CERTIFICATION TEST REPORT

Report Number. : 13019133-E2V2

Applicant	:	APPLE, INC. 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A
Model	:	A2282
FCC ID	:	BCGA2282
EUT Description	:	NETWORK ADAPTER
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C

Date Of Issue:
April 28, 2020

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

NVLAP Lab code: 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	4/13/2020	Initial Issue	Tony Li
V2	4/28/2020	Address TCB's questions	Chin Pang

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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: NETWORK ADAPTER

MODEL: A2282

SERIAL NUMBER: F0TC301FPQD7 (CONDUCTED)
F0TC3000PQD7 (RADIATED)

DATE TESTED: JANUARY 23 – FEBRUARY 04, 2020

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	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:

Chin Pang
Senior Engineer
Consumer Technology Division
UL Verification Services Inc.

Prepared By:

Tony Li
Test Engineer
Consumer Technology Division
UL Verification Services Inc.

2. TEST RESULTS SUMMARY

FCC Clause	Requirement	Result	Comment
See Comment	Duty Cycle	Reporting purposes only	ANSI C63.10 Section 11.6.
See Comment	99% OBW	Reporting purposes only	ANSI C63.10 Section 6.9.3.
15.247 (a) (2)	6dB BW	Complies	None.
15.247 (b) (3)	Output Power	Complies	None.
See Comment	Average power	Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (e)	PSD	Complies	None.
15.247 (d)	Conducted Spurious Emissions	Complies	None.
15.209, 15.205	Radiated Emissions	Complies	None.
15.207	AC Mains Conducted Emissions	Complies	None.

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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 414788 D01.

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, 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	47658 Kato Rd
☒ Chamber A (IC:2324B-1)	☐ Chamber D (IC:22541-1)	☐ Chamber I (IC: 2324A-5)
☒ Chamber B (IC:2324B-2)	☐ Chamber E (IC:22541-2)	☐ Chamber J (IC: 2324A-6)
☐ Chamber C (IC:2324B-3)	☐ Chamber F (IC:22541-3)	☐ Chamber K (IC: 2324A-1)
	☐ Chamber G (IC:22541-4)	☐ Chamber L (IC: 2324A-3)
	☐ Chamber H (IC:22541-5)	☐ Chamber M (IC: 2324A-2)

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code: 2324A.

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

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5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

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.

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 (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:
Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
36.5 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

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6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a Network Adapter. It has an integral battery, two Gigabit Ethernet port, lightning connector and antenna. The device supports IEEE 802.11b/g/n radio, Bluetooth radio, and GNSS. Network Adapter comes with 32 GB memory storage and 1GB RAM.

6.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

2.4GHz BAND

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2472	802.11b	9.53	8.97
2412 - 2472	802.11g	Covered by 802.11n HT20 1Tx	
2412 - 2472	802.11n HT20	11.53	14.22

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an PCB/Omni directional antenna.

Frequency Range (GHz)	Antenna (dBi)
2400-2484	3

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was 1A610

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6.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions below 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.

For Radiated harmonic emissions between 1GHz and 18GHz were performed with the EUT set to transmit at the highest power on Channel 1, Channel 6 and Channel 13.

Radiated band edge emissions from 1GHz to 18GHz were performed with the EUT was set to transmit at equal or highest power on Channel 1/Channel 13.

The fundamental and emission spurious of the EUT were investigated in three orthogonal orientations X,Y,Z with EUT connected to both Laptop and Switch/Router via ethernet cable and EUT standalone configuration.
For above 1GHz, it was determined that Y (Landscape) orientation was the worst-case orientation with EUT standalone; therefore, all final radiated testing was performed with the EUT in Y (Landscape) orientation.
For below 1GHz, it was determined that Y (Landscape) orientation was worst-case orientation with EUT connecting to both Laptop and Switch/Router via ethernet cable.

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

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

802.11b mode: 1 Mbps
802.11n HT20mode: MCS0

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6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Apple	MacBook Pro	C02SG8L0G8WP	DoC
Laptop AC/DC adapter	Apple	A1435	C046042GFYFG6HKAY	NA
EUT AC Adapter	Apple	A1385	D29325SM03XDHLHC9	NA
8 Port Gigabit Switch	Netgear	GS108v3	2162993A02E62	DoC
AC Adapter	Netgear	T012LF1209	929038795	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	2	N/A
2	USB	1	USB-C	Shielded	1	N/A
3	Antenna	1	SMA	Un-Shielded	0.2	To spectrum Analyzer

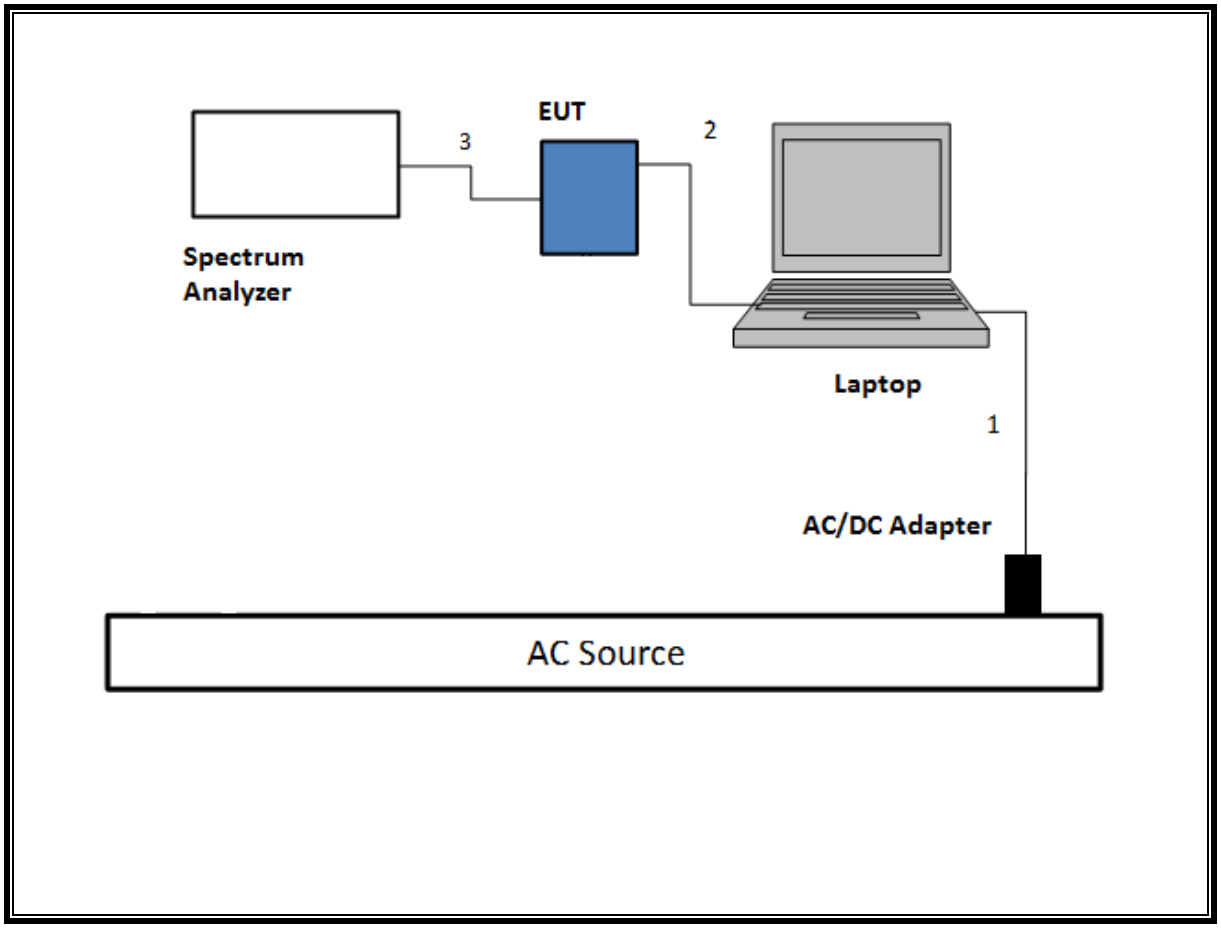
I/O CABLES (BELOW 1GHz AND AC POWER LINE TEST WITH ADAPTER AND LAPTOP)

I/O Cable List						
Cable No	**Port**	**# of identical**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC	3	AC	Un-shielded	2	N/A
2	USB	1	USB-C	Un-shielded	1	N/A
3	Ethernet	2	RJ45	Un-shielded	2	N/A

