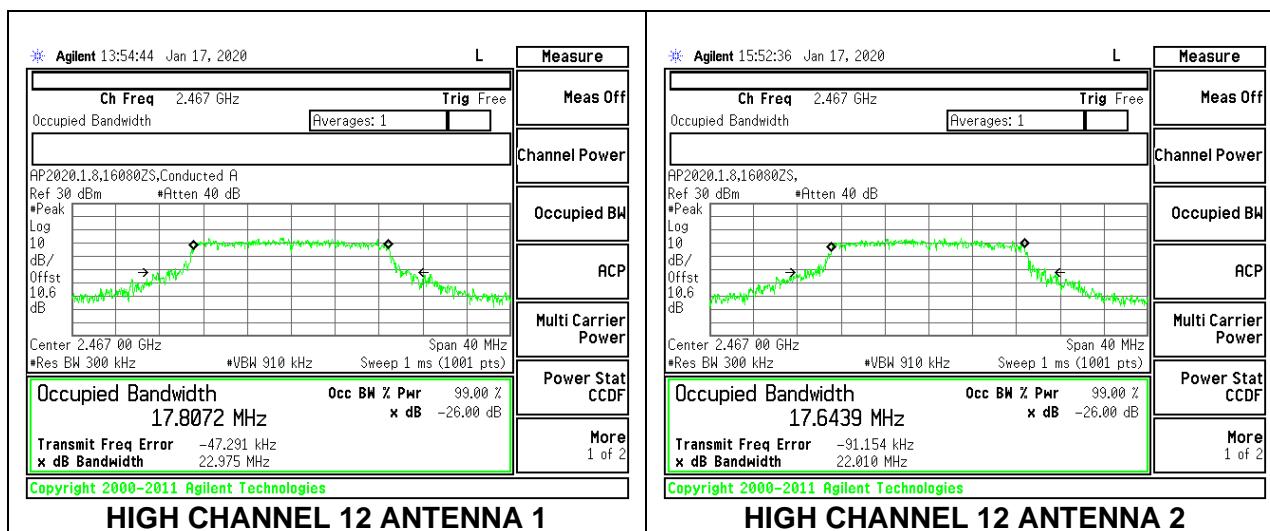
HIGH CHANNEL 10



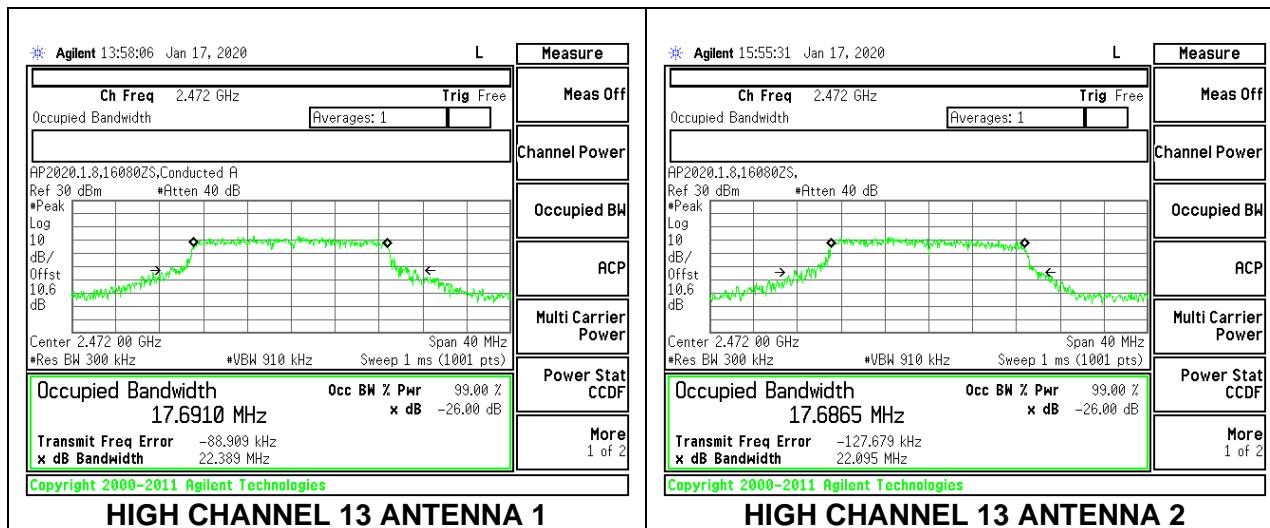
HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13

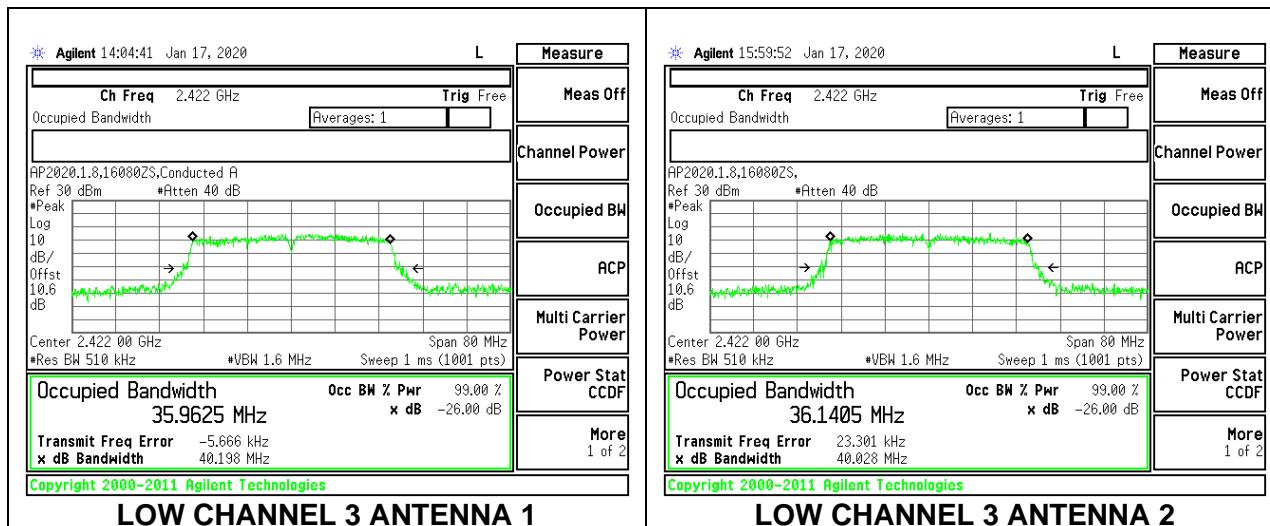


9.2.4. 802.11n HT40 MODE

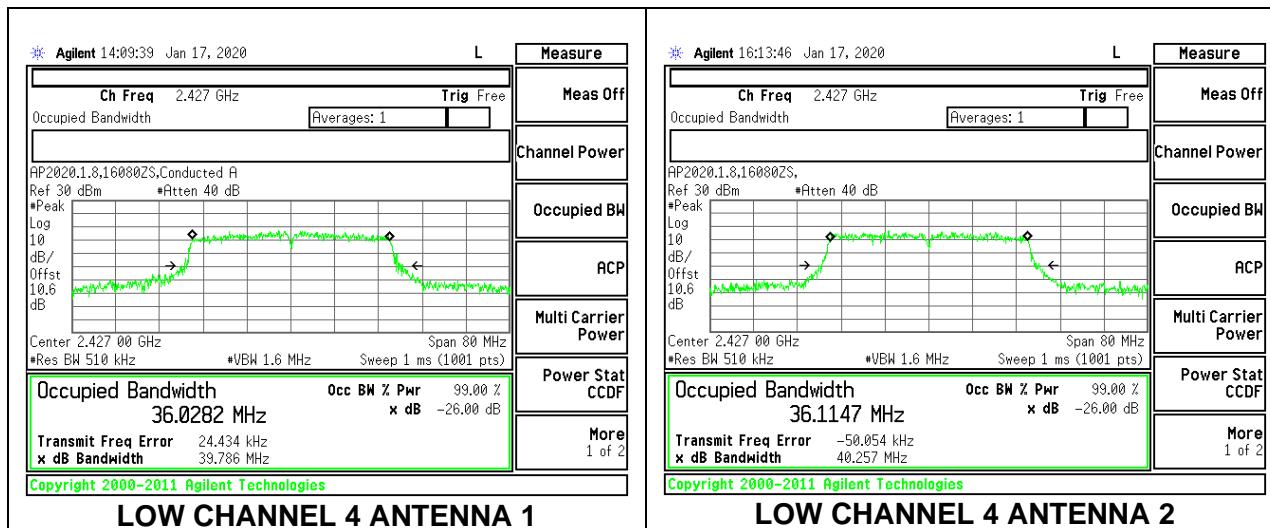
2TX Antenna 1 + Antenna 2 CDD MODE

Channel	Frequency (MHz)	99% Bandwidth Antenna 1 (MHz)	99% Bandwidth Antenna 2 (MHz)
Low 3	2422	35.9625	36.1405
Low 4	2427	36.0282	36.1147
Mid 6	2437	36.1741	36.1382
High 9	2452	36.0918	36.0448
High 10	2457	36.2006	36.0099
High 11	2462	36.0497	36.1216

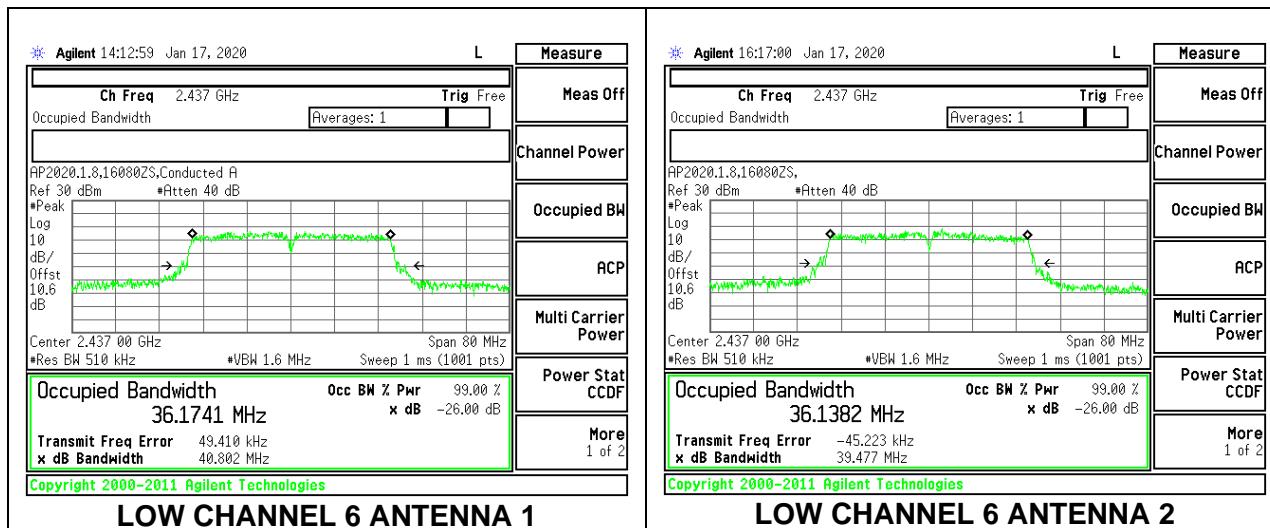
LOW CHANNEL 3



LOW CHANNEL 4



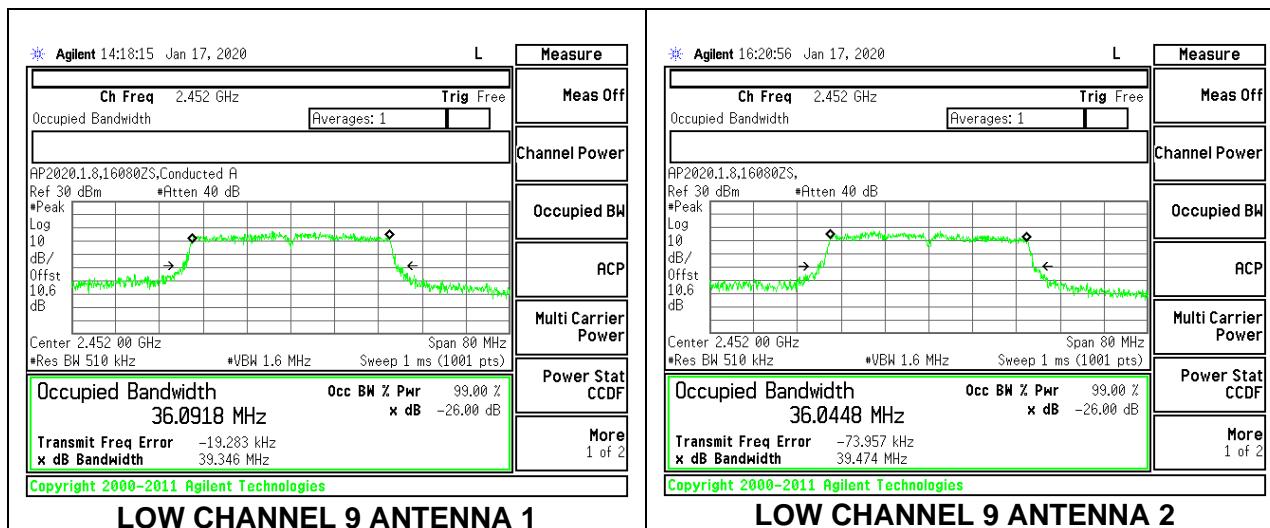
LOW CHANNEL 6



LOW CHANNEL 6 ANTENNA 1

LOW CHANNEL 6 ANTENNA 2

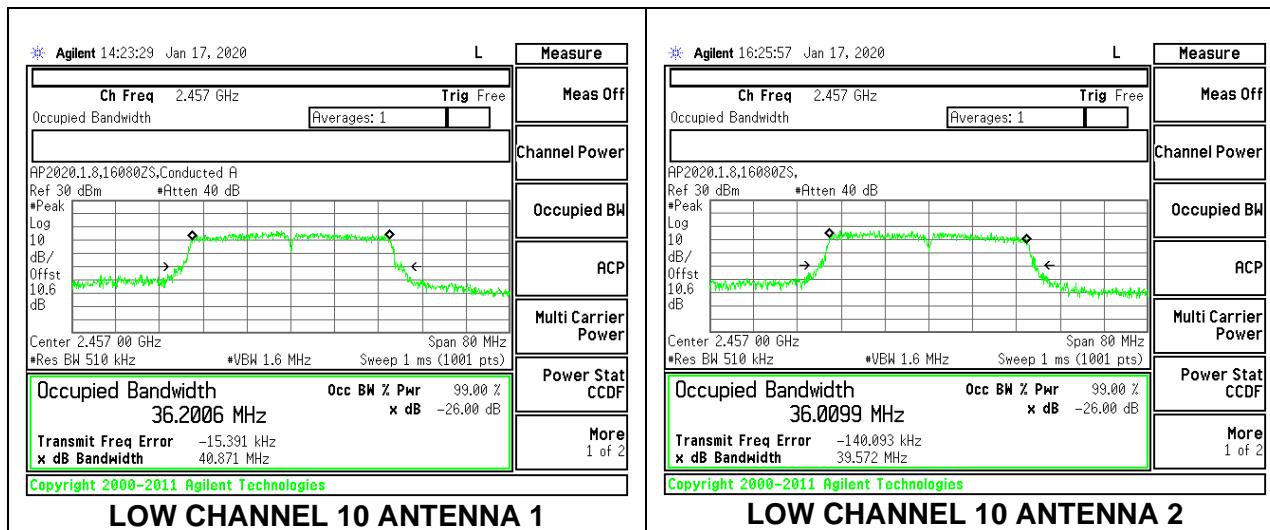
LOW CHANNEL 9



LOW CHANNEL 9 ANTENNA 1

LOW CHANNEL 9 ANTENNA 2

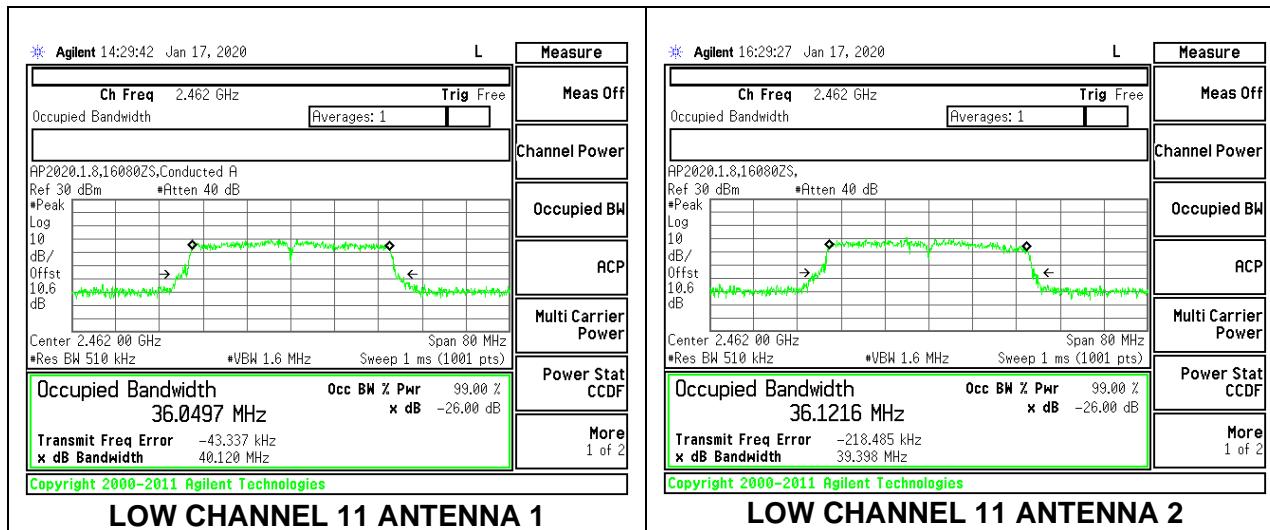
LOW CHANNEL 10



LOW CHANNEL 10 ANTENNA 1

LOW CHANNEL 10 ANTENNA 2

LOW CHANNEL 11



LOW CHANNEL 11 ANTENNA 1

LOW CHANNEL 11 ANTENNA 2

9.3. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

RSS-247 5.2 (a)

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

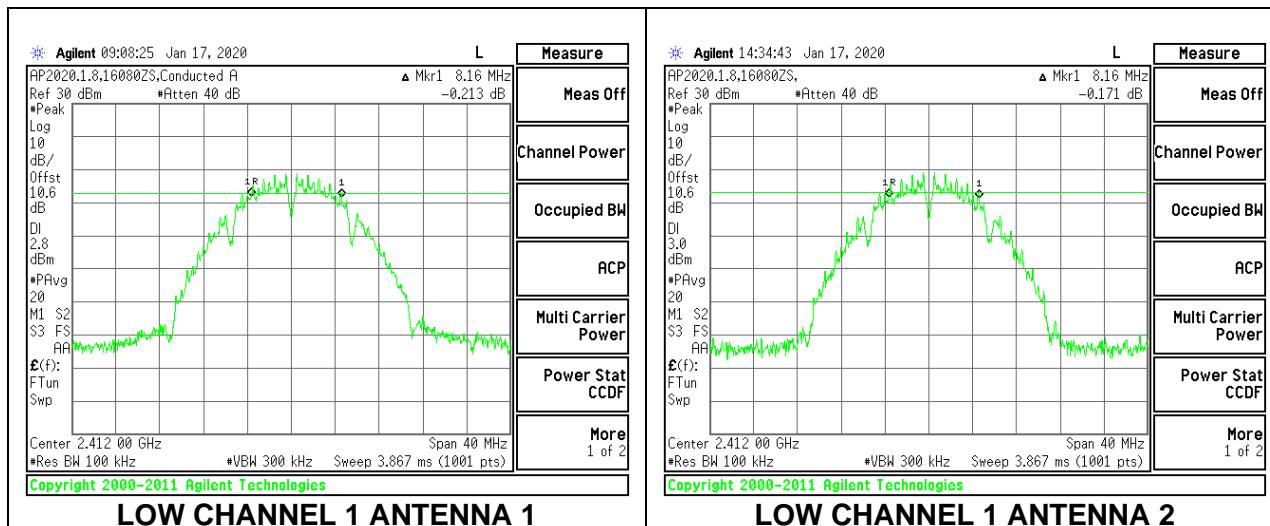
RESULTS

9.3.1. 802.11b MODE

2TX Antenna 1 + Antenna 2 CDD MODE

Channel	Frequency (MHz)	6 dB BW Antenna 1 (MHz)	6 dB BW Antenna 2 (MHz)	Minimum Limit (MHz)
Low 1	2412	8.16	8.16	0.5
Low 2	2417	8.20	8.16	0.5
Mid 6	2437	8.20	8.20	0.5
High 10	2457	8.16	8.20	0.5
High 11	2462	7.80	8.20	0.5
High 12	2467	8.72	8.20	0.5
High 13	2472	9.12	8.64	0.5