TEST SETUP

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

SETUP DIAGRAM FOR CONDUCTED TESTS



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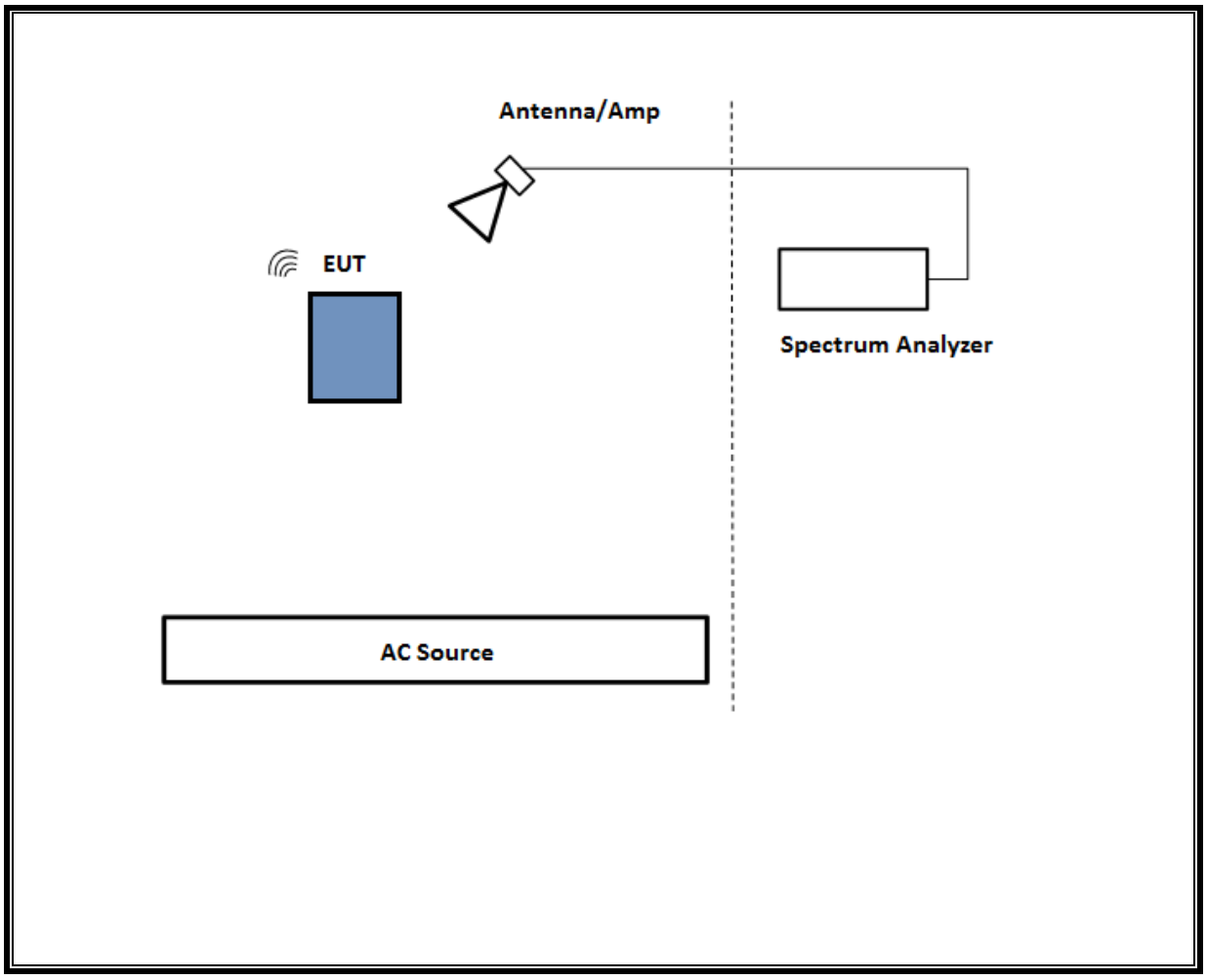
SETUP DIAGRAM FOR RADIATED TESTS ABOVE 1 GHz



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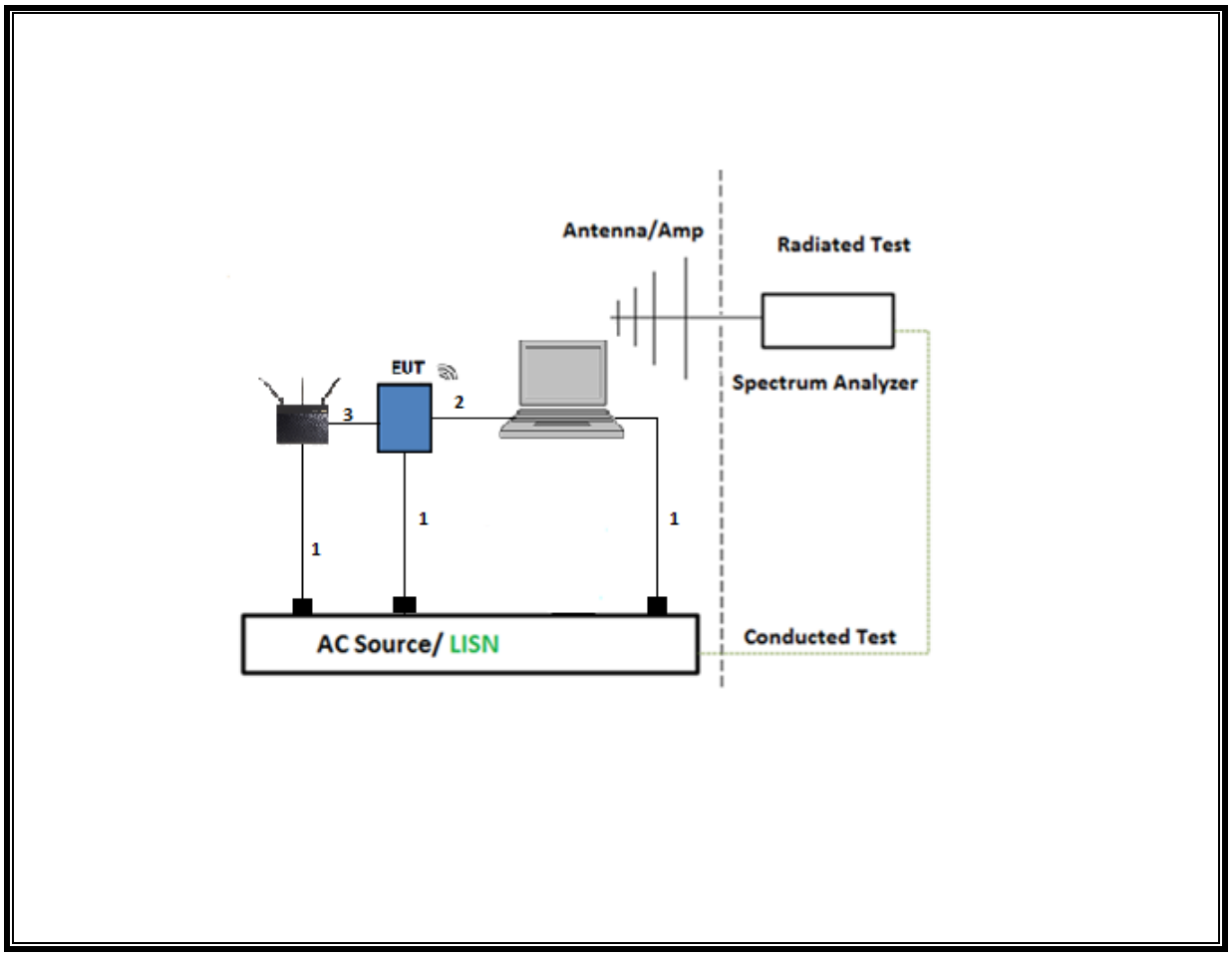
SETUP DIAGRAM FOR BELOW 1GHz and AC LINE CONDUCTED TEST



7. MEASUREMENT METHOD

On Time and Duty Cycle: KDB 558074 D01 v05r02, Section 6.

6 dB BW: KDB 558074 D01 v05ro2, Section 8.1.

Output Power: KDB 558074 D01 v05r02, Section 9.1.3.

Power Spectral Density: KDB 558074 D01 v05r02, Section 10.2.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v05r02, Section 11.0.

Out-of-band emissions in restricted bands: KDB 558074 D01 v05r02, Section 12.1.

Band-edge: KDB 558074 D01 v05r02, Section 12.1.

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

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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**	**ID Num**	**Last Cal**	**Cal Due**
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T907	01/22/2020	01/22/2021
Antenna, Double Ridge Guide Horn Antenna 700MHz to 18GHz	A.H. SYSTEMS, INC.	SAS-571	PRE0194893	05/16/2019	05/16/2020
Amplifier, 1-18GHz	Miteq Inc.	AFS42-00101800-25-S-42	T931	05/11/2019	05/11/2020
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T346	05/14/2019	05/14/2020
Amplifier, 1 to 18GHz	Miteq	AFS42-00101800-25-S-42	T1165	05/24/2019	05/24/2020
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	T339	01/21/2020	01/21/2021
Antenna, Active Loop 9KHz to 30MHz	ETS-Lindgren	6502	T1616	10/28/2019	10/28/2020
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunsol Sciences Corp.	JB3	T408	08/23/2019	08/23/2020
Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	T286	07/31/2019	07/31/2020
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	T447	08/13/2019	08/13/2020
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1210	01/21/2020	01/21/2021
*Pre-Amp 18-26GHz	Agilent Technology	8449B	T404	03/23/2019	03/23/2020
*Power Meter, P-series single channel	Keysight	N1911A	T1268	01/31/2019	01/31/2020
*Power Sensor	Keysight	N1921A	T1225	03/01/2019	03/01/2020

AC Line Conducted					
Description	**Manufacturer**	**Model**	**ID Num**	**Last Cal**	**Cal Due**
*EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESR	T1436	04/14/2019	04/14/2020
Power Cable, Line Conducted Emissions	UL	PR1	T861	10/27/2019	10/27/2020
LISN for Conducted Emissions CISPR-16	FISCHER CUSTOM COMMUNICATIONS	FCC-LISN-50/250-25-2-01	T1310	01/23/2020	01/23/2021
UL AUTOMATION SOFTWARE					
Radiated Software	UL	UL EMC	Ver 9.5, Mar 6, 2020		
Conducted Software	UL	UL EMC	2020.2.26		
AC Line Conducted Software	UL	UL EMC	Ver 9.5, February 21, 2020		

*Testing is completed before equipment expiration date.

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9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

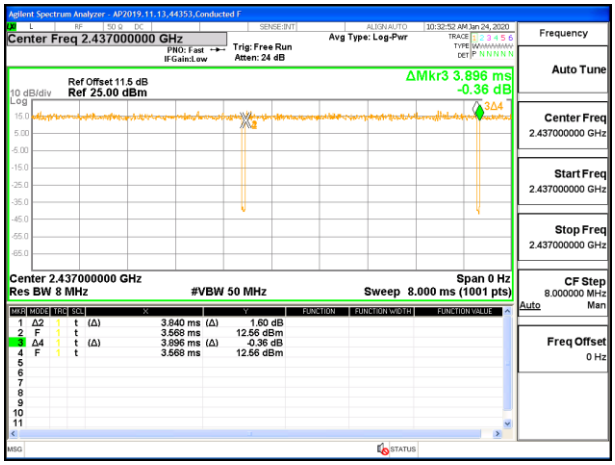
KDB 558074 Zero-Span Spectrum Analyzer Method.

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 1TX	12.500	12.580	0.994	99.36%	0.00	0.010
802.11n HT20 1TX	3.840	3.896	0.986	98.56%	0.00	0.010

DUTY CYCLE PLOTS

DUTY CYCLE 802.11b 1TX MODE



DUTY CYCLE 802.11n HT20 1TX MODE

9.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

9.2.1. 802.11b MODE

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	13.3050
Mid 6	2437	13.1480
High 11	2462	13.3940
High 12	2467	13.3800
High 13	2472	13.4080

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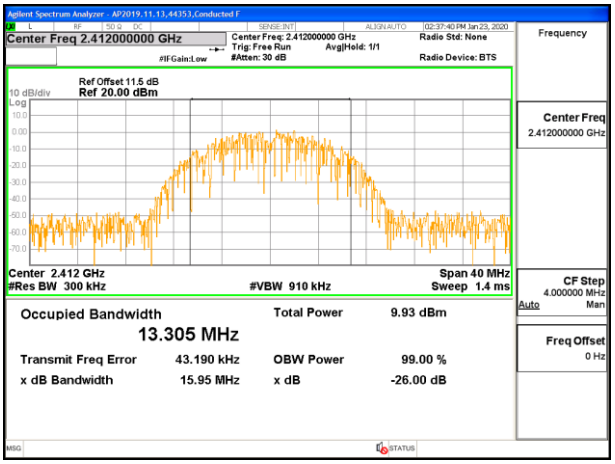
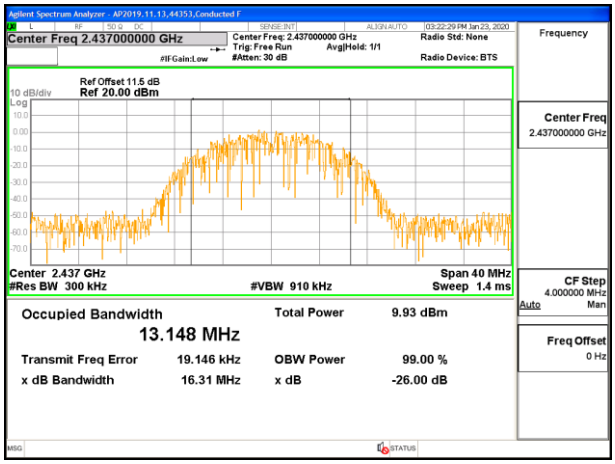
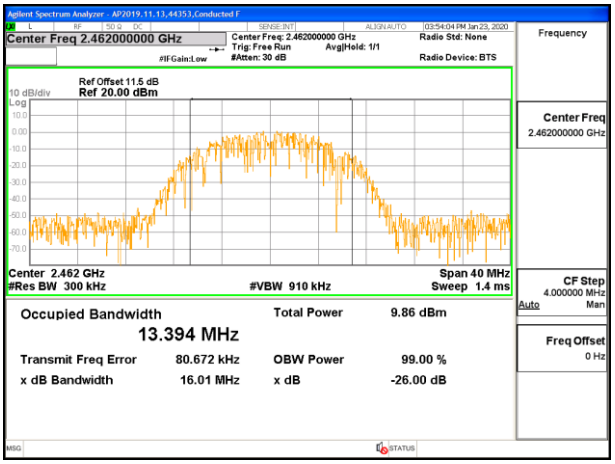


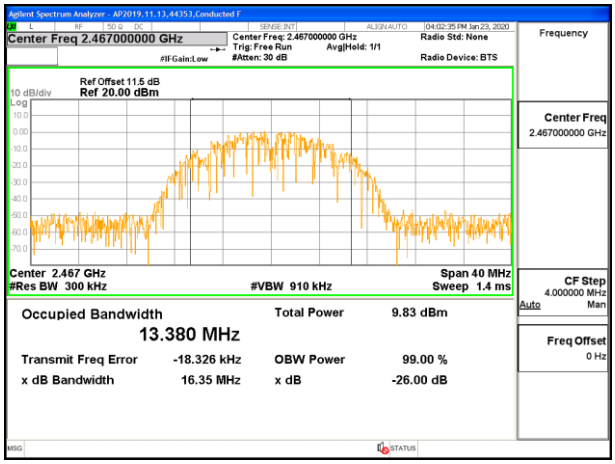
LOW CHANNEL 1



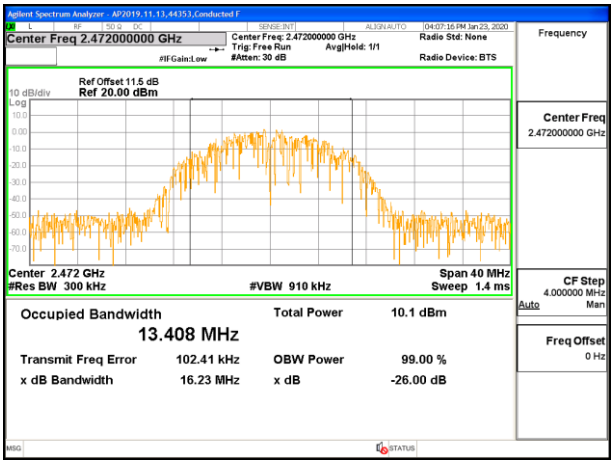
MID CHANNEL 6



HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13

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9.2.2. 802.11n HT20 MODE

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low 1	2412	17.6830
Mid 6	2437	17.7410
High 11	2462	17.8010
High 12	2467	17.7660
High 13	2472	17.7380

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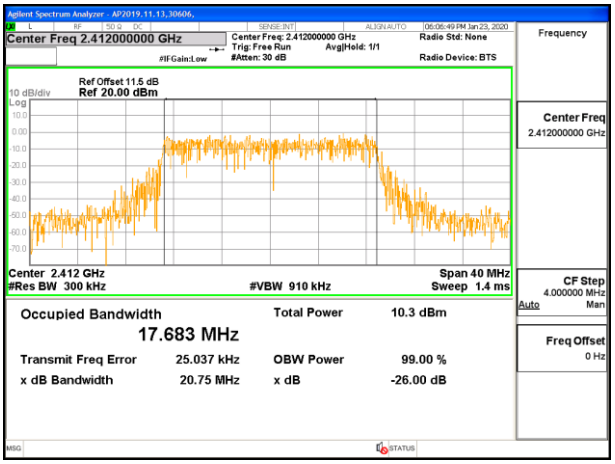
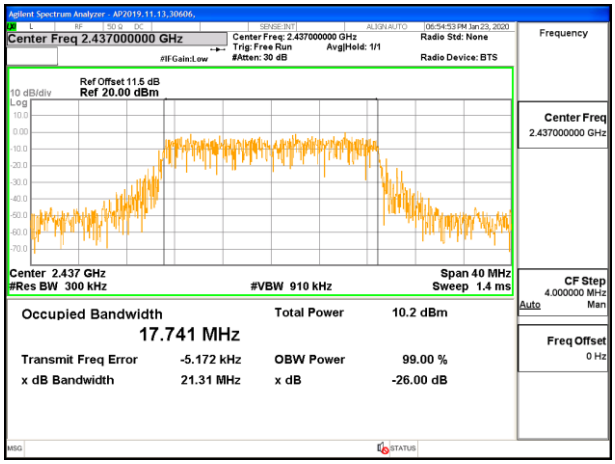
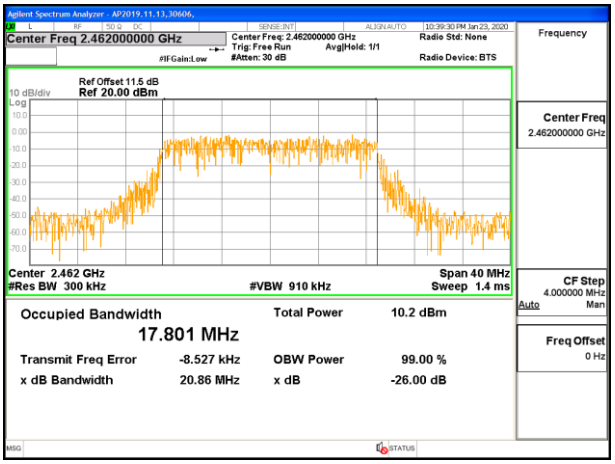