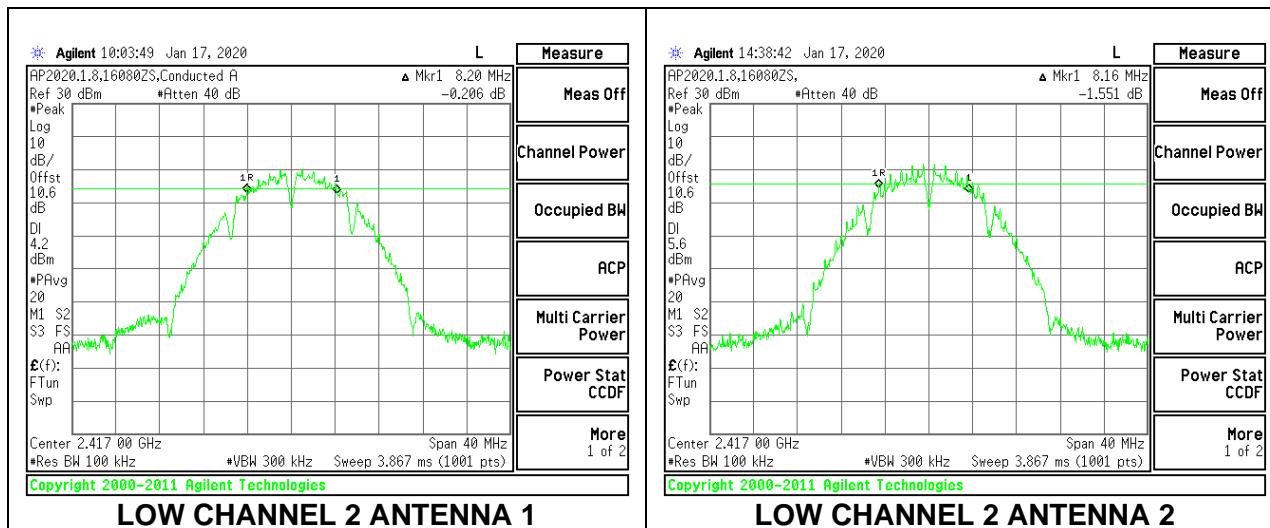
LOW CHANNEL 1



LOW CHANNEL 1 ANTENNA 1

LOW CHANNEL 1 ANTENNA 2

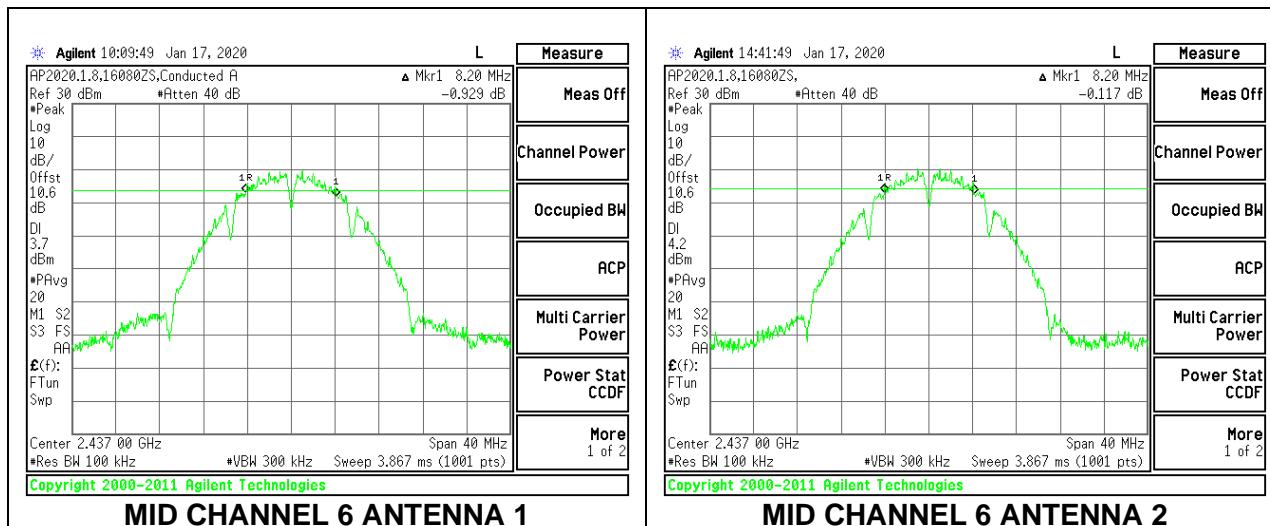
LOW CHANNEL 2



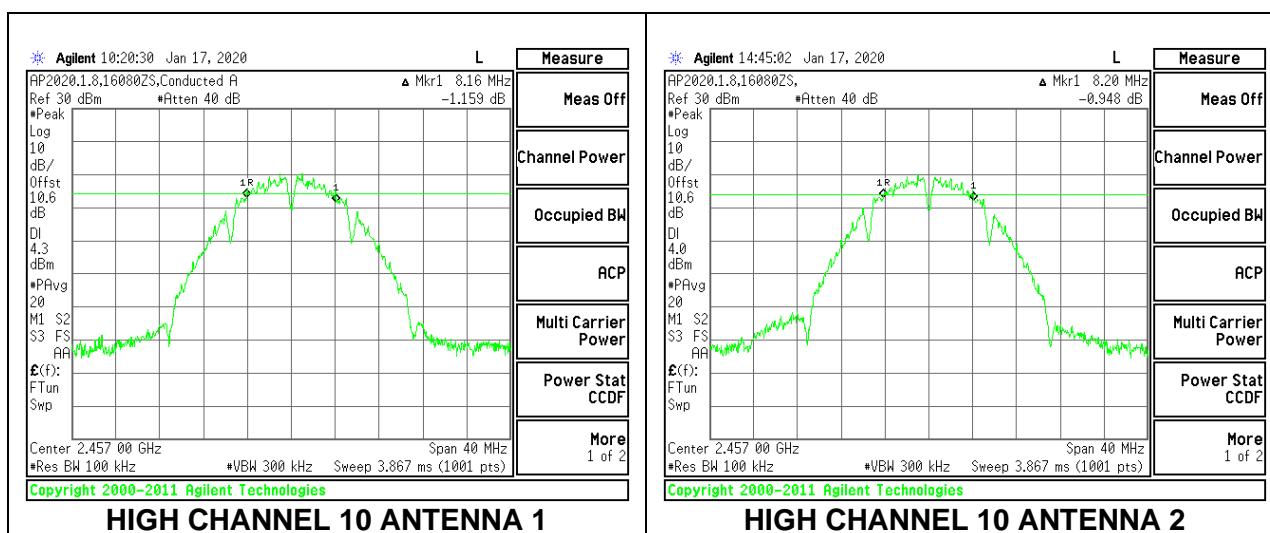
LOW CHANNEL 2 ANTENNA 1

LOW CHANNEL 2 ANTENNA 2

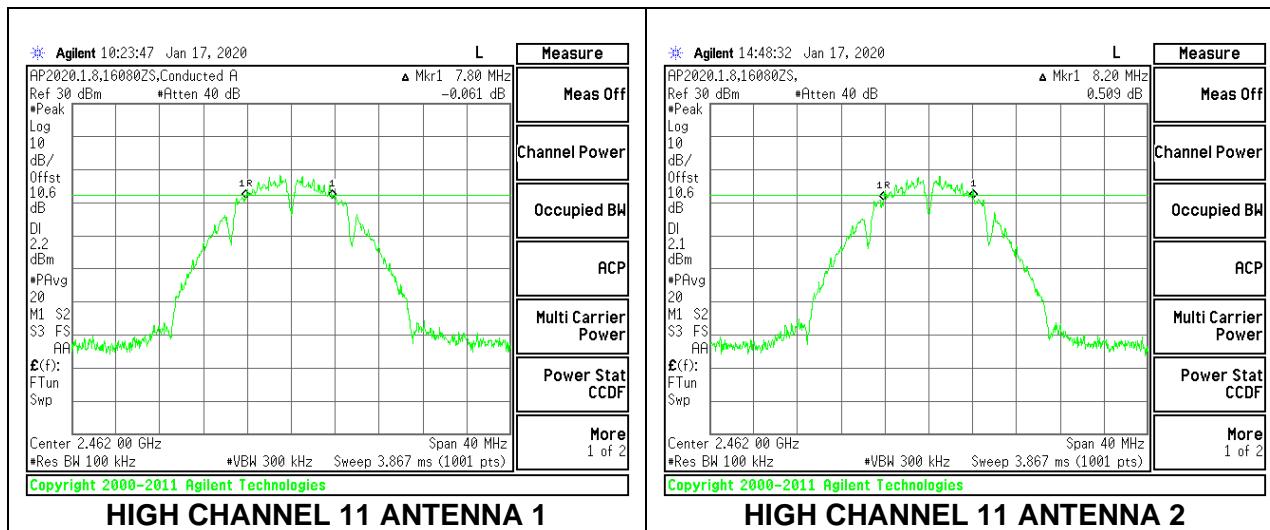
MID CHANNEL 6



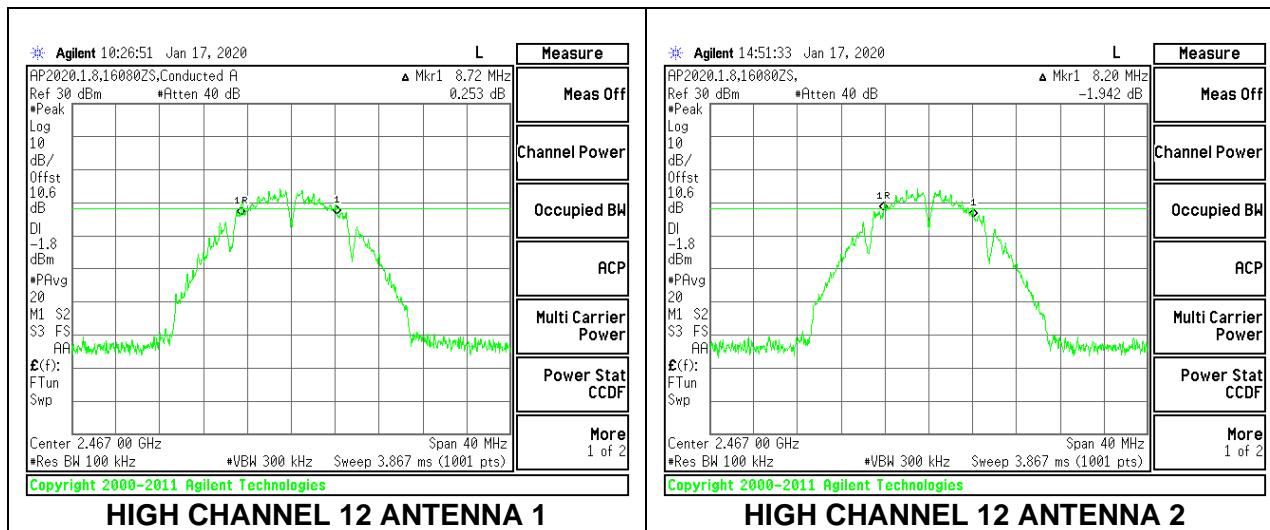
HIGH CHANNEL 10



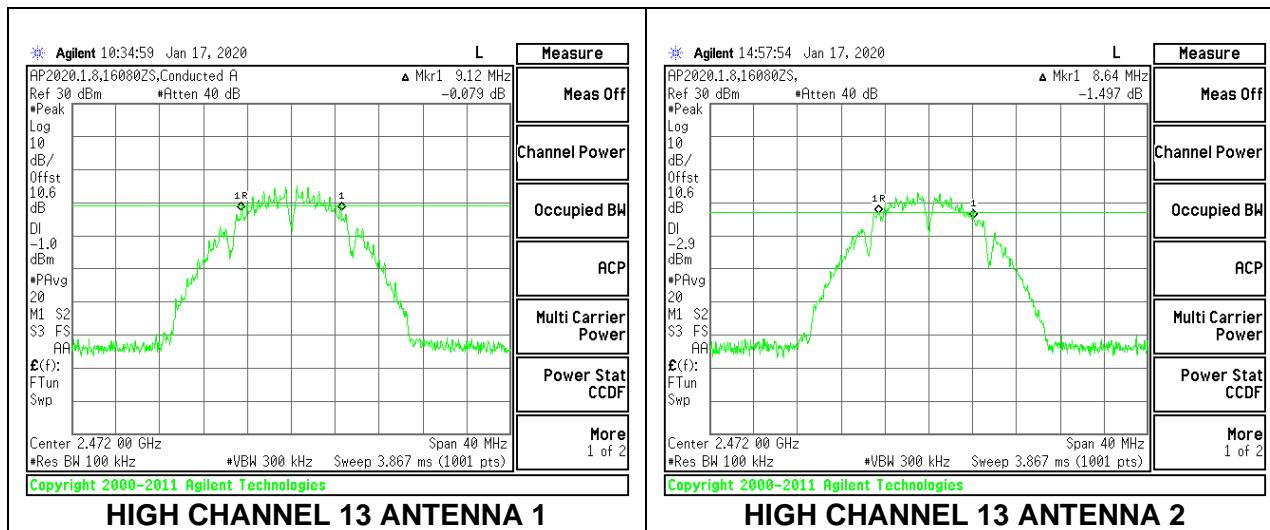
HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13

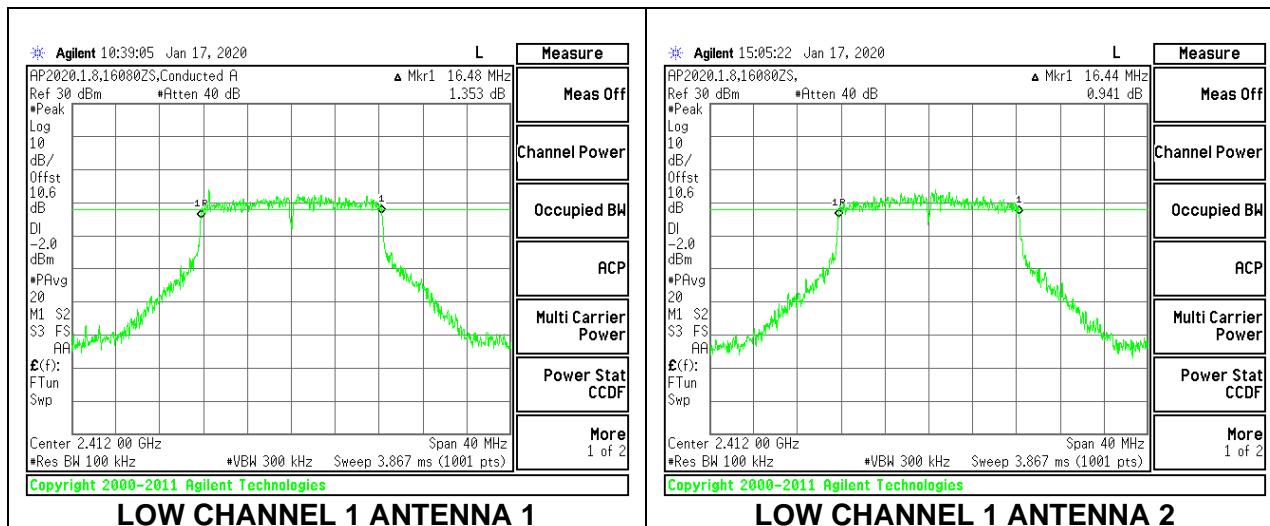


9.3.2. 802.11g MODE

2TX Antenna 1 + Antenna 2 CDD MODE

Channel	Frequency (MHz)	6 dB BW Antenna 1 (MHz)	6 dB BW Antenna 2 (MHz)	Minimum Limit (MHz)
Low 1	2412	16.48	16.44	0.5
Low 2	2417	16.52	16.40	0.5
Mid 6	2437	16.00	16.48	0.5
High 10	2457	16.44	16.52	0.5
High 11	2462	15.88	16.48	0.5
High 12	2467	15.76	16.48	0.5
High 13	2472	15.84	16.20	0.5

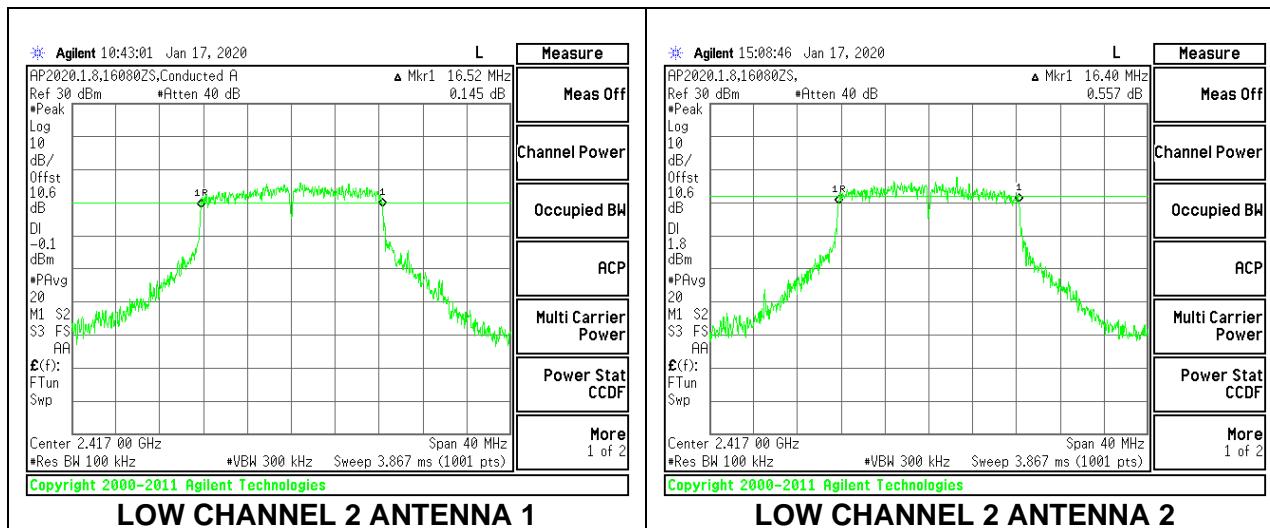
LOW CHANNEL 1



LOW CHANNEL 1 ANTENNA 1

LOW CHANNEL 1 ANTENNA 2

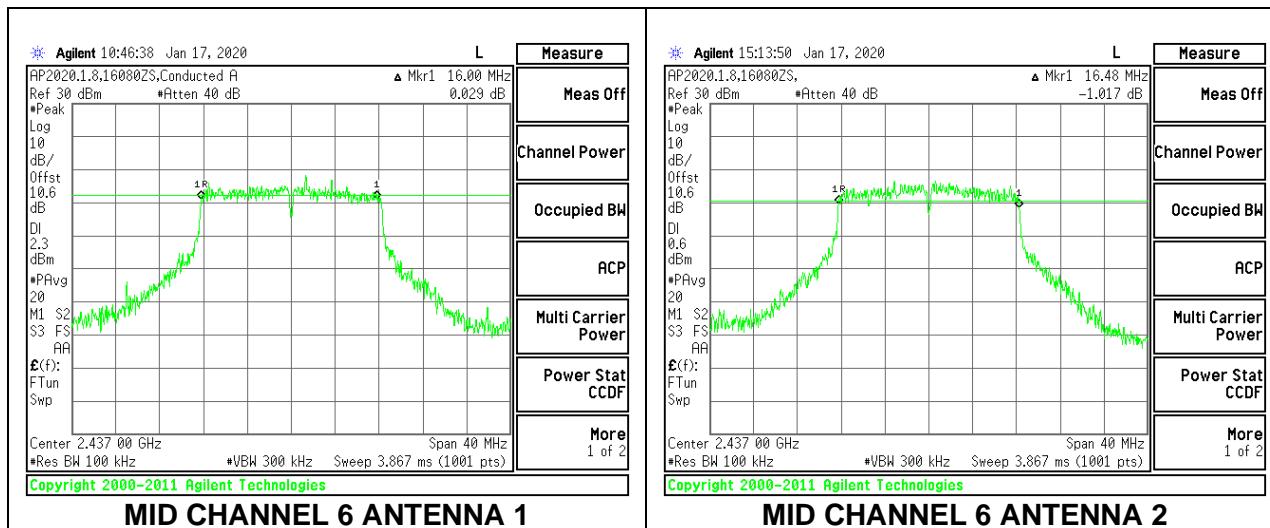
LOW CHANNEL 2



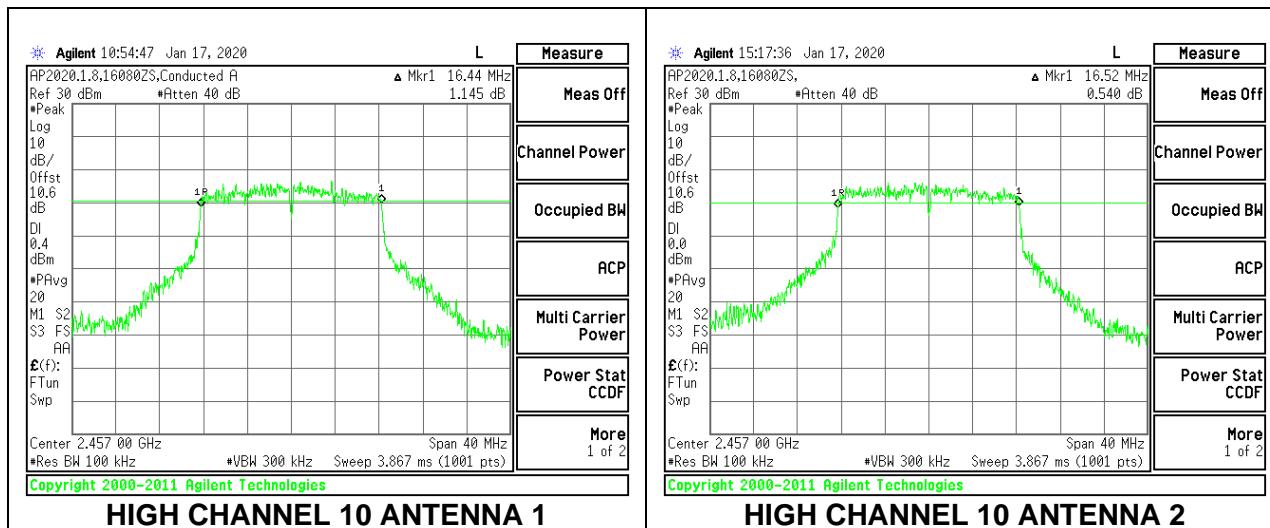
LOW CHANNEL 2 ANTENNA 1

LOW CHANNEL 2 ANTENNA 2

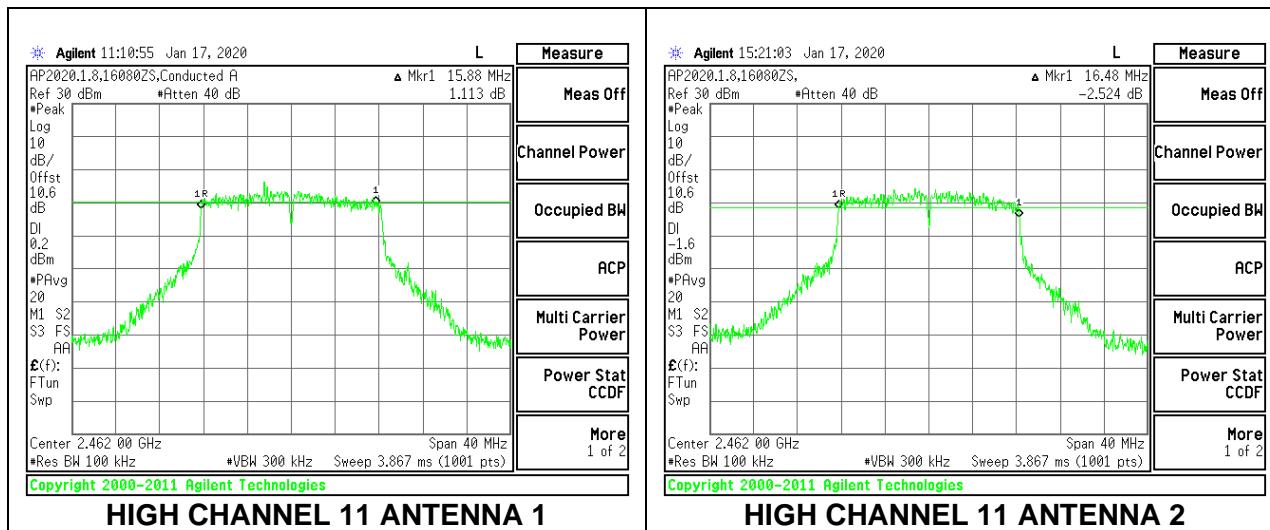
MID CHANNEL 6



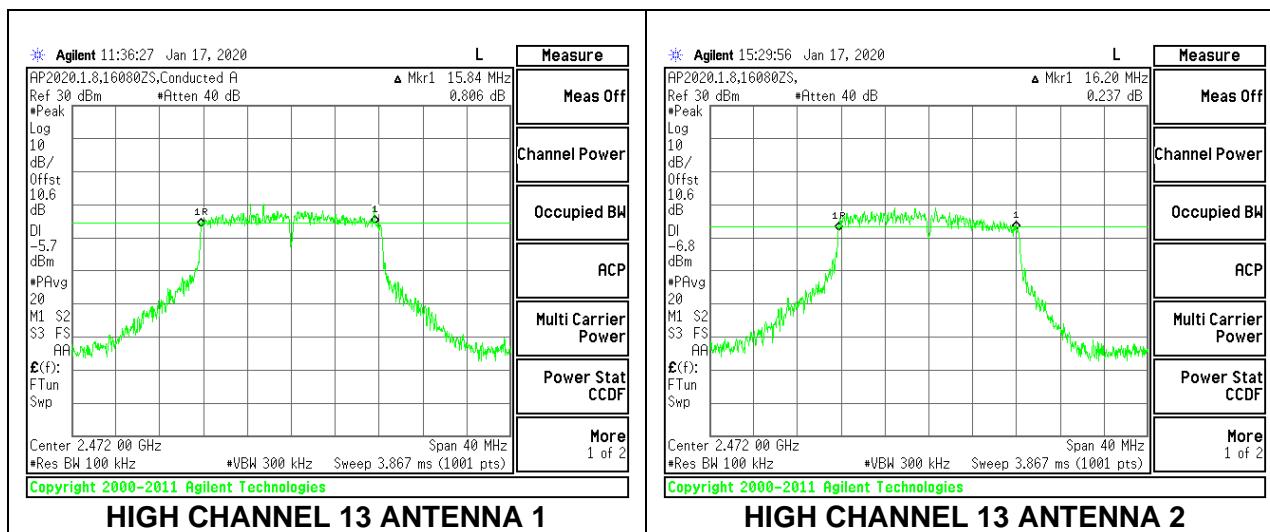
HIGH CHANNEL 10



HIGH CHANNEL 11



HIGH CHANNEL 13

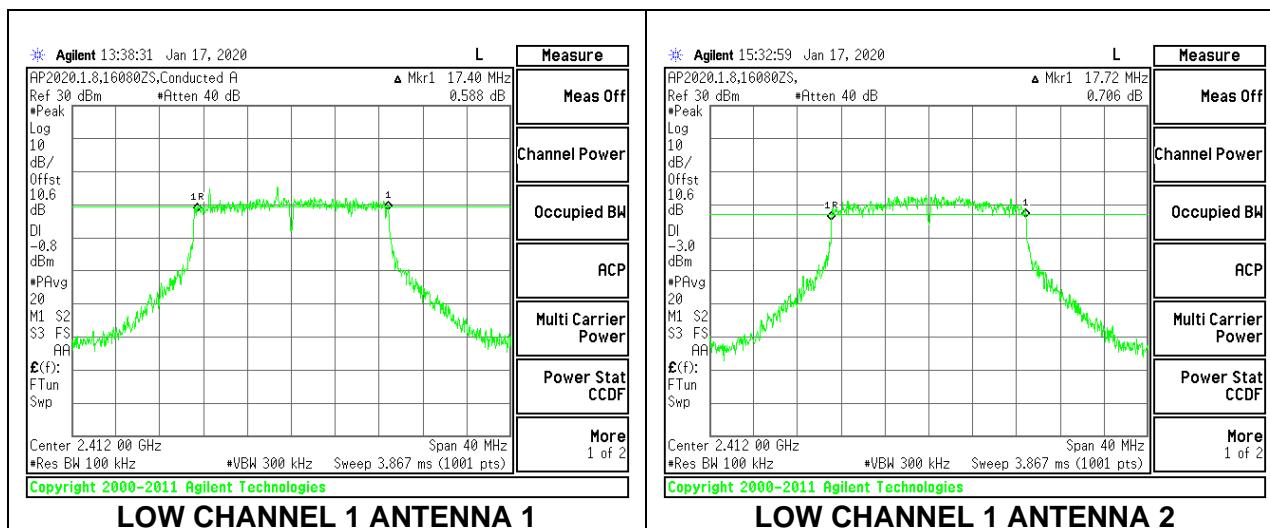


9.3.3. 802.11n HT20 MODE

2TX Antenna 1 + Antenna 2 CDD MODE

Channel	Frequency (MHz)	6 dB BW Antenna 1 (MHz)	6 dB BW Antenna 2 (MHz)	Minimum Limit (MHz)
Low 1	2412	17.40	17.72	0.5
Low 2	2417	17.28	17.64	0.5
Mid 6	2437	17.72	17.08	0.5
High 10	2457	17.64	17.52	0.5
High 11	2462	17.68	17.68	0.5
High 12	2467	17.72	16.40	0.5
High 13	2472	16.60	17.72	0.5

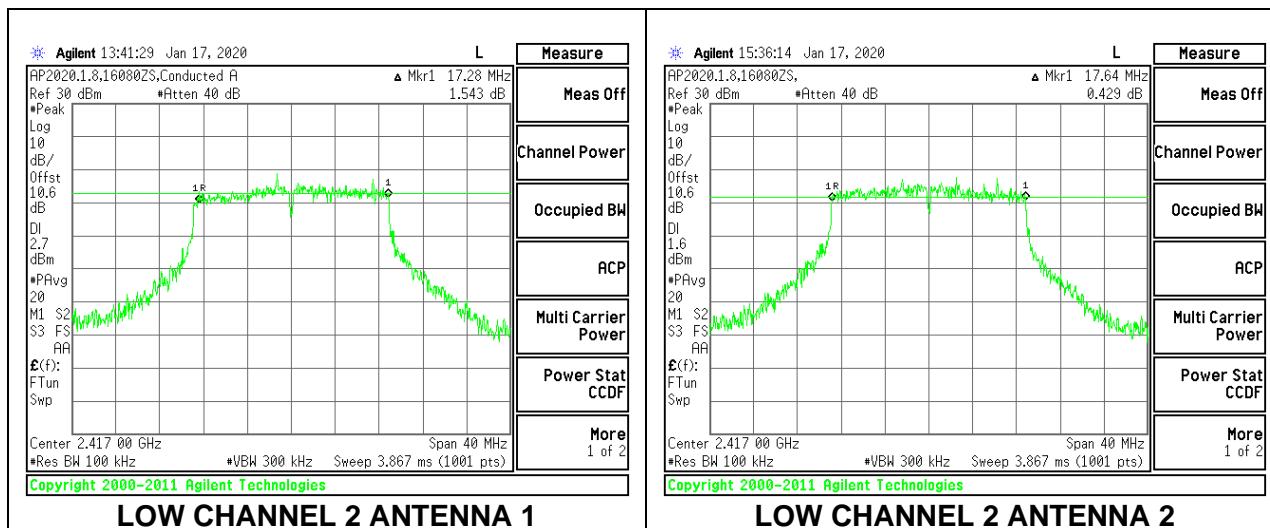
LOW CHANNEL 1



LOW CHANNEL 1 ANTENNA 1

LOW CHANNEL 1 ANTENNA 2

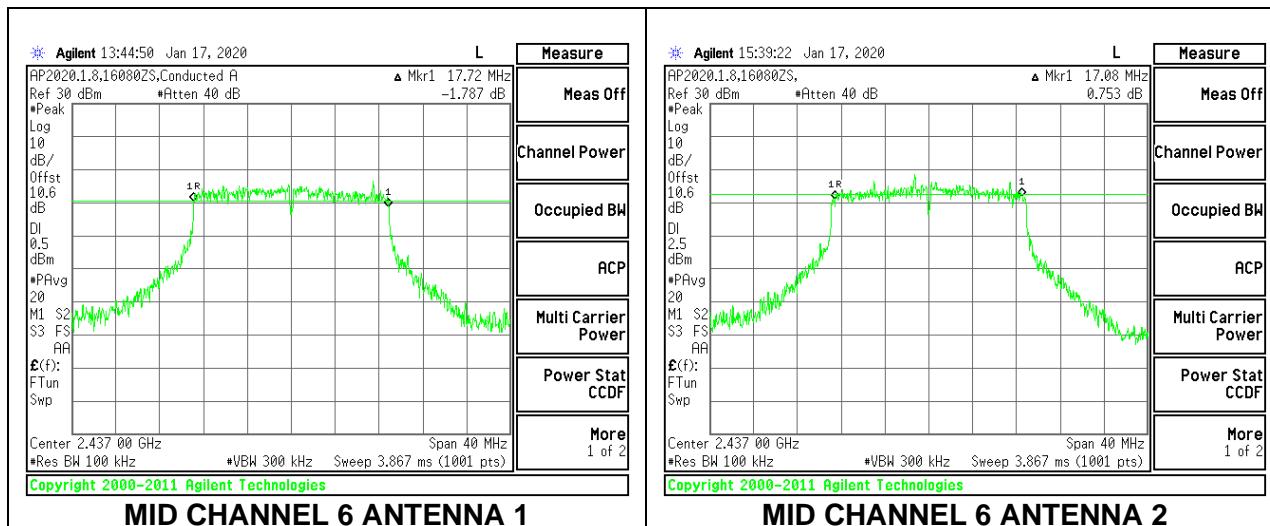
LOW CHANNEL 2



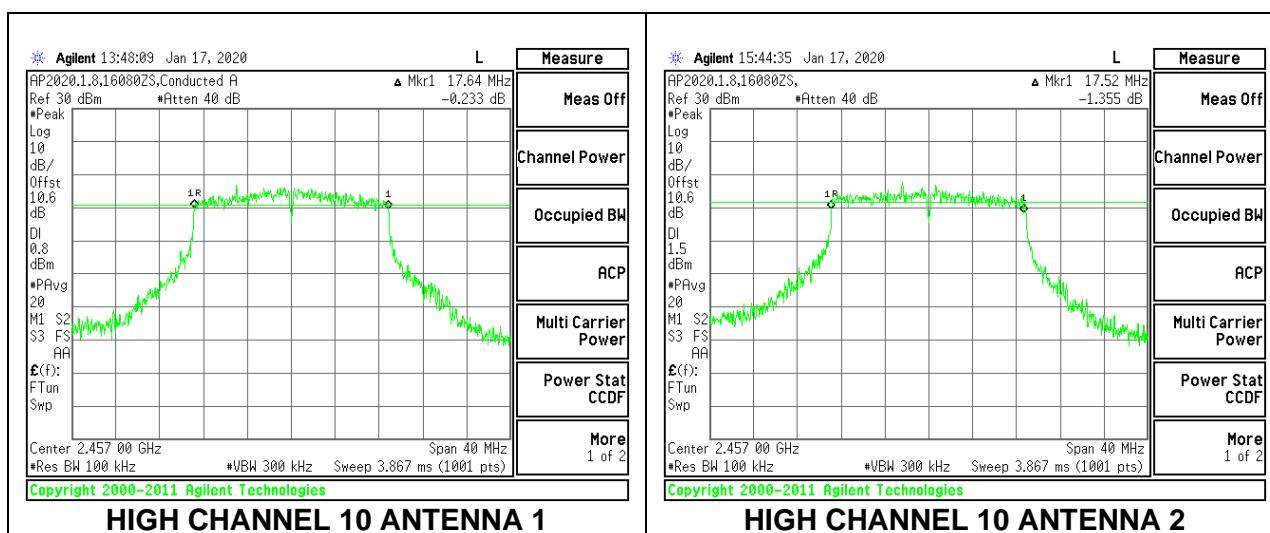
LOW CHANNEL 2 ANTENNA 1

LOW CHANNEL 2 ANTENNA 2

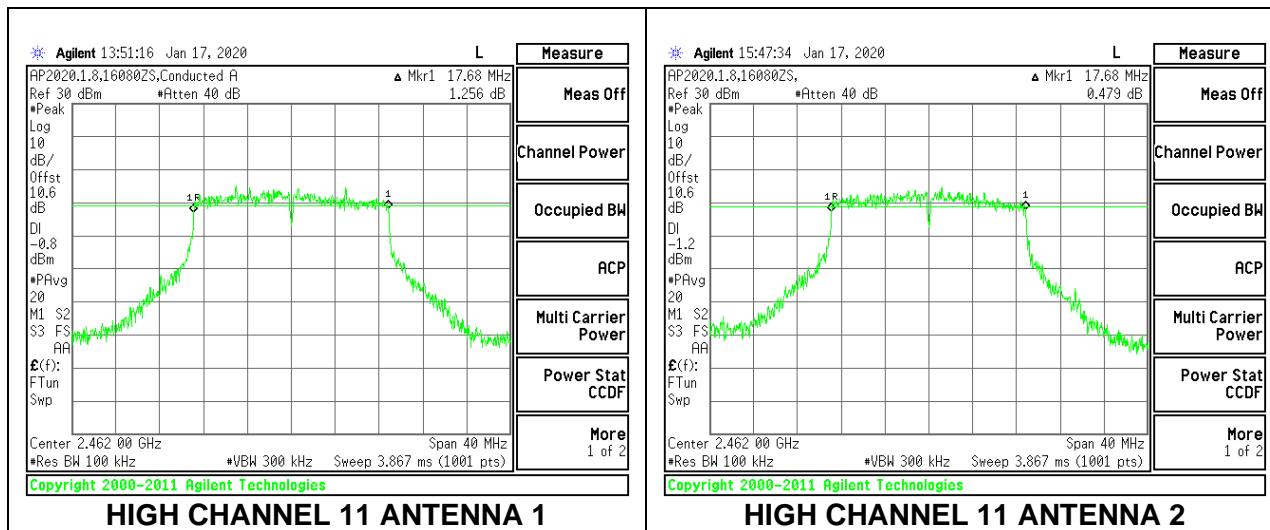
MID CHANNEL 6



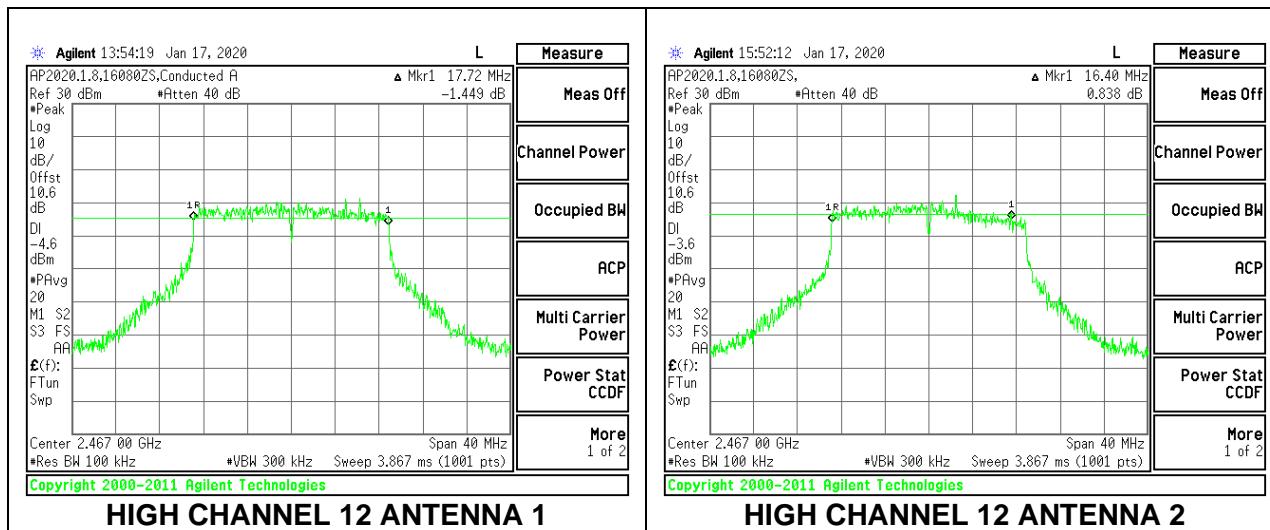
HIGH CHANNEL 10



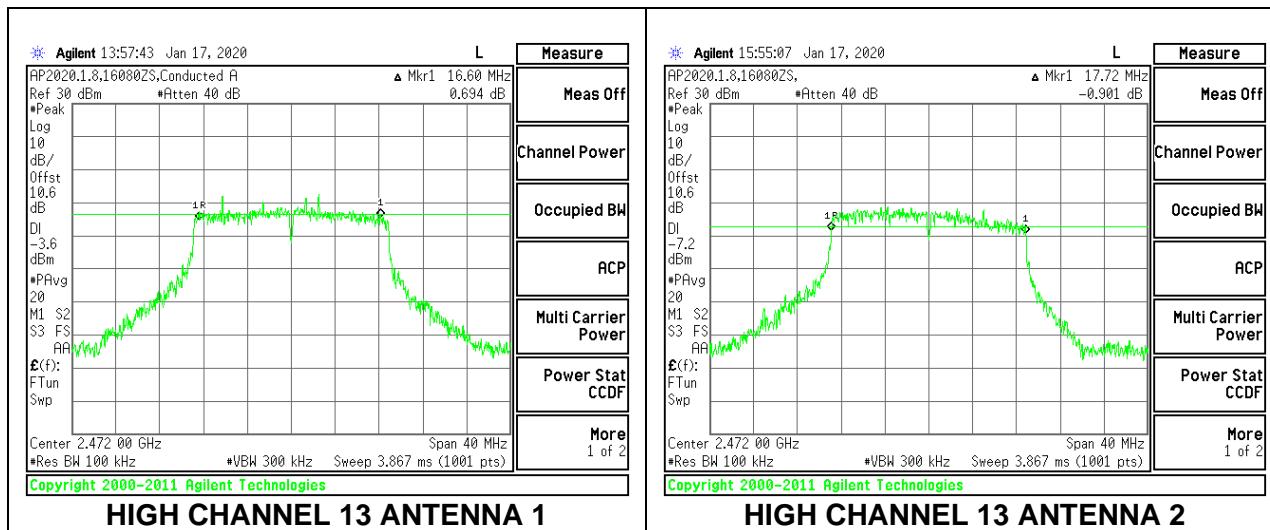
HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13