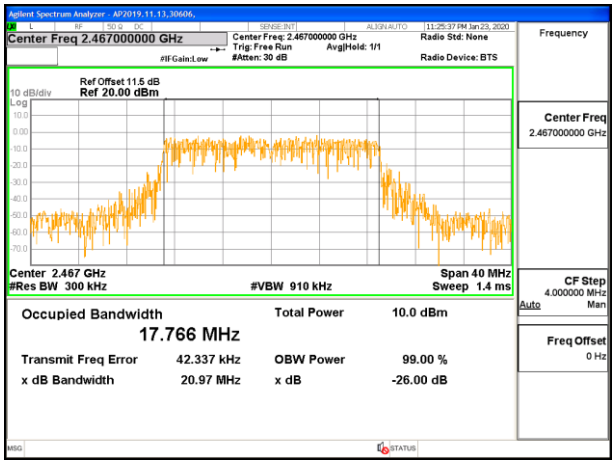
LOW CHANNEL 1



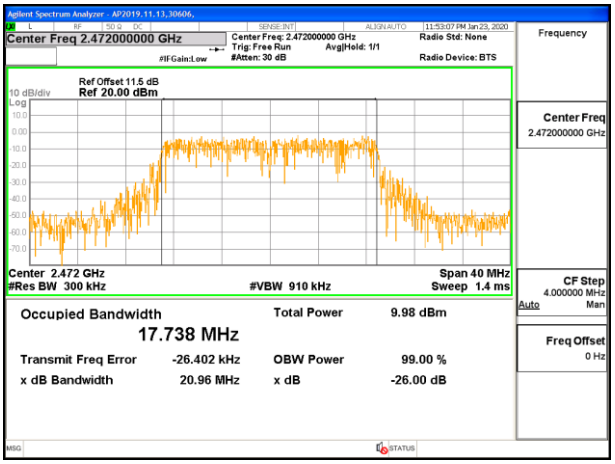
MID CHANNEL 6



HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13

9.3. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

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

RESULTS

9.3.1. 802.11b MODE

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low 1	2412	8.5600	0.5
Mid 6	2437	8.6400	0.5
High 11	2462	8.1600	0.5
High 12	2467	8.6400	0.5
High 13	2472	8.6800	0.5

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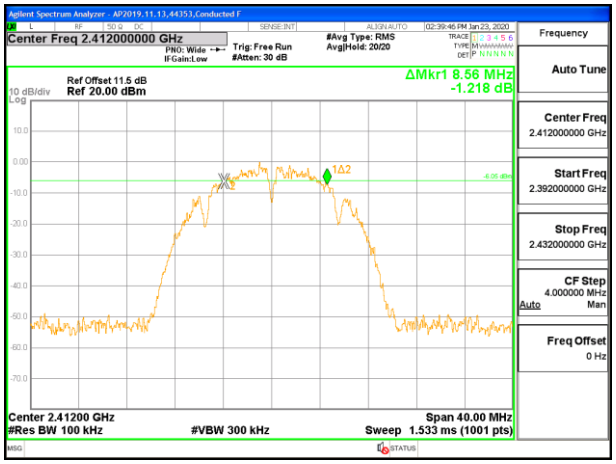
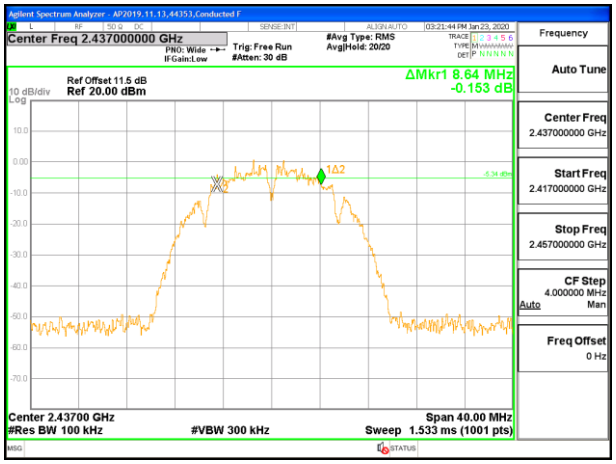
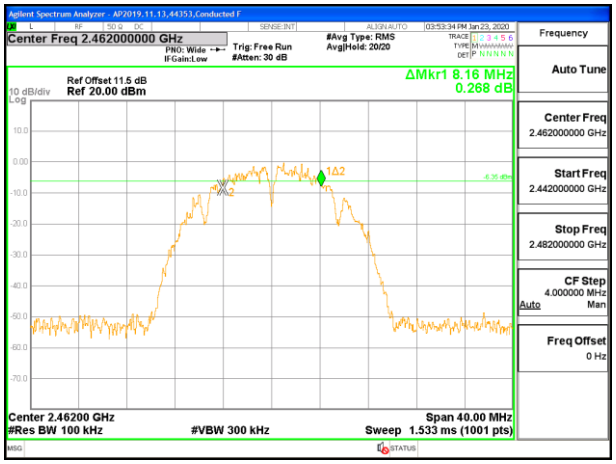


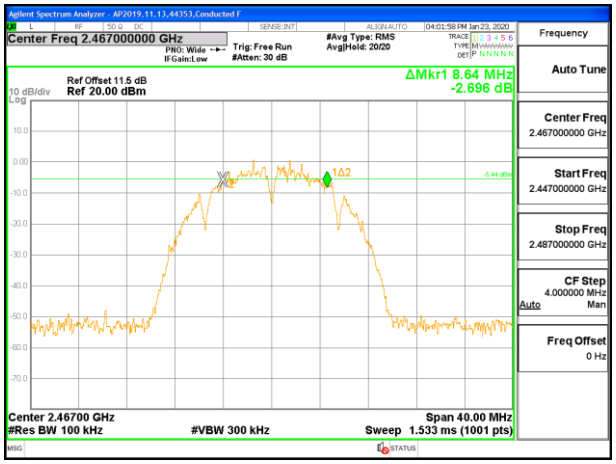
LOW CHANNEL 1



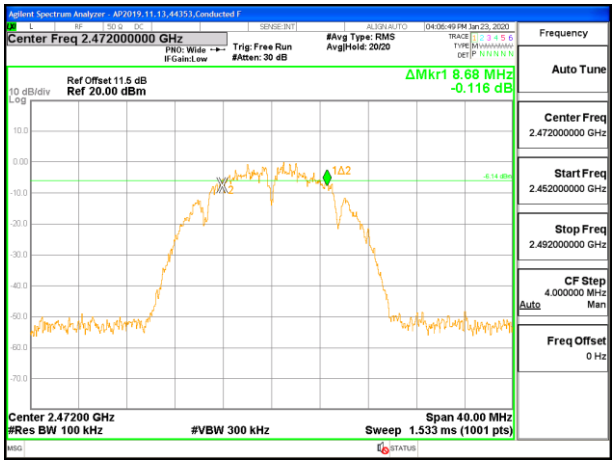
MID CHANNEL 6



HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13

9.3.2. 802.11n HT20 MODE

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low 1	2412	17.880	0.5
Mid 6	2437	17.720	0.5
High 11	2462	17.840	0.5
High 12	2467	17.640	0.5
High 13	2472	17.800	0.5