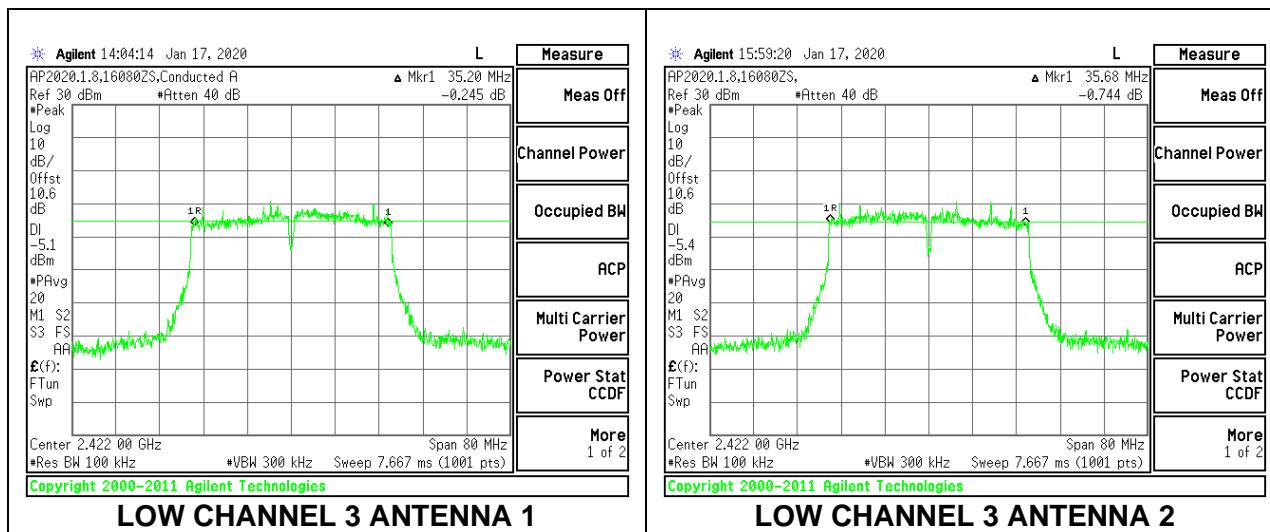


9.3.4. 802.11n HT40 MODE

2TX Antenna 1 + Antenna 2 CDD MODE

Channel	Frequency (MHz)	6 dB BW Antenna 1 (MHz)	6 dB BW Antenna 2 (MHz)	Minimum Limit (MHz)
Low 3	2422	35.20	35.68	0.5
Low 4	2427	36.00	35.92	0.5
Mid 6	2437	35.52	35.84	0.5
High 9	2452	36.24	36.16	0.5
High 10	2457	35.28	35.60	0.5
High 11	2462	36.48	35.92	0.5

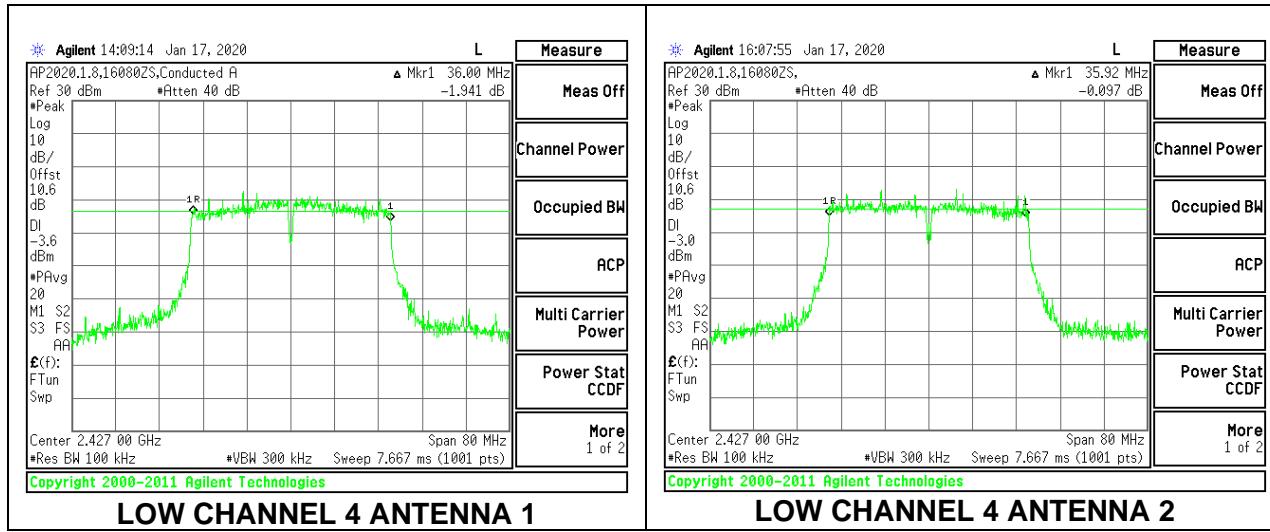
LOW CHANNEL 3



LOW CHANNEL 3 ANTENNA 1

LOW CHANNEL 3 ANTENNA 2

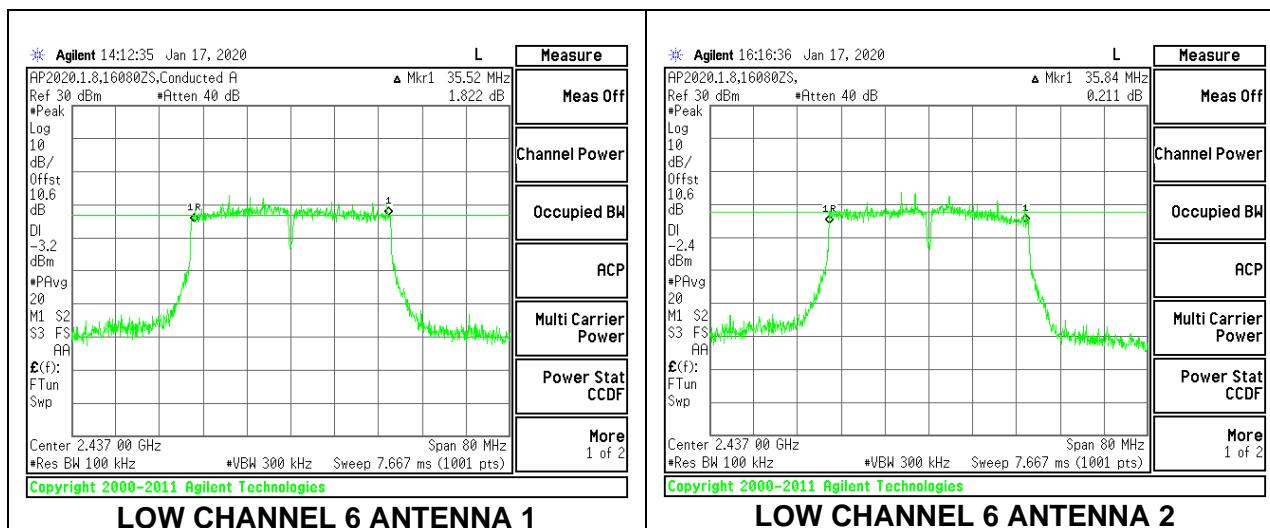
LOW CHANNEL 4



LOW CHANNEL 4 ANTENNA 1

LOW CHANNEL 4 ANTENNA 2

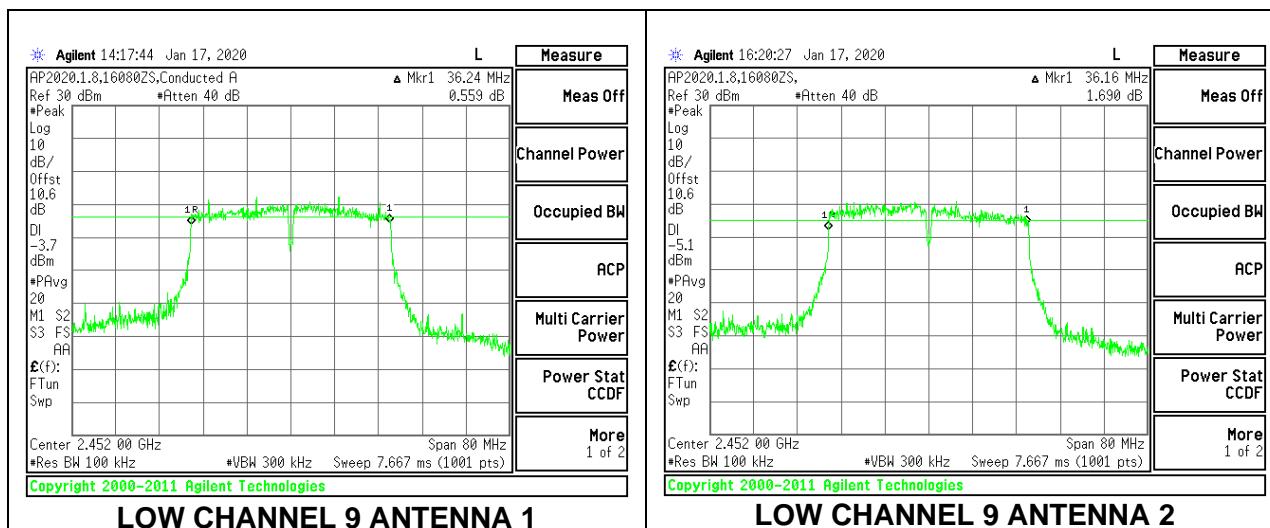
LOW CHANNEL 6



LOW CHANNEL 6 ANTENNA 1

LOW CHANNEL 6 ANTENNA 2

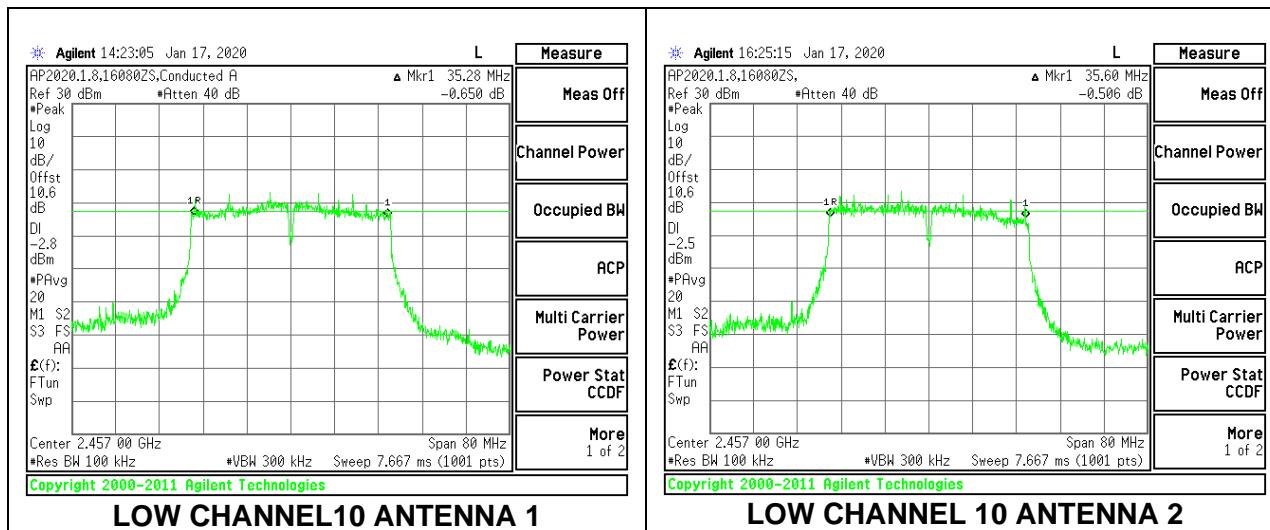
LOW CHANNEL 9



LOW CHANNEL 9 ANTENNA 1

LOW CHANNEL 9 ANTENNA 2

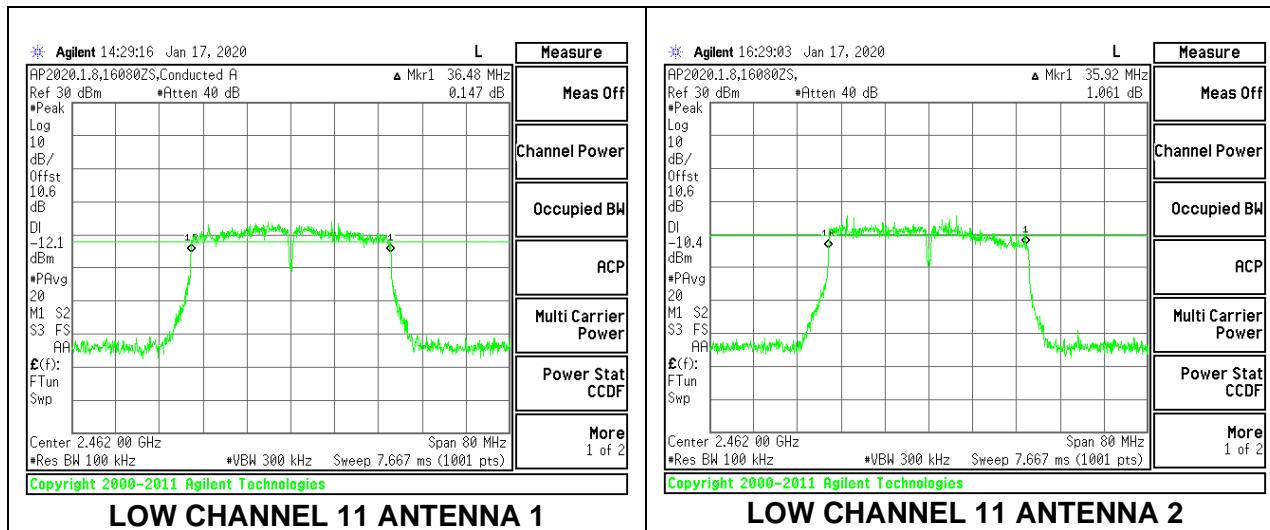
LOW CHANNEL 10



LOW CHANNEL 10 ANTENNA 1

LOW CHANNEL 10 ANTENNA 2

LOW CHANNEL 11



LOW CHANNEL 11 ANTENNA 1

LOW CHANNEL 11 ANTENNA 2

9.4. 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 power meter.

The cable assembly insertion loss was entered as an offset in the power meter to allow for a gated peak reading of power.

DIRECTIONAL 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 1 Gain (dBi)	Antenna 2 Gain (dBi)	Uncorrelated Chains	Correlated Chains
			Directional Gain (dBi)	Directional Gain (dBi)
2.4	1.10	2.30	1.74	4.73

RESULTS

9.4.1. 802.11b MODE

2TX Antenna 1 + Antenna 2 CDD MODE

Test Engineer:	16080 ZS & 40882 JC
Test Date:	01/16/2020 & 04/27/2020

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC/ISED Power Limit (dBm)	ISED EIRP Limit (dBm)	Max Power (dBm)
Low 1	2412	1.74	30.00	36	30.00
Low 2	2417	1.74	30.00	36	30.00
Mid 6	2437	1.74	30.00	36	30.00
High 10	2457	1.74	30.00	36	30.00
High 11	2462	1.74	30.00	36	30.00
High 12	2467	1.74	30.00	36	30.00
High 13	2472	1.74	30.00	36	30.00

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

Channel	Frequency (MHz)	Antenna 1 Meas Power (dBm)	Antenna 2 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	18.61	18.52	21.58	30.00	-8.42
Low 2	2417	21.34	21.49	24.43	30.00	-5.57
Mid 6	2437	21.48	22.20	24.87	30.00	-5.13
High 10	2457	21.69	22.36	25.05	30.00	-4.95
High 11	2462	19.55	19.47	22.52	30.00	-7.48
High 12	2467	15.81	15.32	18.58	30.00	-11.42
High 13	2472	14.51	13.67	17.12	30.00	-12.88

9.4.2. 802.11g MODE

2TX Antenna 1 + Antenna 2 CDD MODE

Test Engineer:	16080 ZS & 40882 JC
Test Date:	01/16/2020 & 04/27/2020

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC/ISED Power Limit (dBm)	ISED EIRP Limit (dBm)	Max Power (dBm)
Low 1	2412	1.74	30.00	36	30.00
Low 2	2417	1.74	30.00	36	30.00
Mid 6	2437	1.74	30.00	36	30.00
High 10	2457	1.74	30.00	36	30.00
High 11	2462	1.74	30.00	36	30.00
High 12	2467	1.74	30.00	36	30.00
High 13	2472	1.74	30.00	36	30.00

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

Channel	Frequency (MHz)	Antenna 1 Meas Power (dBm)	Antenna 2 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	18.65	18.60	21.64	30.00	-8.36
Low 2	2417	21.42	21.39	24.42	30.00	-5.58
Mid 6	2437	21.48	21.40	24.45	30.00	-5.55
High 10	2457	22.86	21.36	25.18	30.00	-4.82
High 11	2462	19.56	19.27	22.43	30.00	-7.57
High 12	2467	15.88	15.70	18.80	30.00	-11.20
High 13	2472	5.82	5.95	8.90	30.00	-21.10

9.4.3. 802.11n HT20 MODE

2TX Antenna 1 + Antenna 2 CDD MODE

Test Engineer:	16080 ZS & 40882 JC
Test Date:	01/16/2020 & 04/27/2020

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC/ISED Power Limit (dBm)	ISED EIRP Limit (dBm)	Max Power (dBm)
Low 1	2412	1.74	30.00	36	30.00
Low 2	2417	1.74	30.00	36	30.00
Mid 6	2437	1.74	30.00	36	30.00
High 10	2457	1.74	30.00	36	30.00
High 11	2462	1.74	30.00	36	30.00
High 12	2467	1.74	30.00	36	30.00
High 13	2472	1.74	30.00	36	30.00

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

Channel	Frequency (MHz)	Antenna 1 Meas Power (dBm)	Antenna 2 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	20.90	20.84	23.88	30.00	-6.12
Low 2	2417	23.27	21.76	25.59	30.00	-4.41
Mid 6	2437	23.29	21.94	25.68	30.00	-4.32
High 10	2457	23.31	22.37	25.88	30.00	-4.12
High 11	2462	22.34	22.11	25.24	30.00	-4.76
High 12	2467	18.12	18.04	21.09	30.00	-8.91
High 13	2472	5.61	4.82	8.24	30.00	-21.76

9.4.4. 802.11n HT40 MODE

2TX Antenna 1 + Antenna 2 CDD MODE

Test Engineer:	16080 ZS
Test Date:	01/16/2020

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC/ISED Power Limit (dBm)	ISED EIRP Limit (dBm)	Max Power (dBm)
Low 3	2422	1.74	30.00	36	30.00
Low 4	2427	1.74	30.00	36	30.00
Mid 6	2437	1.74	30.00	36	30.00
High 9	2452	1.74	30.00	36	30.00
High 10	2457	1.74	30.00	36	30.00
High 11	2462	1.74	30.00	36	30.00

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

Channel	Frequency (MHz)	Antenna 1 Meas Power (dBm)	Antenna 2 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 3	2422	20.16	20.09	23.14	30.00	-6.86
Low 4	2427	22.27	22.20	25.25	30.00	-4.75
Mid 6	2437	22.57	22.46	25.53	30.00	-4.47
High 9	2452	22.81	22.70	25.77	30.00	-4.23
High 10	2457	22.76	22.67	25.73	30.00	-4.27
High 11	2462	14.43	14.70	17.58	30.00	-12.42

9.5. AVERAGE POWER

LIMITS

None; for reporting purposes only

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss was entered as an offset in the power meter to allow for a gated average reading of power

RESULTS

9.5.1. 802.11b MODE

2TX Antenna 1 + Antenna 2 CDD MODE

Test Engineer:	16080 ZS & 40882 JC
Test Date:	01/16/2020 & 04/27/2020

Channel	Frequency (MHz)	Antenna 1 Power (dBm)	Antenna 2 Power (dBm)	Total Power (dBm)
Low 1	2412	16.09	16.05	19.08
Low 2	2417	19.04	18.89	21.98
Mid 6	2437	19.06	18.80	21.94
High 10	2457	19.09	18.81	21.96
High 11	2462	17.01	16.97	20.00
High 12	2467	13.29	12.89	16.10
High 13	2472	12.47	11.95	15.23

9.5.2. 802.11g MODE

2TX Antenna 1 + Antenna 2 CDD MODE

Test Engineer:	16080 ZS & 40882 JC
Test Date:	01/16/2020 & 04/27/2020

Channel	Frequency (MHz)	Antenna 1 Power (dBm)	Antenna 2 Power (dBm)	Total Power (dBm)
Low 1	2412	16.24	16.18	19.22
Low 2	2417	19.09	18.99	22.05
Mid 6	2437	19.01	18.94	21.99
High 10	2457	19.00	18.77	21.90
High 11	2462	17.11	17.06	20.10
High 12	2467	13.32	13.21	16.28
High 13	2472	0.73	0.55	3.65

9.5.3. 802.11n HT20 MODE

2TX Antenna 1 + Antenna 2 CDD MODE

Test Engineer:	16080 ZS & 40882 JC
Test Date:	01/16/2020 & 04/27/2020

Channel	Frequency (MHz)	Antenna 1 Power (dBm)	Antenna 2 Power (dBm)	Total Power (dBm)
Low 1	2412	16.14	16.11	19.14
Low 2	2417	18.78	18.38	21.59
Mid 6	2437	18.55	18.42	21.50
High 10	2457	18.75	18.51	21.64
High 11	2462	17.12	17.08	20.11
High 12	2467	13.20	13.11	16.17
High 13	2472	0.04	-0.28	2.89

9.5.4. 802.11n HT40 MODE

2TX Antenna 1 + Antenna 2 CDD MODE

Test Engineer:	16080 ZS
Test Date:	01/16/2020

Channel	Frequency (MHz)	Antenna 1 Power (dBm)	Antenna 2 Power (dBm)	Total Power (dBm)
Low 3	2422	14.22	14.12	17.18
Low 4	2427	16.19	16.15	19.18
Mid 6	2437	16.26	16.11	19.20
High 9	2452	16.47	16.40	19.45
High 10	2457	16.44	16.35	19.41
High 11	2462	8.55	8.95	11.76

9.6. 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.

RESULTS

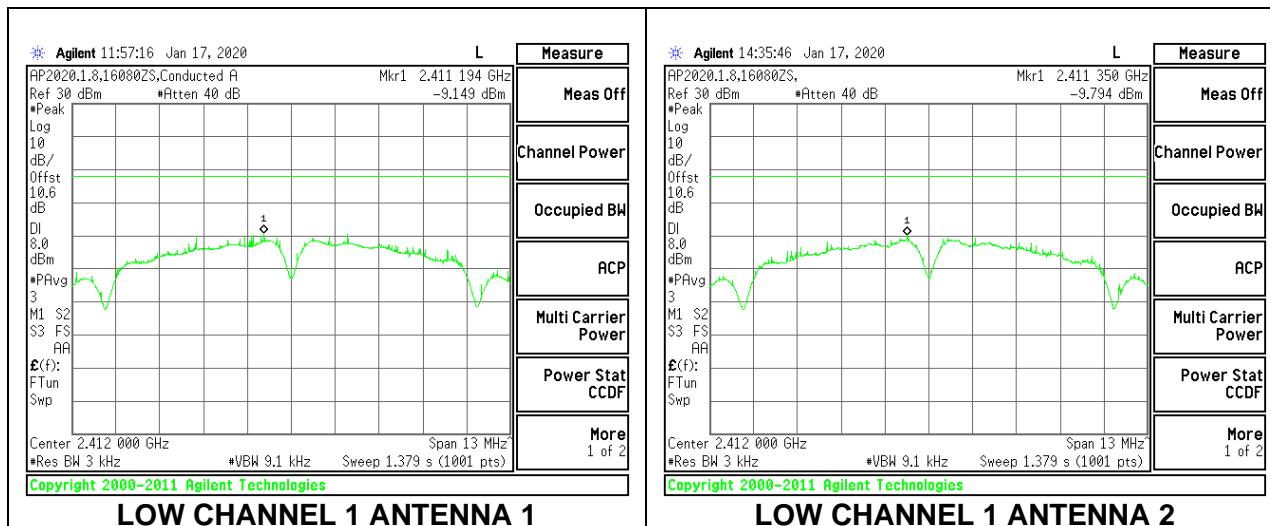
9.6.1. 802.11b MODE

2TX Antenna 1 + Antenna 2 CDD MODE

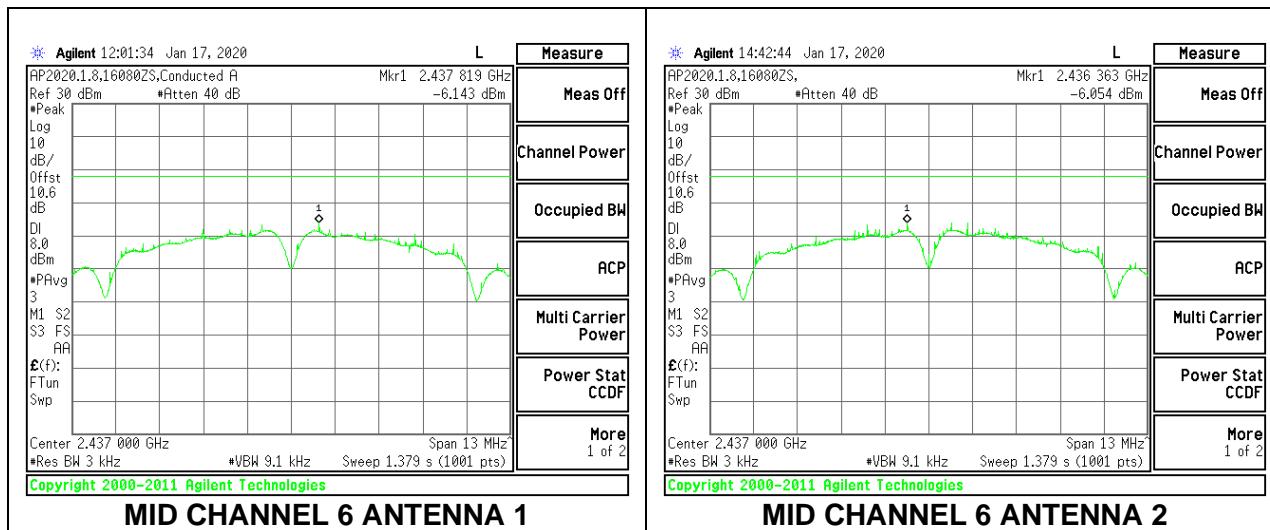
PSD Results

Channel	Frequency (MHz)	Antenna 1 Meas (dBm/ 3kHz)	Antenna 2 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-9.149	-9.794	-6.45	8.0	-14.4
Low 2	2417	-4.338	-5.870	-2.03	8.0	-10.0
Mid 6	2437	-6.143	-6.054	-3.09	8.0	-11.1
High 10	2457	-5.049	-6.701	-2.79	8.0	-10.8
High 11	2462	-8.083	-9.332	-5.65	8.0	-13.7
High 12	2467	-12.257	-12.771	-9.50	8.0	-17.5
High 13	2472	-12.248	-14.026	-10.04	8.0	-18.0

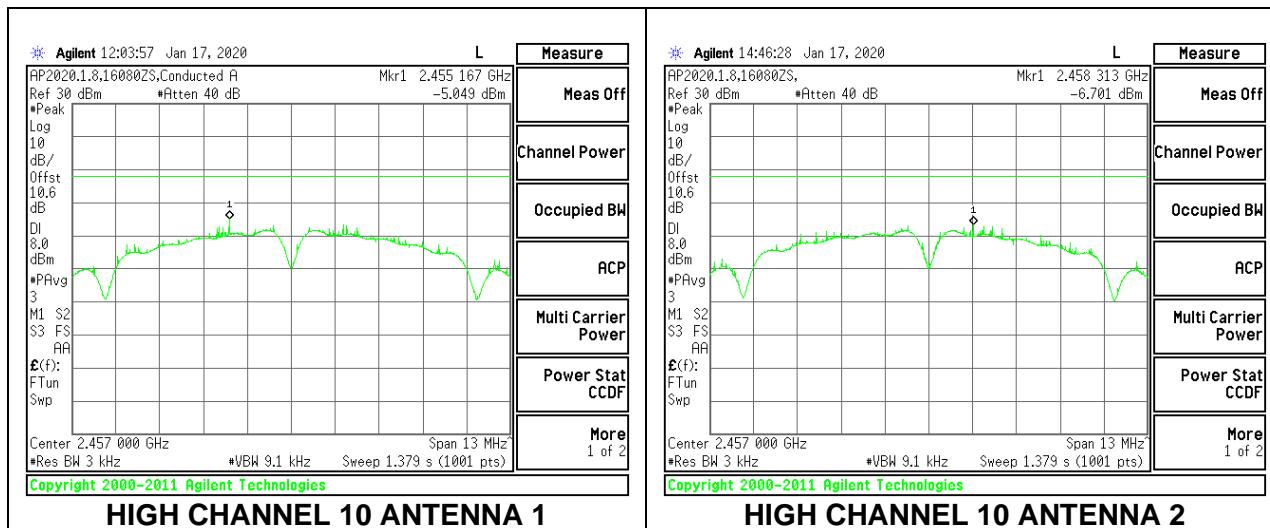
LOW CHANNEL 1



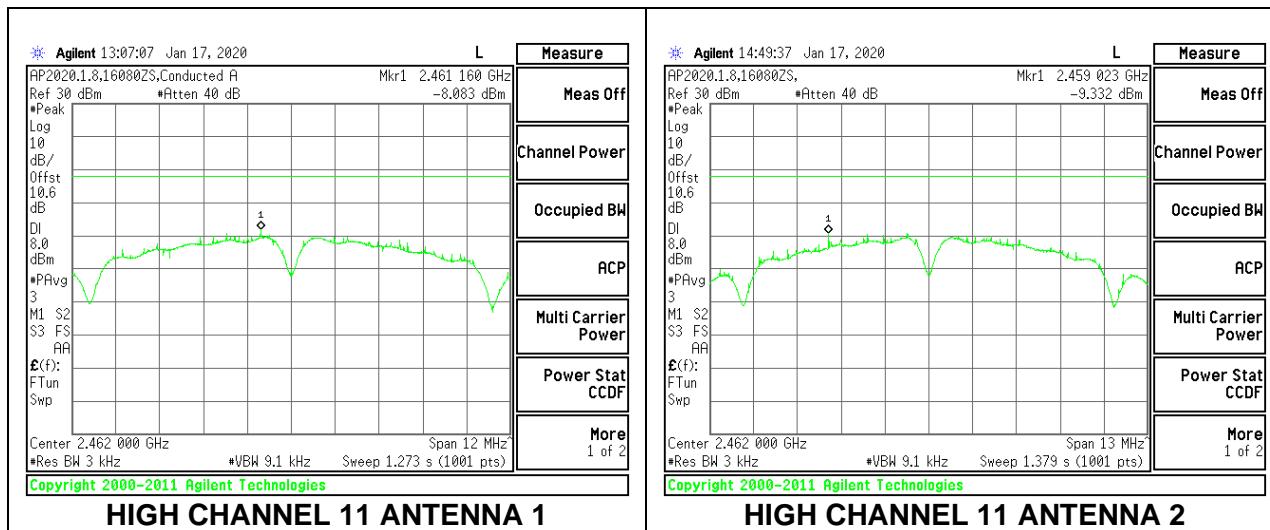
MID CHANNEL 6



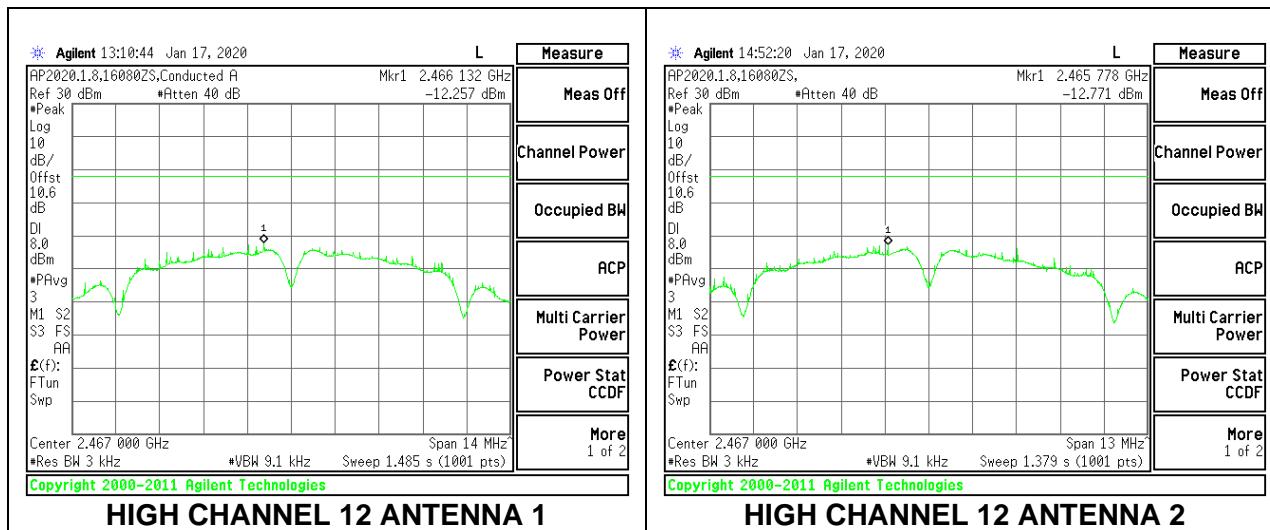
HIGH CHANNEL 10



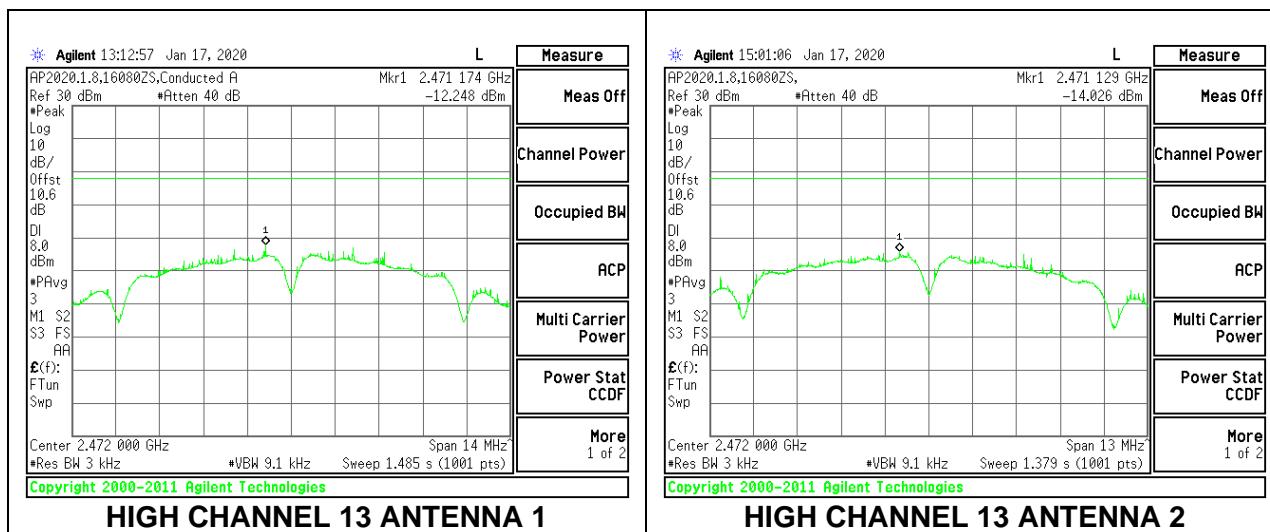
HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13