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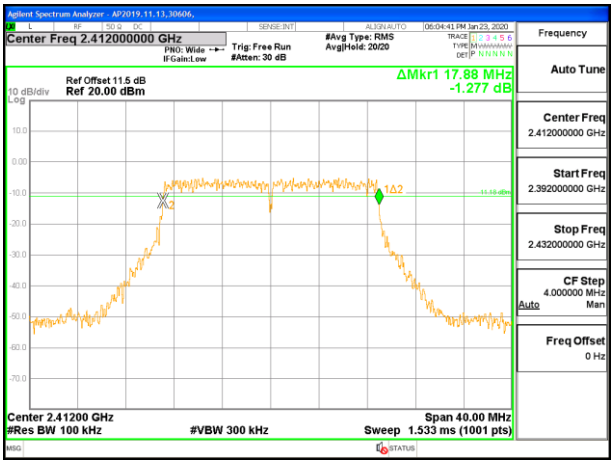
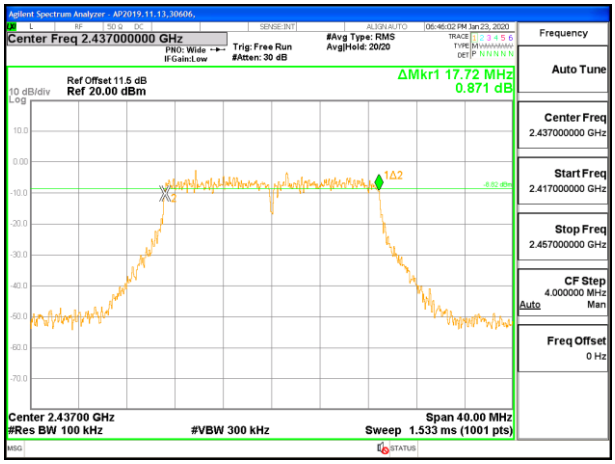
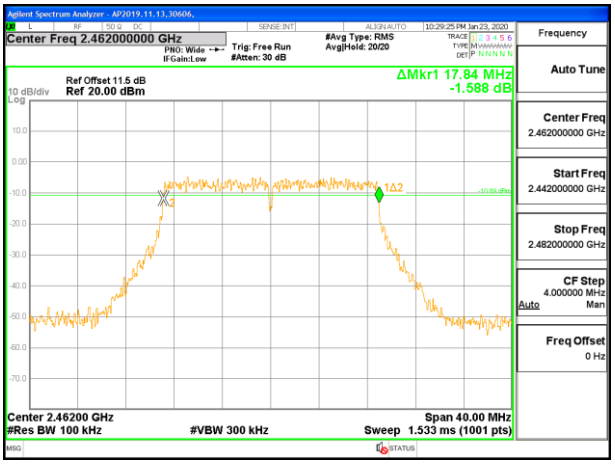


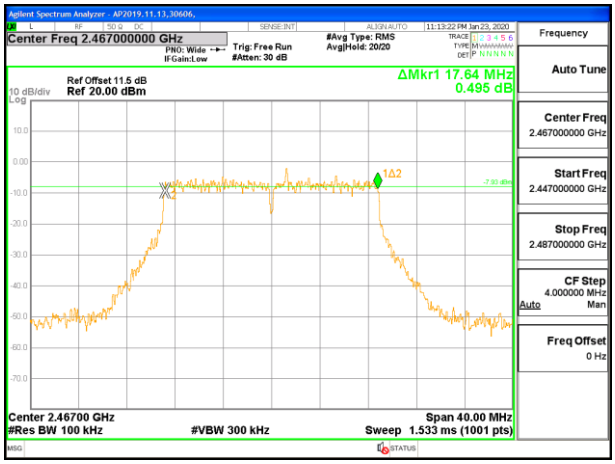
LOW CHANNEL 1



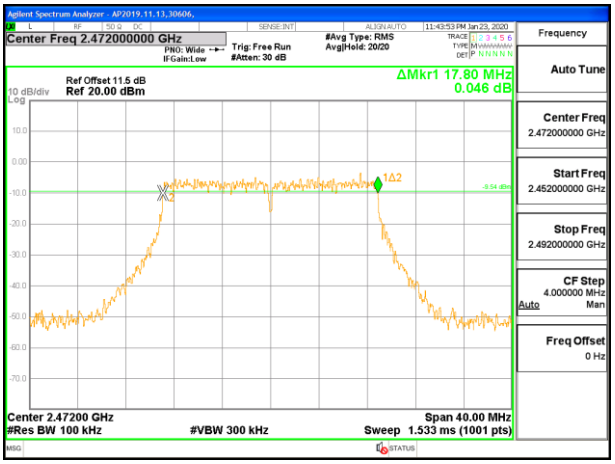
MID CHANNEL 6



HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13

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9.4. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

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 with wideband power sensor.

The cable assembly insertion loss of 11.5 dB (including 10 dB pad and 1.5 dB cable) was entered as an offset in the power meter to allow for a gated average reading of power.

DIRECTIONAL ANTENNA GAIN

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

RESULTS

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9.4.1. 802.11b MODE

Test Engineer:	1-21-2020
Test Date:	44353

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	Max Power (dBm)

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

Results

Channel	Frequency (MHz)	Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	9.53	9.53	30.00	-20.47
Mid 6	2437	9.48	9.48	30.00	-20.52
High 11	2462	9.42	9.42	30.00	-20.58
High 12	2467	9.40	9.40	30.00	-20.60
High 13	2472	9.32	9.32	30.00	-20.68

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9.4.2. 802.11n HT20 MODE

Test Engineer:	1-21-2020
Test Date:	44353

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	Max Power (dBm)

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

Results

Channel	Frequency (MHz)	Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low 1	2412	11.53	11.53	30.00	-18.47
Mid 6	2437	11.48	11.48	30.00	-18.52
High 11	2462	11.50	11.50	30.00	-18.50
High 12	2467	11.46	11.46	30.00	-18.54
High 13	2472	3.00	3.00	30.00	-27.00

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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 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

RESULTS

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9.5.1. 802.11b MODE

Test Engineer:	1-21-2020
Test Date:	44353

Channel	Frequency (MHz)	Power (dBm)
Low 1	2412	6.98
Mid 6	2437	6.97
High 11	2462	6.84
High 12	2467	6.88
High 13	2472	6.79

9.5.2. 802.11n HT20 MODE

Test Engineer:	1-21-2020
Test Date:	44353

Channel	Frequency (MHz)	Power (dBm)
Low 1	2412	6.93
Mid 6	2437	6.88
High 11	2462	6.91
High 12	2467	6.84
High 13	2472	-6.00

9.6. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

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

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9.6.1. 802.11b MODE

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

PSD Results

Channel	Frequency (MHz)	Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-16.74	-16.74	8.0	-24.7
Mid 6	2437	-16.55	-16.55	8.0	-24.5
High 11	2462	-16.87	-16.87	8.0	-24.9
High 12	2467	-16.13	-16.13	8.0	-24.1
High 13	2472	-16.17	-16.17	8.0	-24.2

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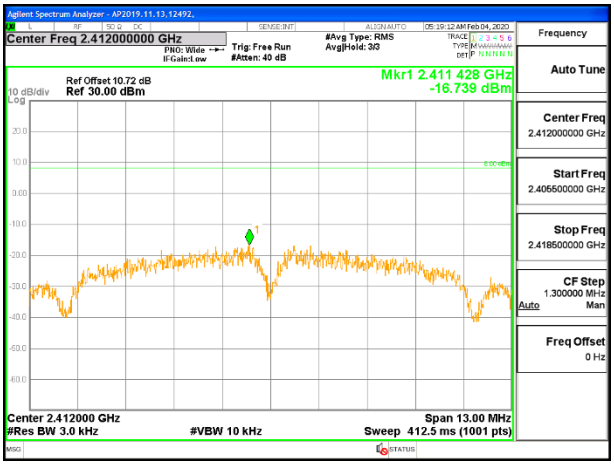
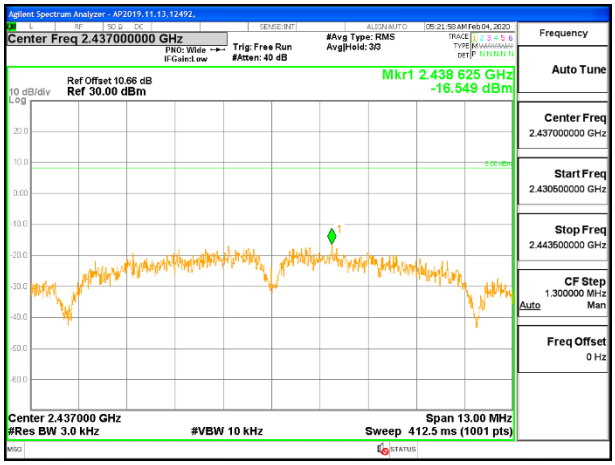
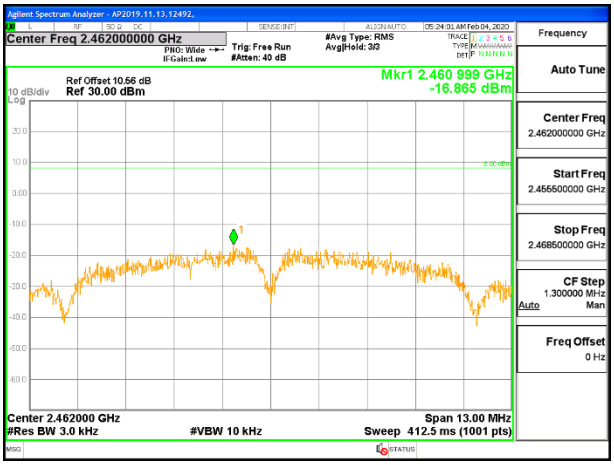