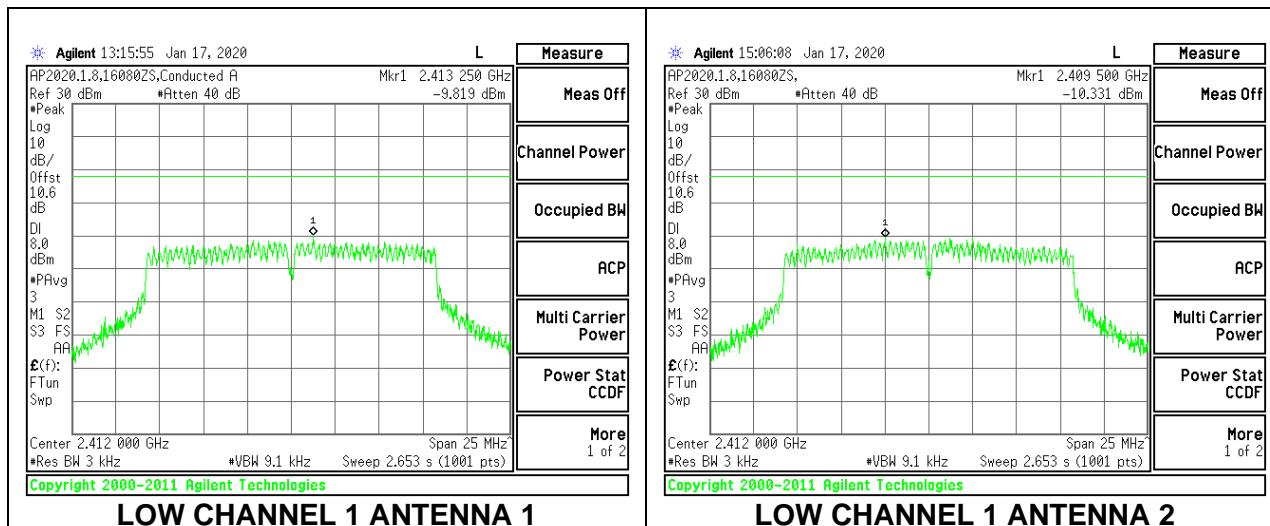
9.6.2. 802.11g MODE

2TX Antenna 1 + Antenna 2 CDD MODE

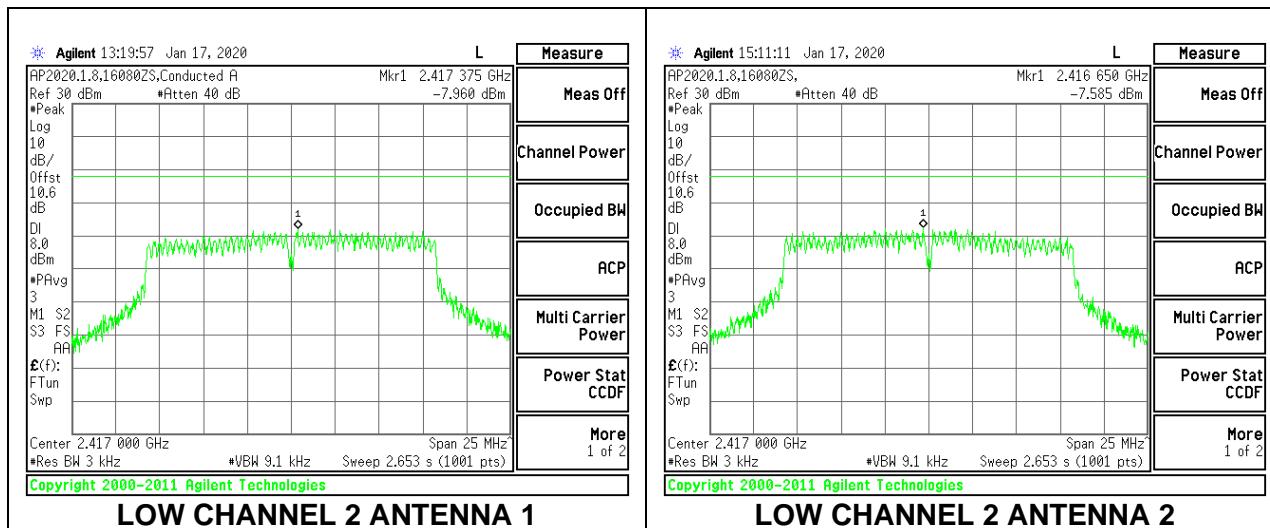
PSD Results

Channel	Frequency (MHz)	Antenna 1 Meas (dBm/ 3kHz)	Antenna 2 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-9.819	-10.331	-7.06	8.0	-15.1
Low 2	2417	-7.960	-7.585	-4.76	8.0	-12.8
Mid 6	2437	-7.259	-6.733	-3.98	8.0	-12.0
High 10	2457	-7.681	-7.272	-4.46	8.0	-12.5
High 11	2462	-9.887	-9.383	-6.62	8.0	-14.6
High 12	2467	-14.155	-12.804	-10.42	8.0	-18.4
High 13	2472	-13.498	-15.304	-11.30	8.0	-19.3

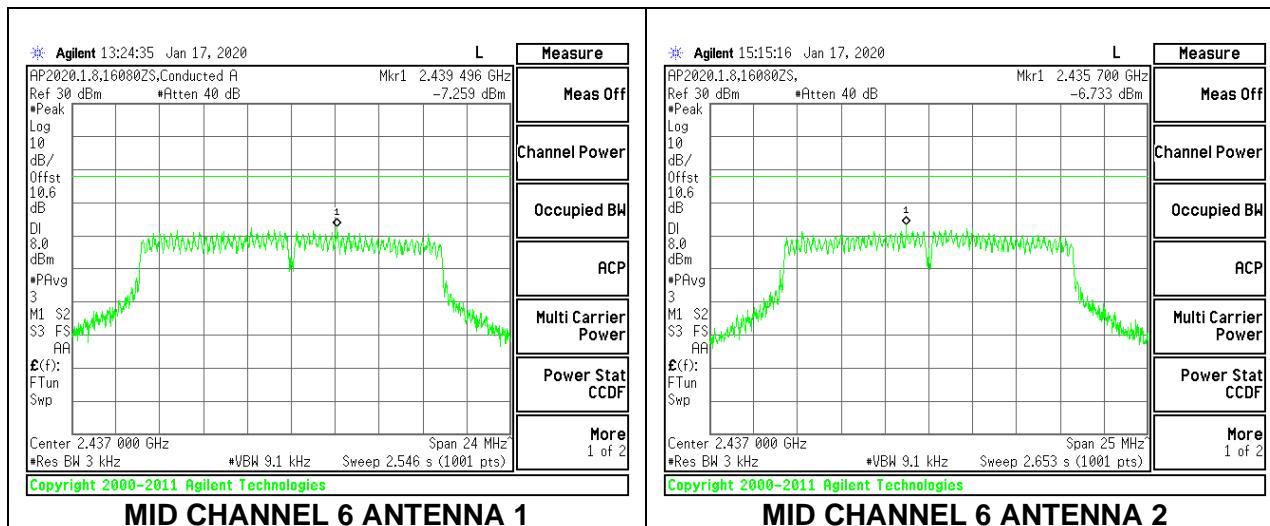
LOW CHANNEL 1



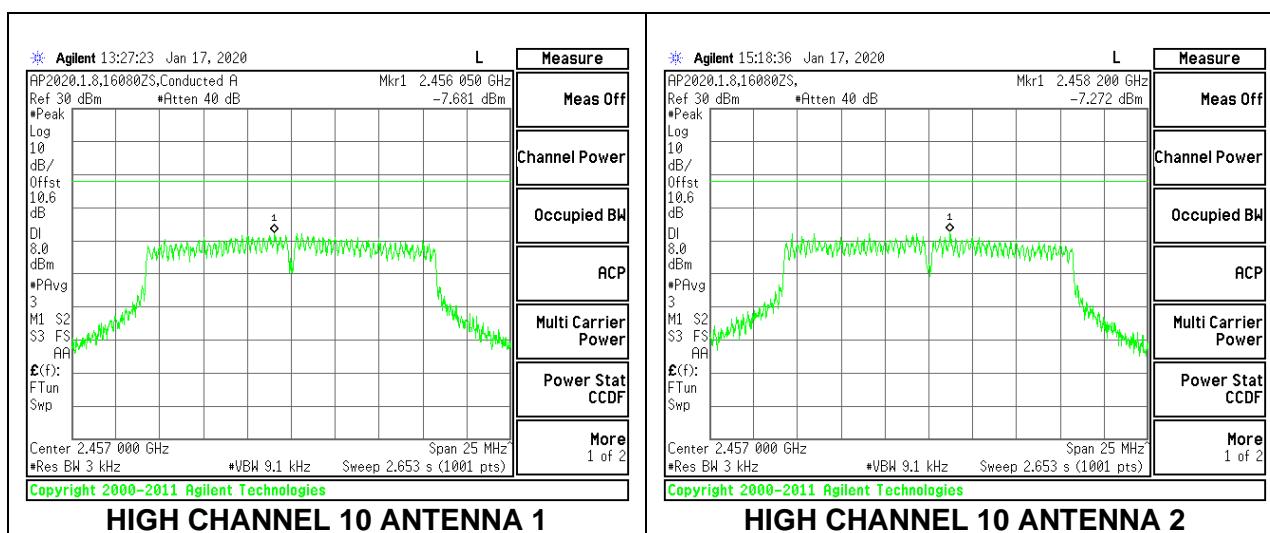
LOW CHANNEL 2



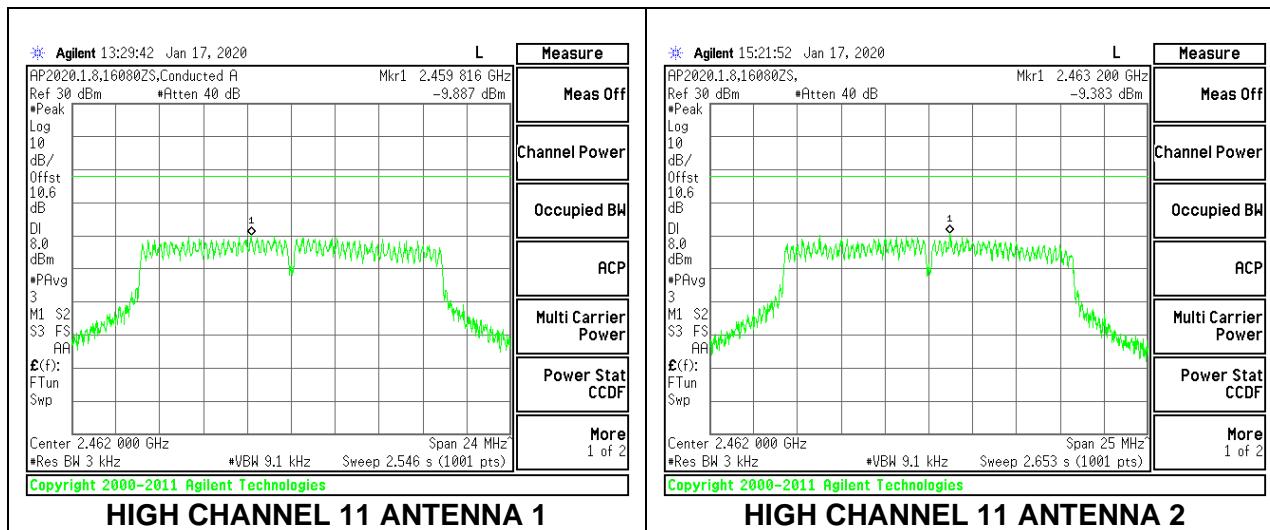
MID CHANNEL 6



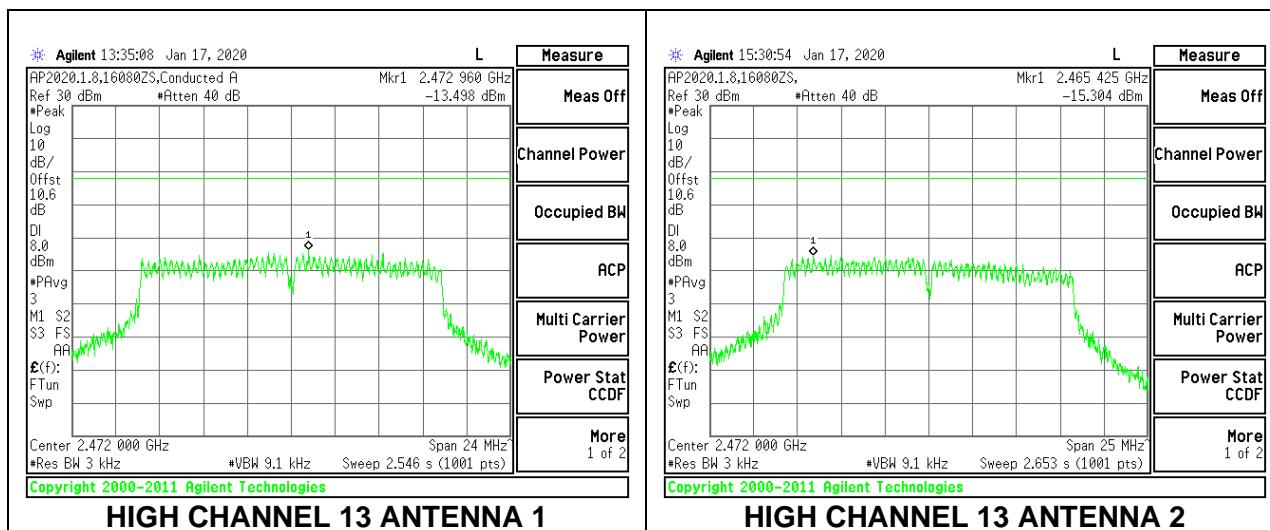
HIGH CHANNEL 10



HIGH CHANNEL 11



HIGH CHANNEL 13



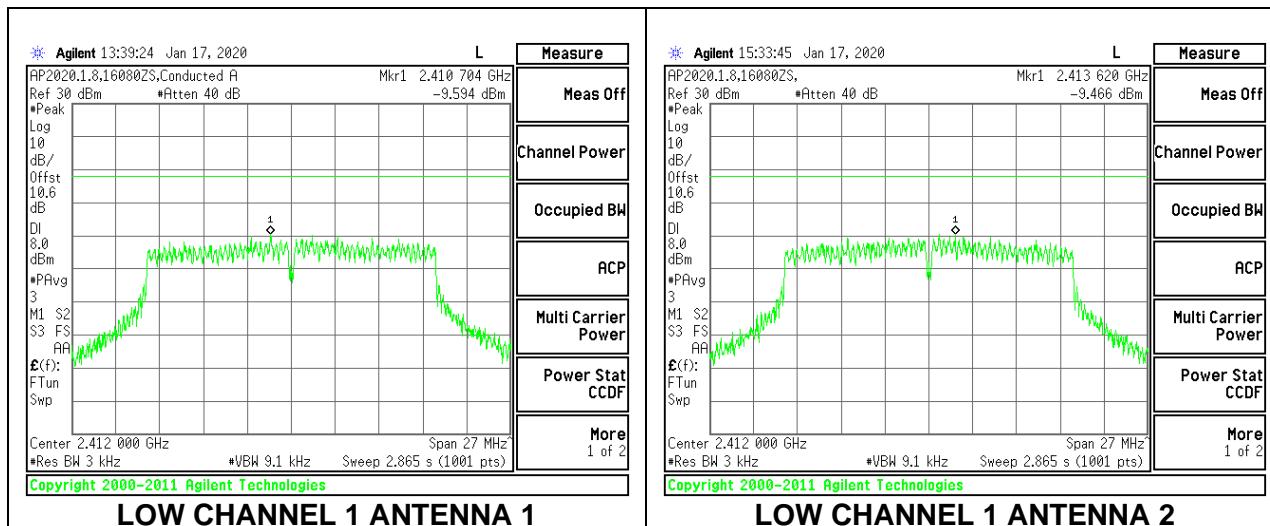
9.6.3. 802.11n HT20 MODE

2TX Antenna 1 + Antenna 2 CDD MODE

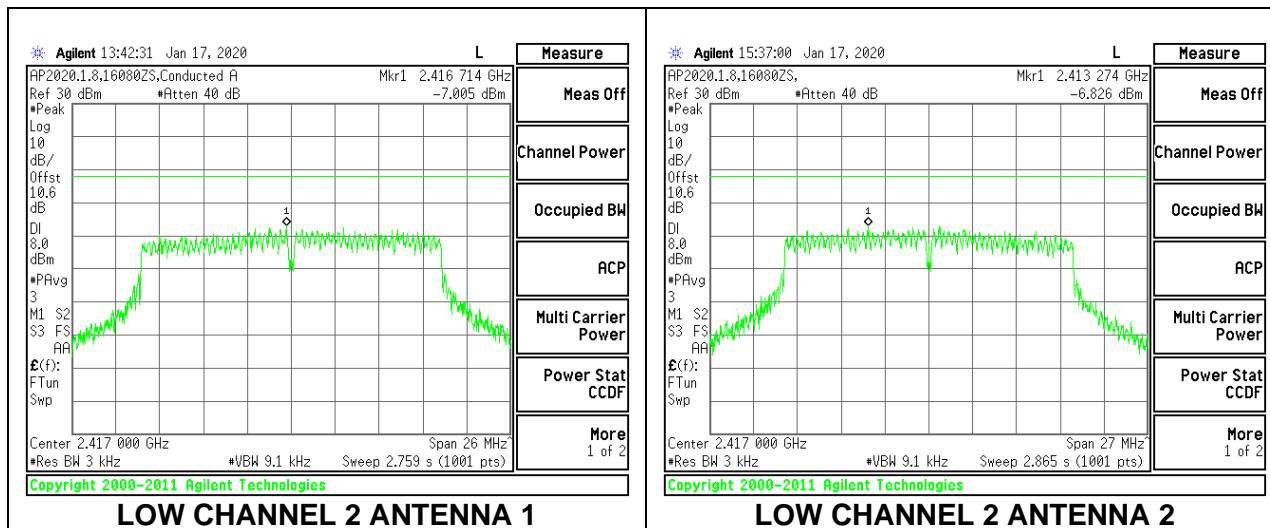
PSD Results

Channel	Frequency (MHz)	Antenna 1 Meas (dBm/ 3kHz)	Antenna 2 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-9.594	-9.466	-6.52	8.0	-14.5
Low 2	2417	-7.005	-6.826	-3.90	8.0	-11.9
Mid 6	2437	-7.432	-6.464	-3.91	8.0	-11.9
High 10	2457	-7.162	-5.807	-3.42	8.0	-11.4
High 11	2462	-9.142	-8.502	-5.80	8.0	-13.8
High 12	2467	-13.455	-12.765	-10.09	8.0	-18.1
High 13	2472	-14.348	-13.466	-10.87	8.0	-18.9