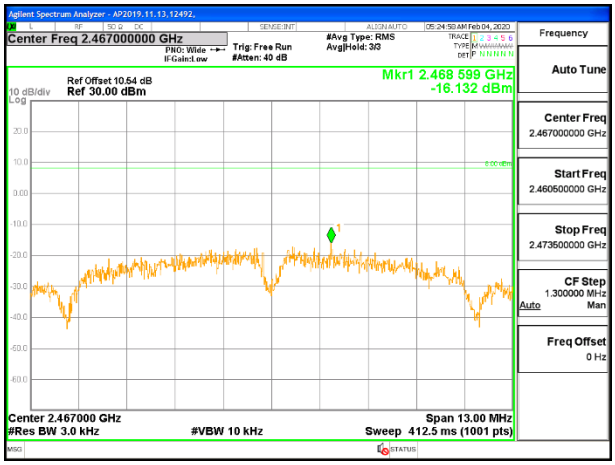
LOW CHANNEL 1



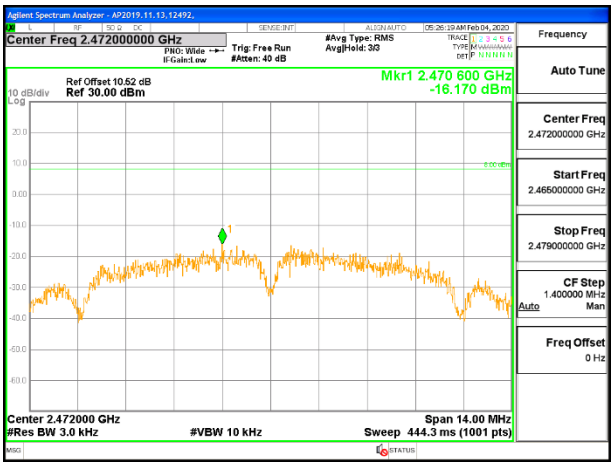
MID CHANNEL 6



HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13

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9.6.2. 802.11n HT20 MODE

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

PSD Results

Channel	Frequency (MHz)	Meas (dBm/ 3kHz)	Total Corr'd PSD (dBm/ 3kHz)	Limit (dBm/ 3kHz)	Margin (dB)
Low 1	2412	-19.19	-19.19	8.0	-27.2
Mid 6	2437	-19.23	-19.23	8.0	-27.2
High 11	2462	-19.31	-19.31	8.0	-27.3
High 12	2467	-19.44	-19.44	8.0	-27.4
High 13	2472	-19.42	-19.42	8.0	-27.4

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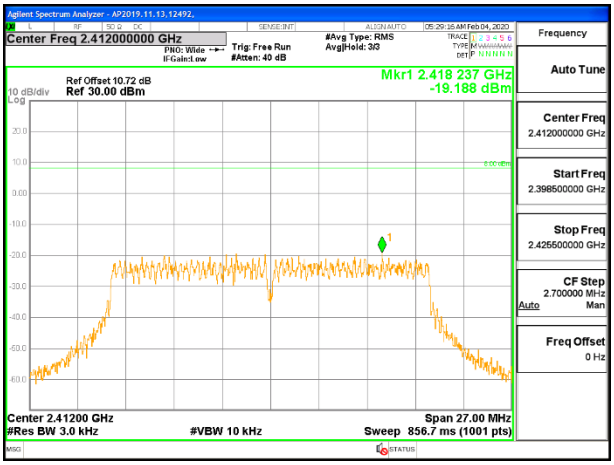
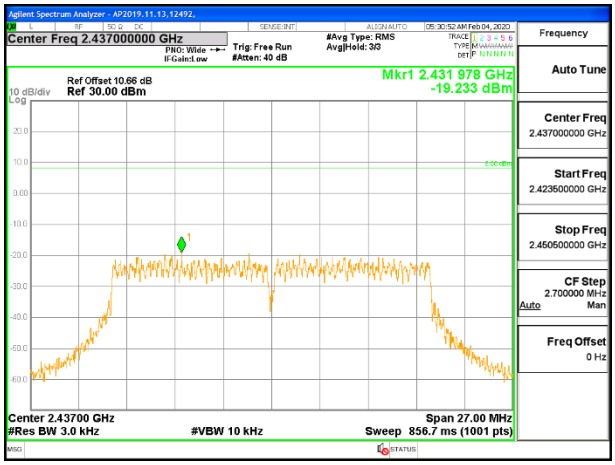
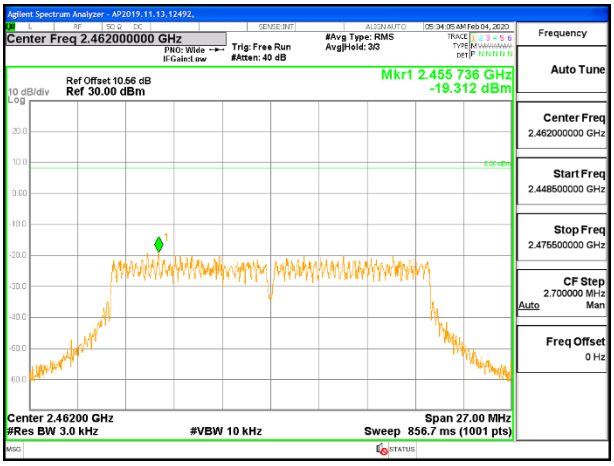


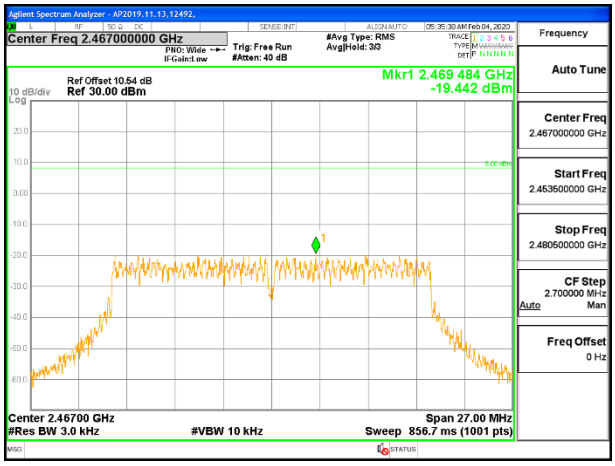
LOW CHANNEL 1



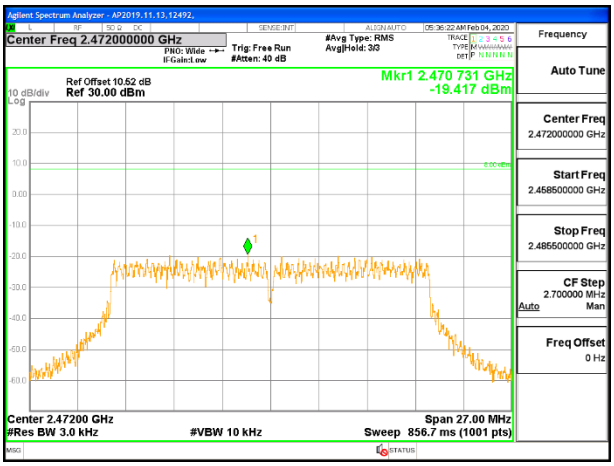
MID CHANNEL 6



HIGH CHANNEL 11



HIGH CHANNEL 12



HIGH CHANNEL 13

9.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

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

RESULTS

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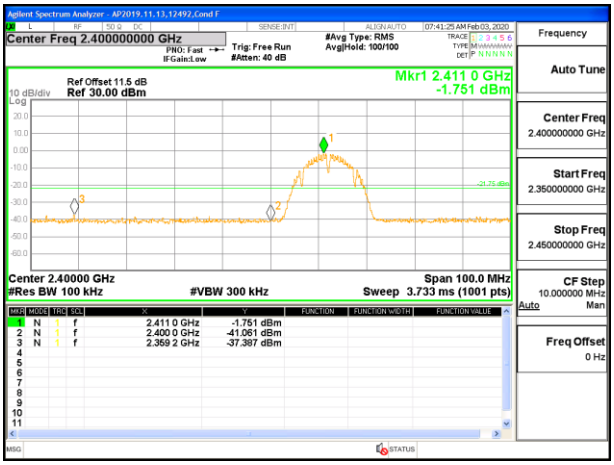
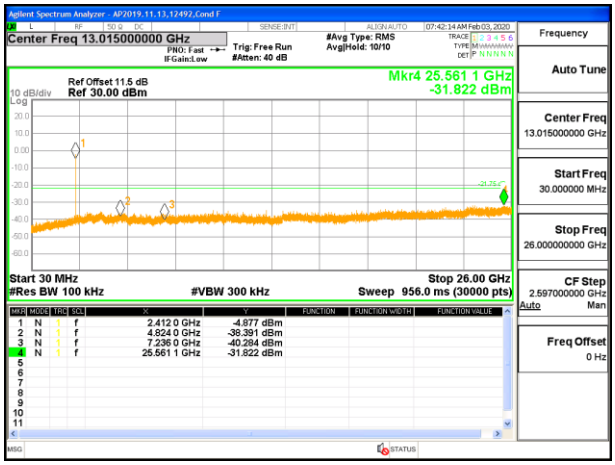
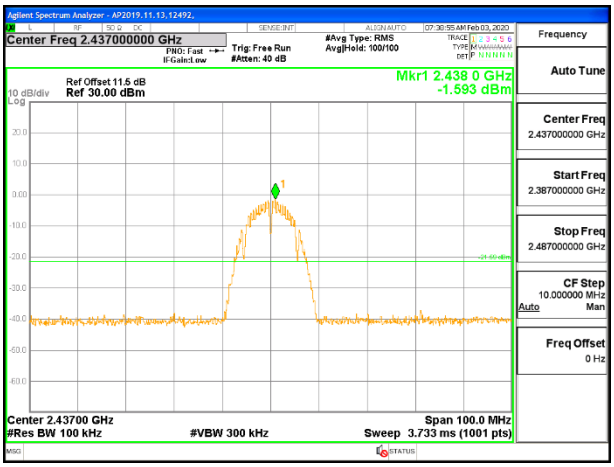
9.7.1. 802.11b MODE



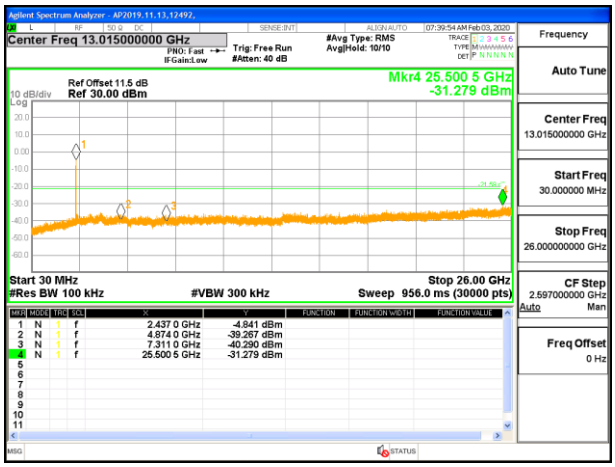
LOW CHANNEL 1 BANDEDGE



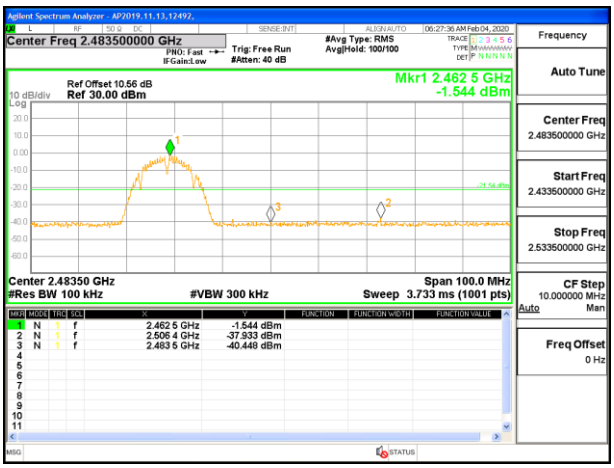
OUT-OF-BAND LOW CHANNEL 1



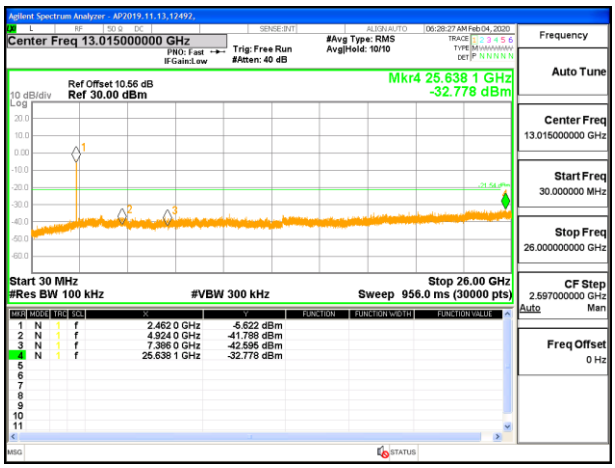
IN-BAND REFERNCE LEVEL



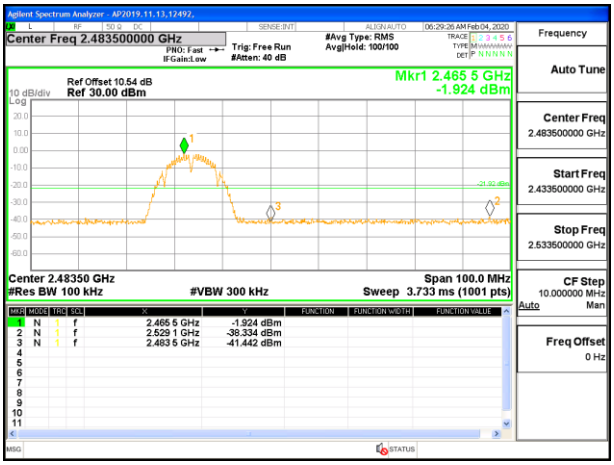
OUT-OF-BAND MID CHANNEL



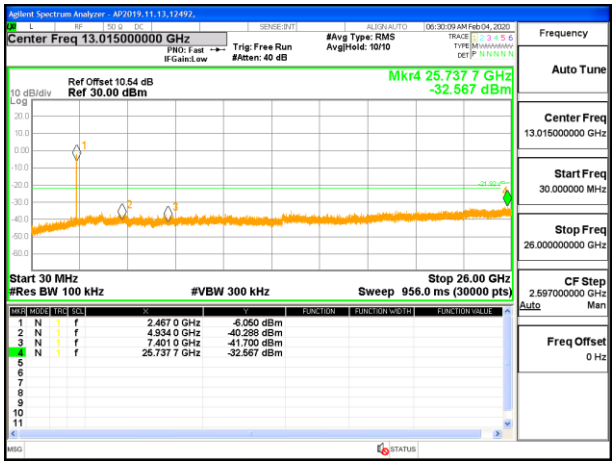
HIGH CHANNEL 11 BANDEDGE



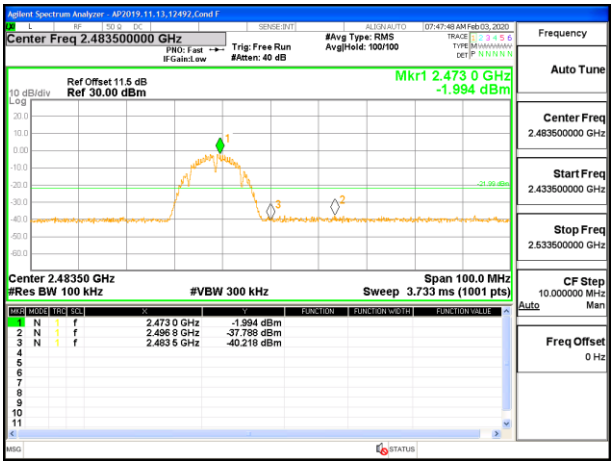
OUT-OF-BAND HIGH CHANNEL 11



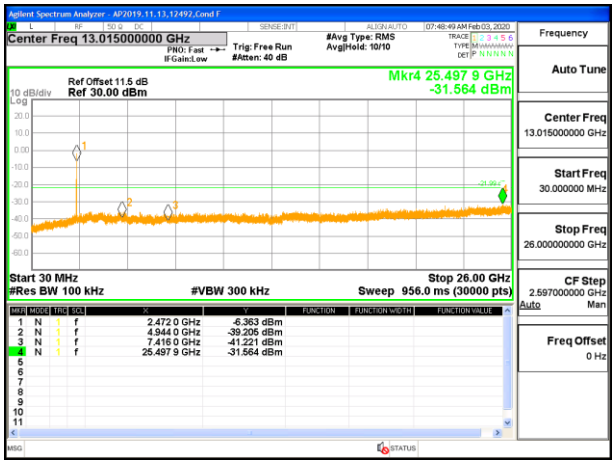
HIGH CHANNEL 12 BANDEDGE



OUT-OF-BAND HIGH CHANNEL 12

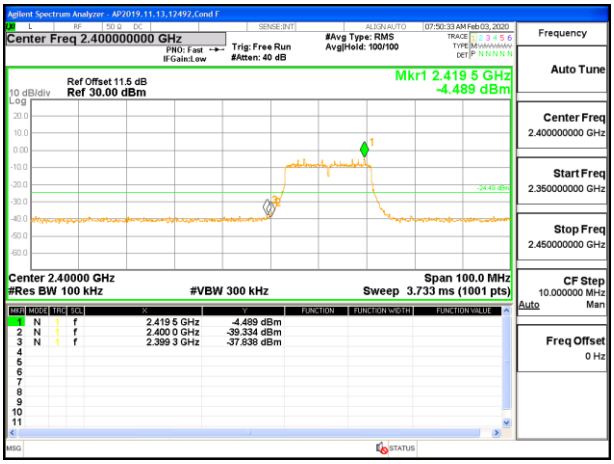


HIGH CHANNEL 13 BANDEDGE

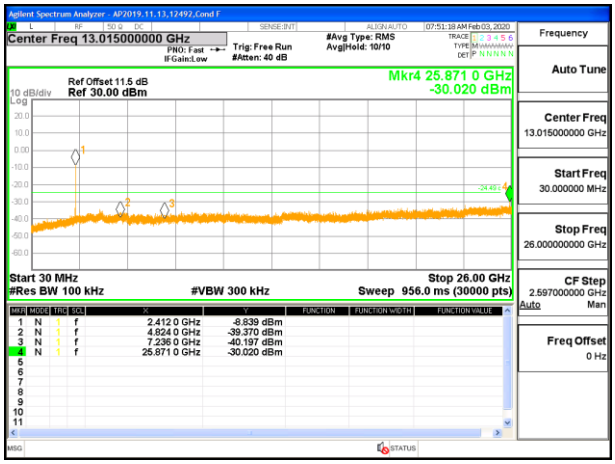


OUT-OF-BAND HIGH CHANNEL 13

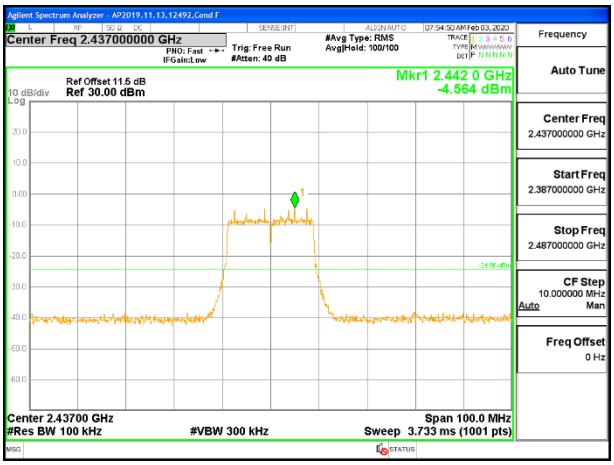
9.7.2. 802.11n HT20 MODE



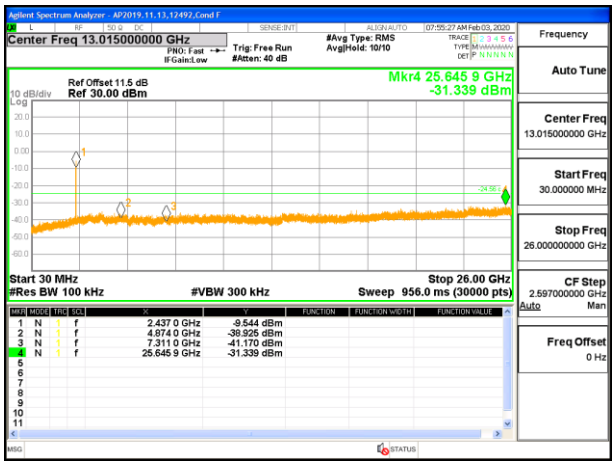
LOW CHANNEL 1 BANDEDGE



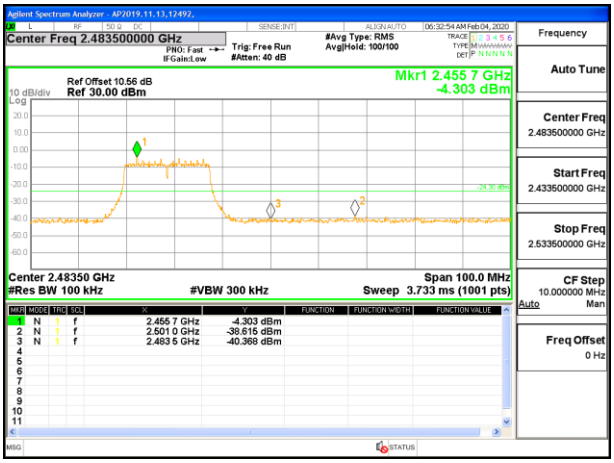
OUT-OF-BAND LOW CHANNEL 1



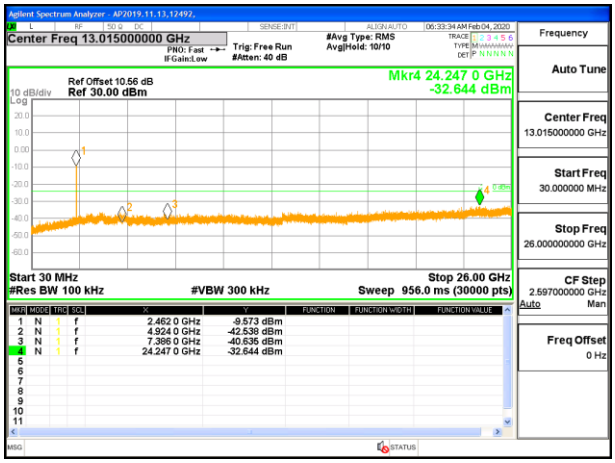
IN-BAND REFERNCE LEVEL



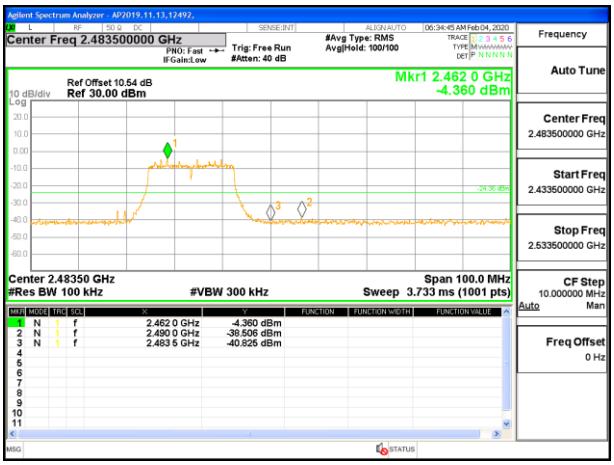
OUT-OF-BAND MID CHANNEL