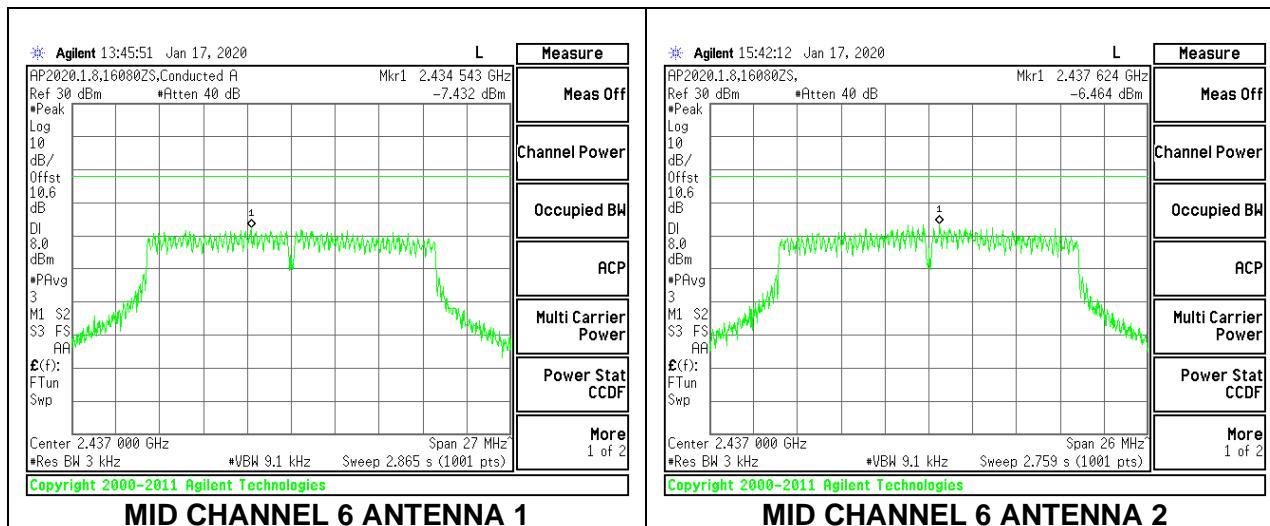
LOW CHANNEL 1



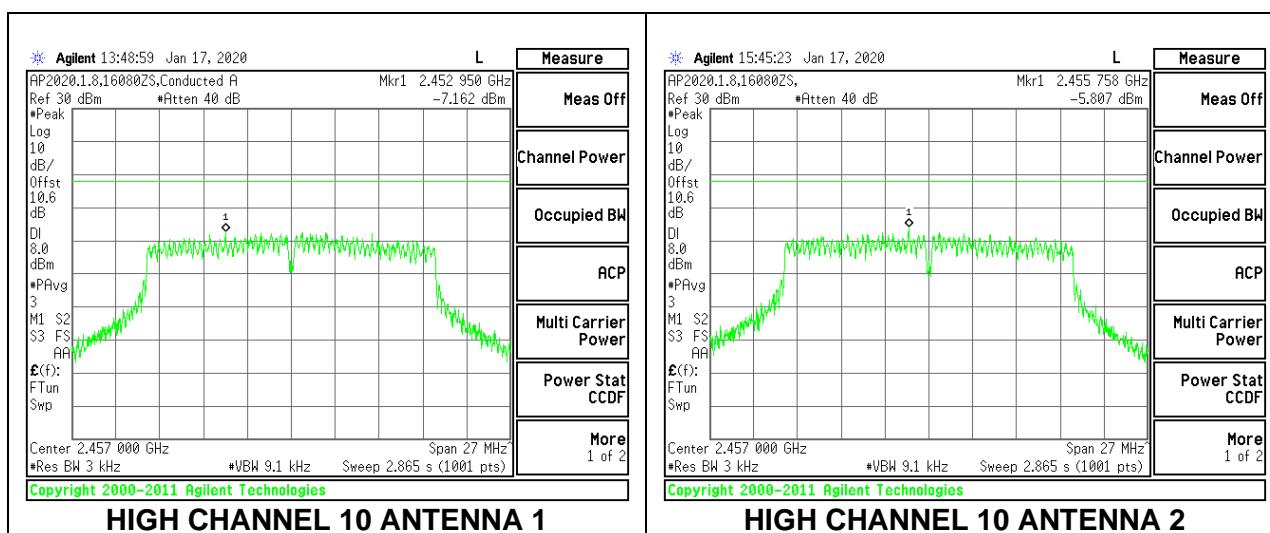
LOW CHANNEL 2



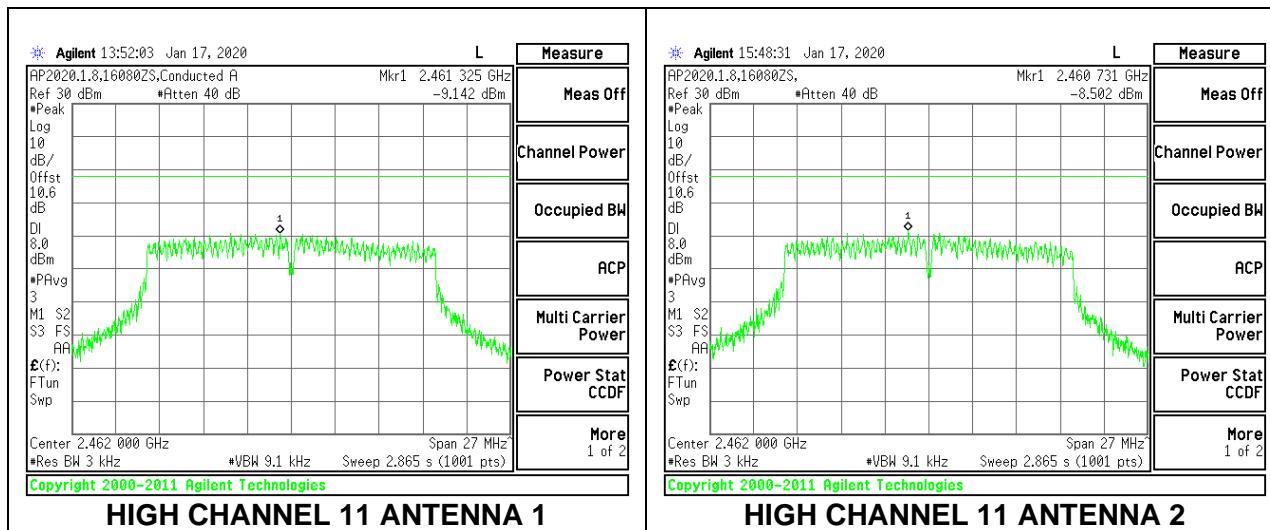
MID CHANNEL 6



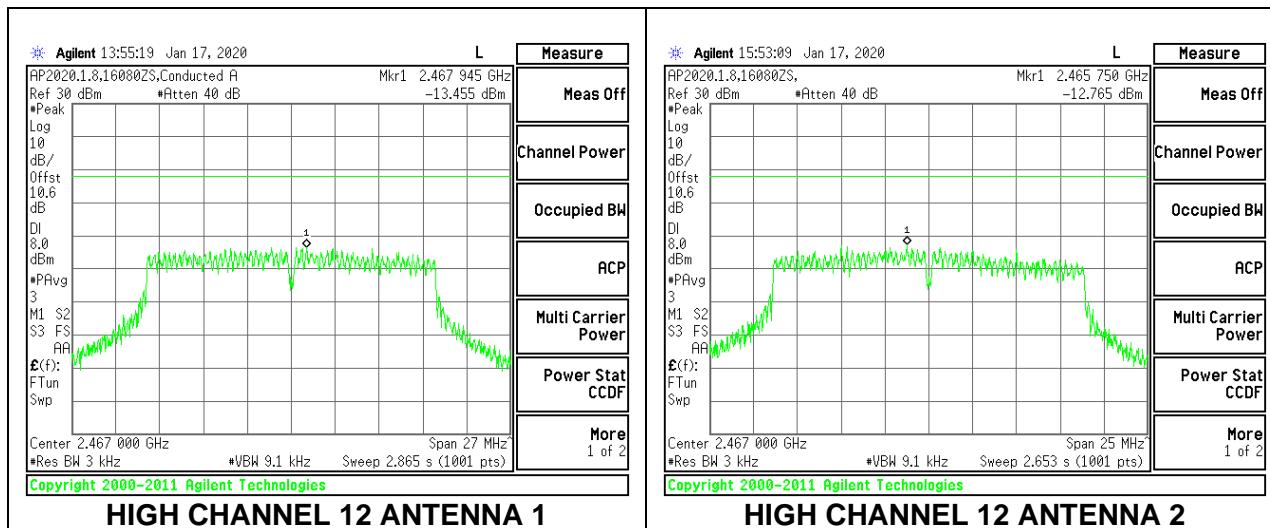
HIGH CHANNEL 10



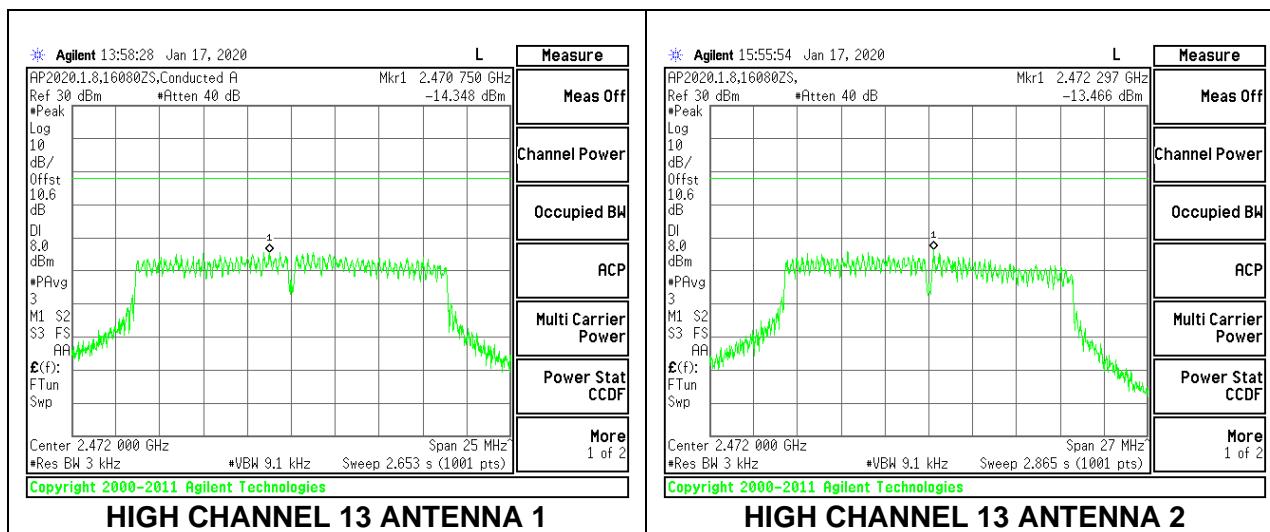
HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13



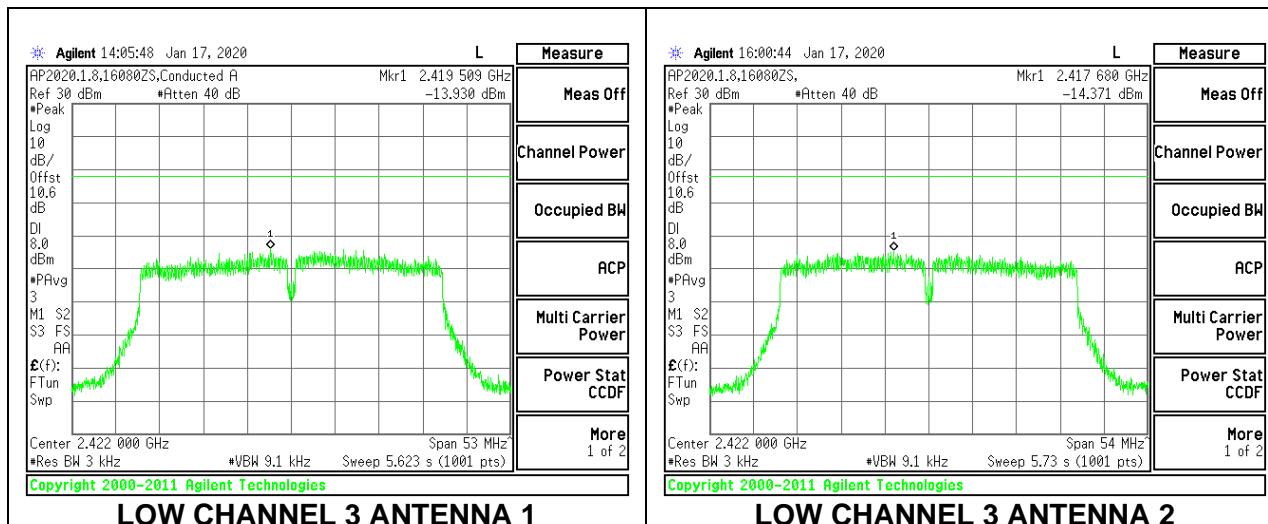
9.6.4. 802.11n HT40 MODE

2TX Antenna 1 + Antenna 2 CDD MODE

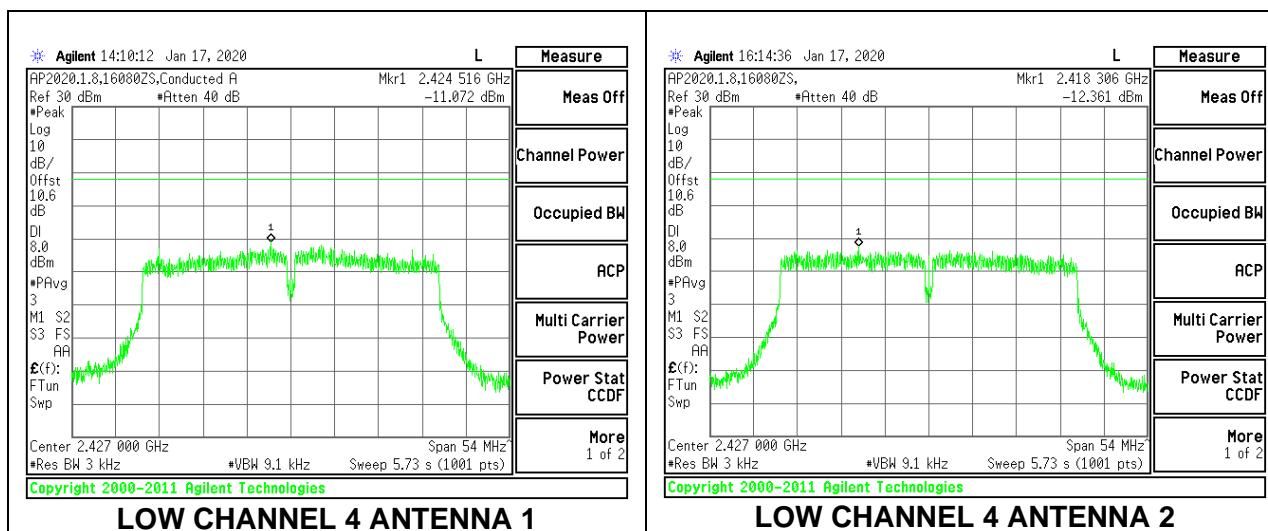
PSD Results

Channel	Frequency (MHz)	Antenna 1 Meas (dBm/ 3kHz)	Antenna 2 Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 3	2422	-13.930	-14.371	-11.13	8.0	-19.1
Low 4	2427	-11.072	-12.361	-8.66	8.0	-16.7
Mid 6	2437	-11.969	-12.557	-9.24	8.0	-17.2
High 9	2452	-12.654	-12.626	-9.63	8.0	-17.6
High 10	2457	-11.876	-12.573	-9.20	8.0	-17.2
High 11	2462	-19.381	-19.267	-16.31	8.0	-24.3

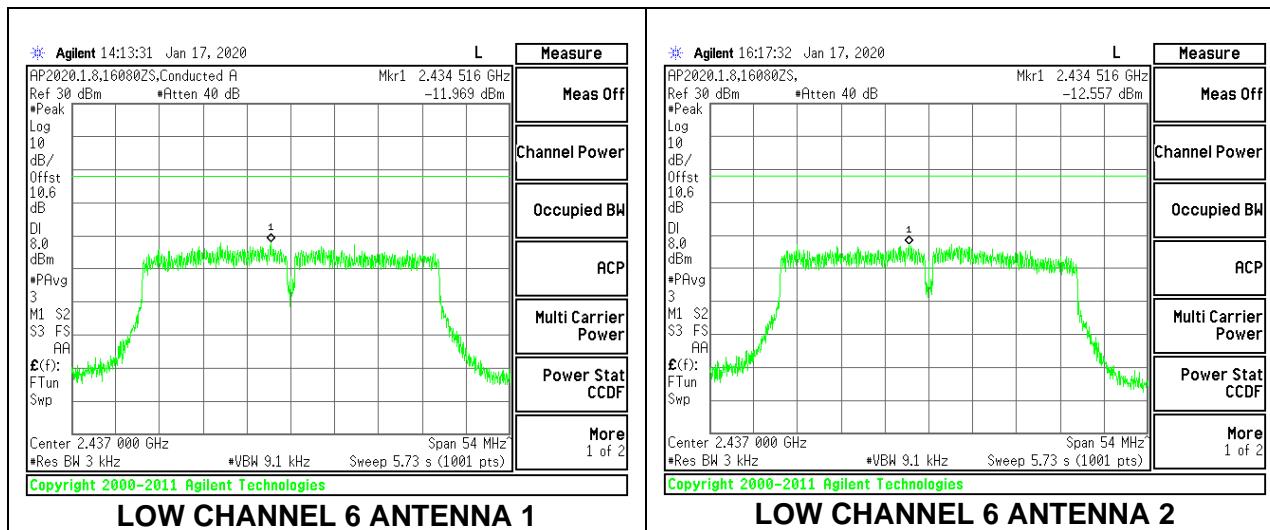
LOW CHANNEL 3



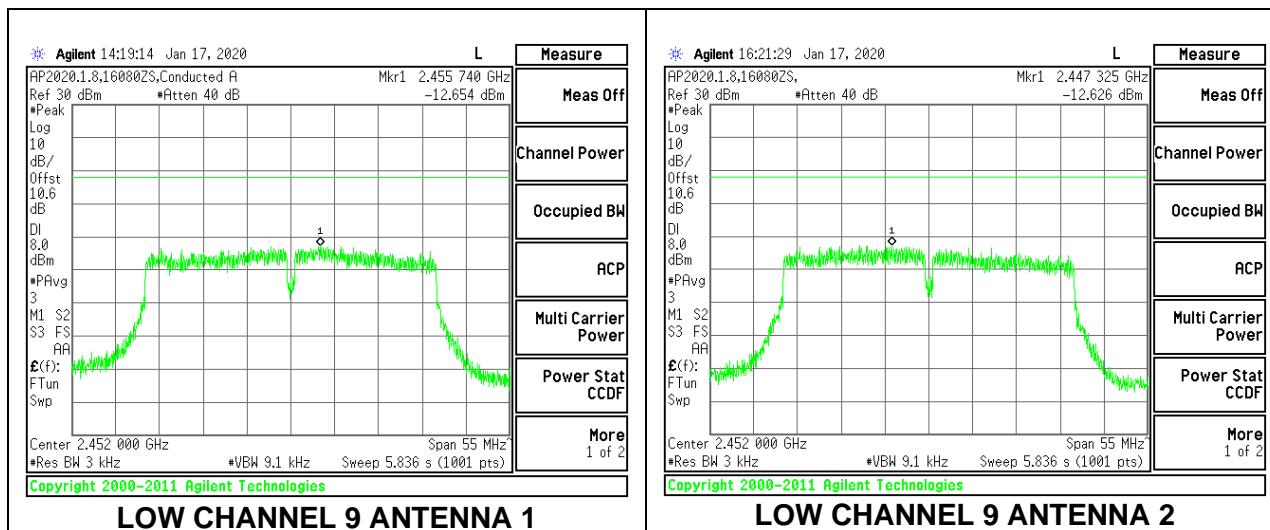
LOW CHANNEL 4



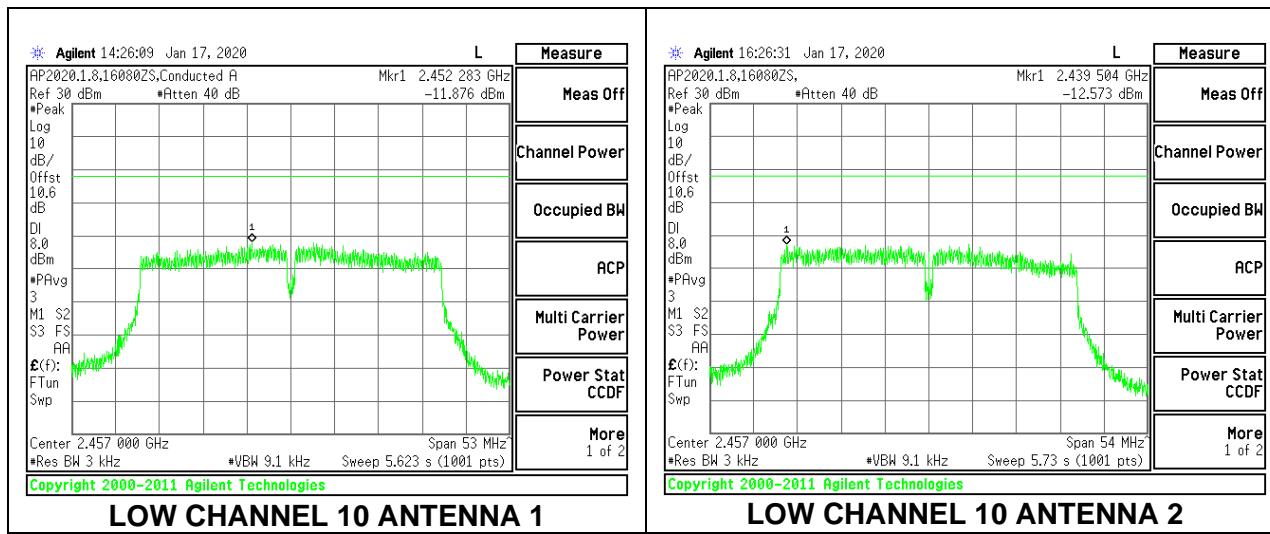
LOW CHANNEL 6



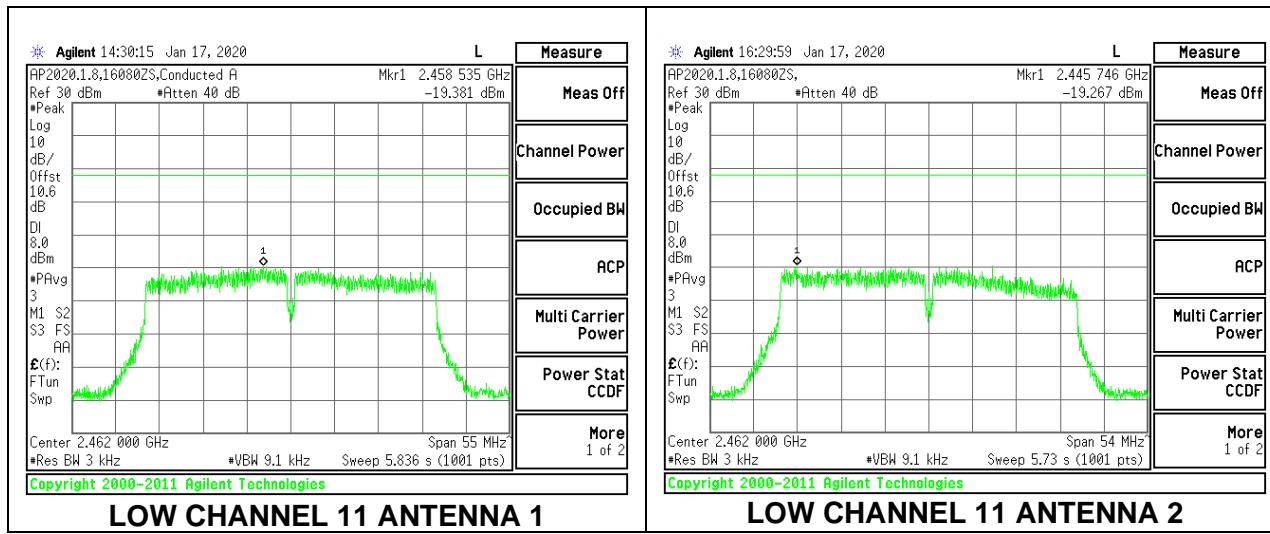
LOW CHANNEL 9



LOW CHANNEL 10



LOW CHANNEL 11



9.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

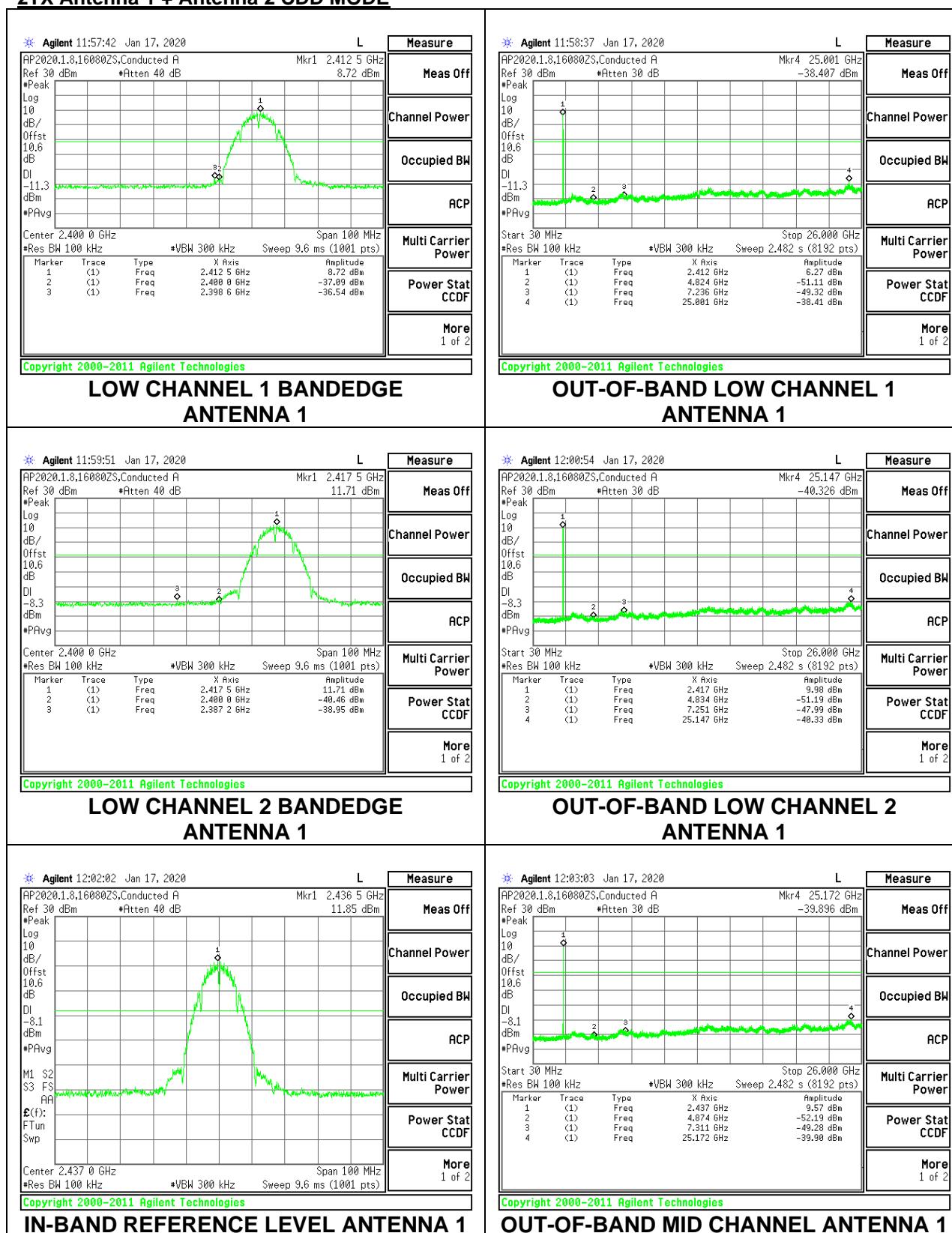
RSS-247 5.5

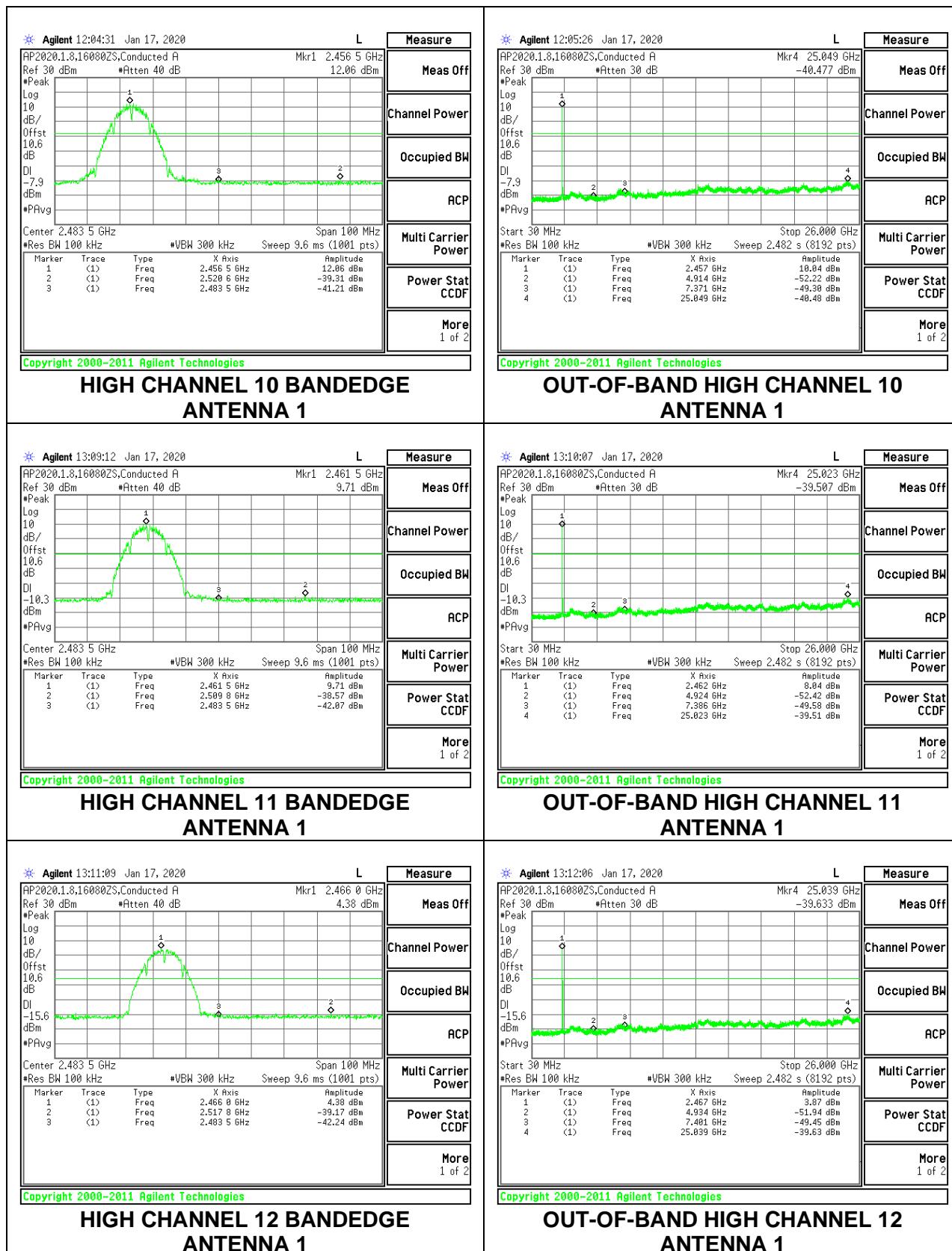
Output power was measured based on the use of peak measurement, therefore the required attenuation is 20 dB.

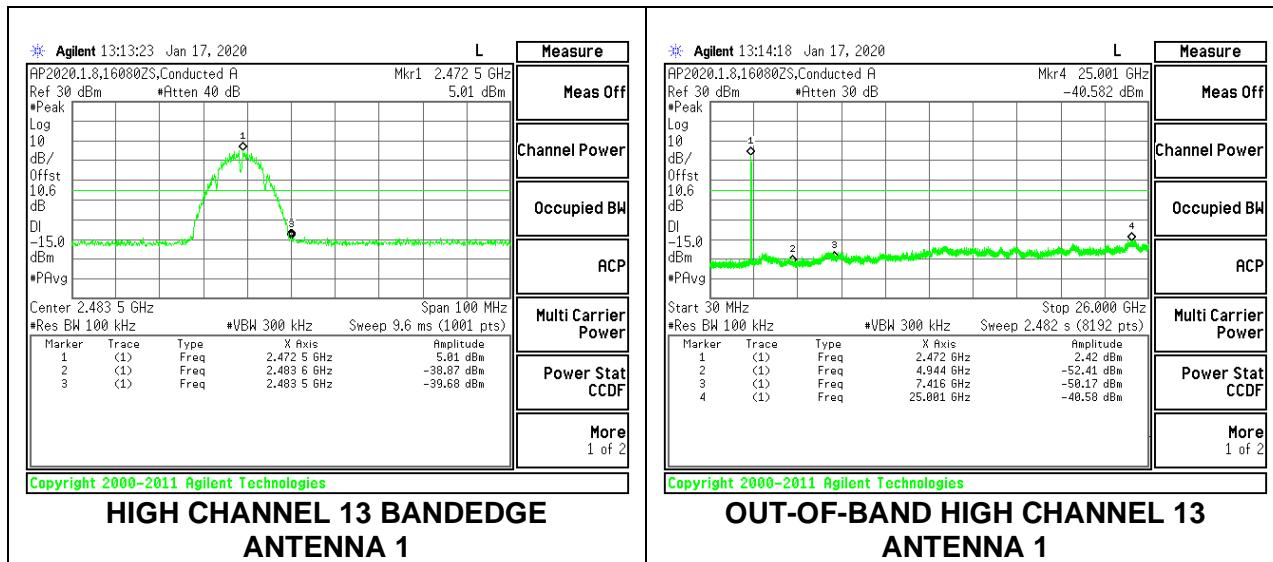
RESULTS

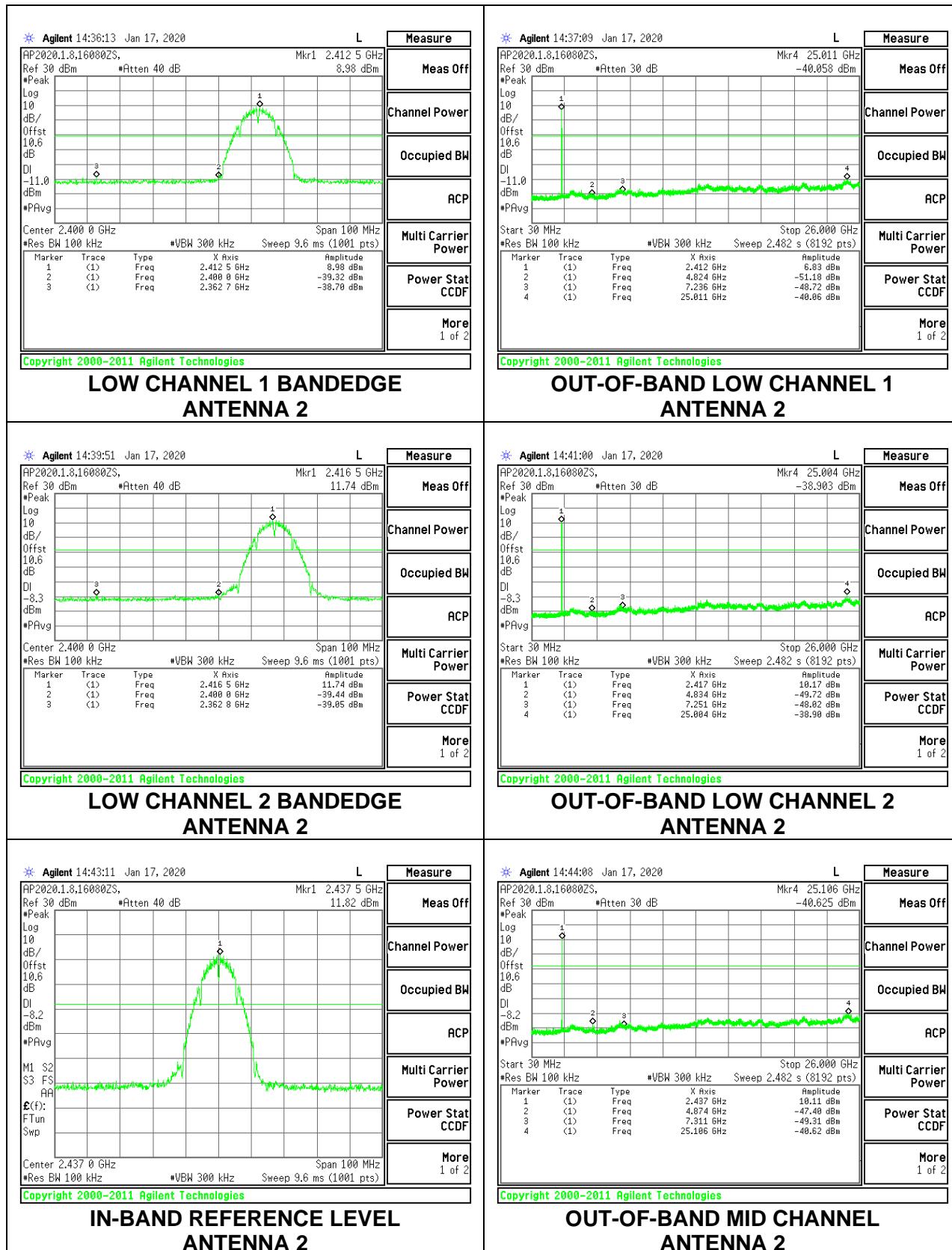
9.7.1. 802.11b MODE

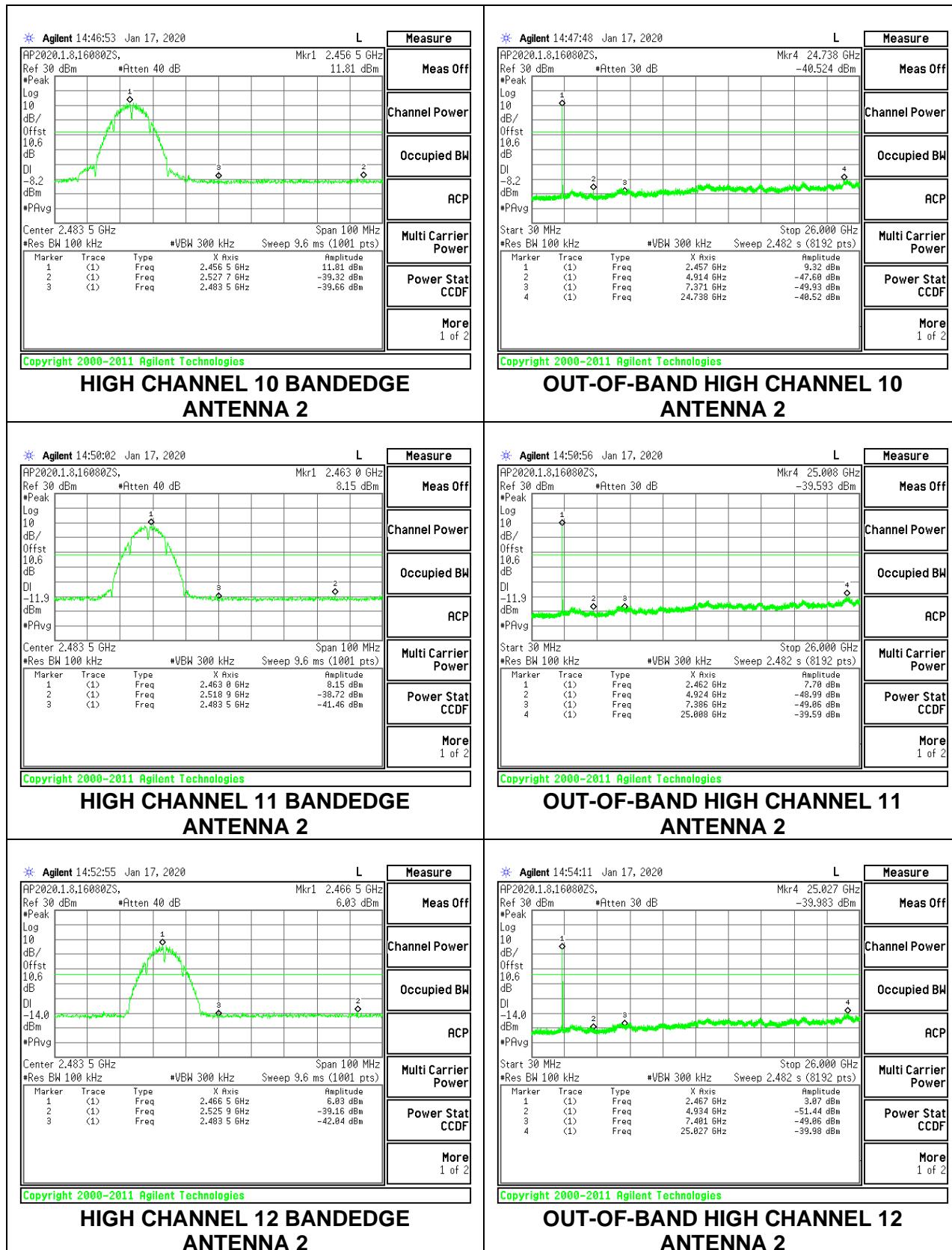
2TX Antenna 1 + Antenna 2 CDD MODE

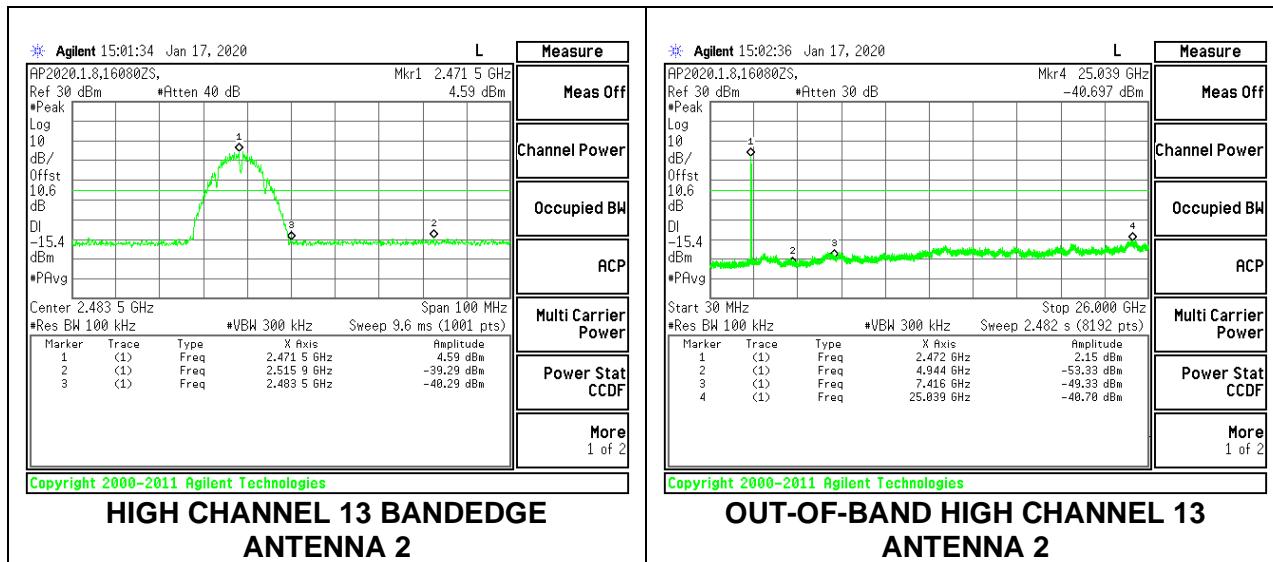












9.7.2. 802.11g MODE
2TX Antenna 1 + Antenna 2 CDD MODE