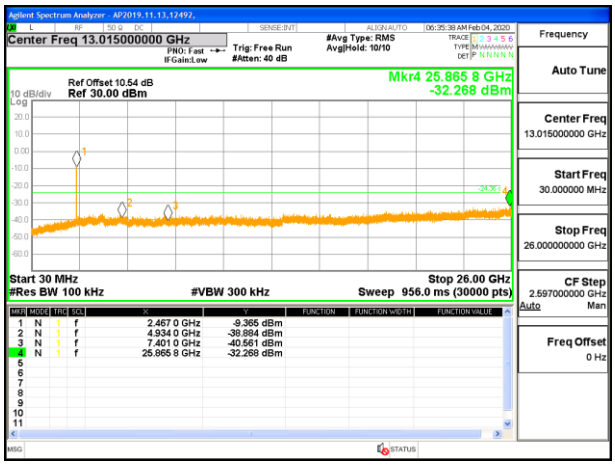
HIGH CHANNEL 11 BANDEDGE



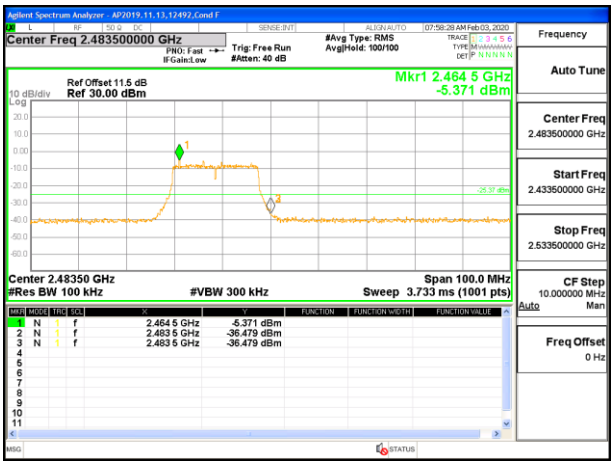
OUT-OF-BAND HIGH CHANNEL 11



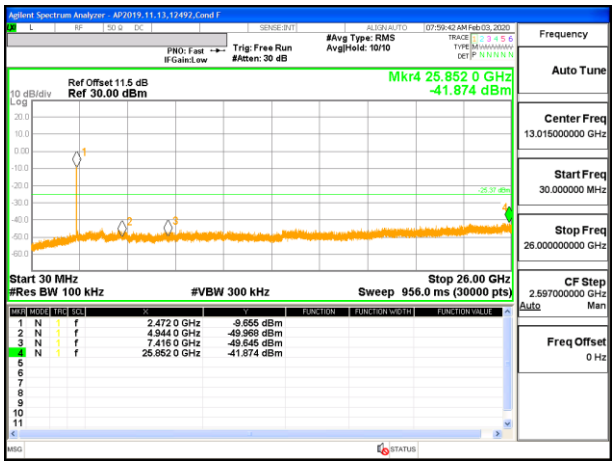
HIGH CHANNEL 12 BANDEDGE



OUT-OF-BAND HIGH CHANNEL 12



HIGH CHANNEL 13 BANDEDGE



OUT-OF-BAND HIGH CHANNEL 13

10. RADIATED TEST RESULTS

LIMITS

FCC §15.205 and §15.209

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.

For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and as applicable for average measurements.

The spectrum from 1 GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. Below 1GHz and above 18GHz emissions, the channel with the highest output power was tested.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.

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KDB 414788 Open Field Site(OFS) and Chamber Correlation Justification

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

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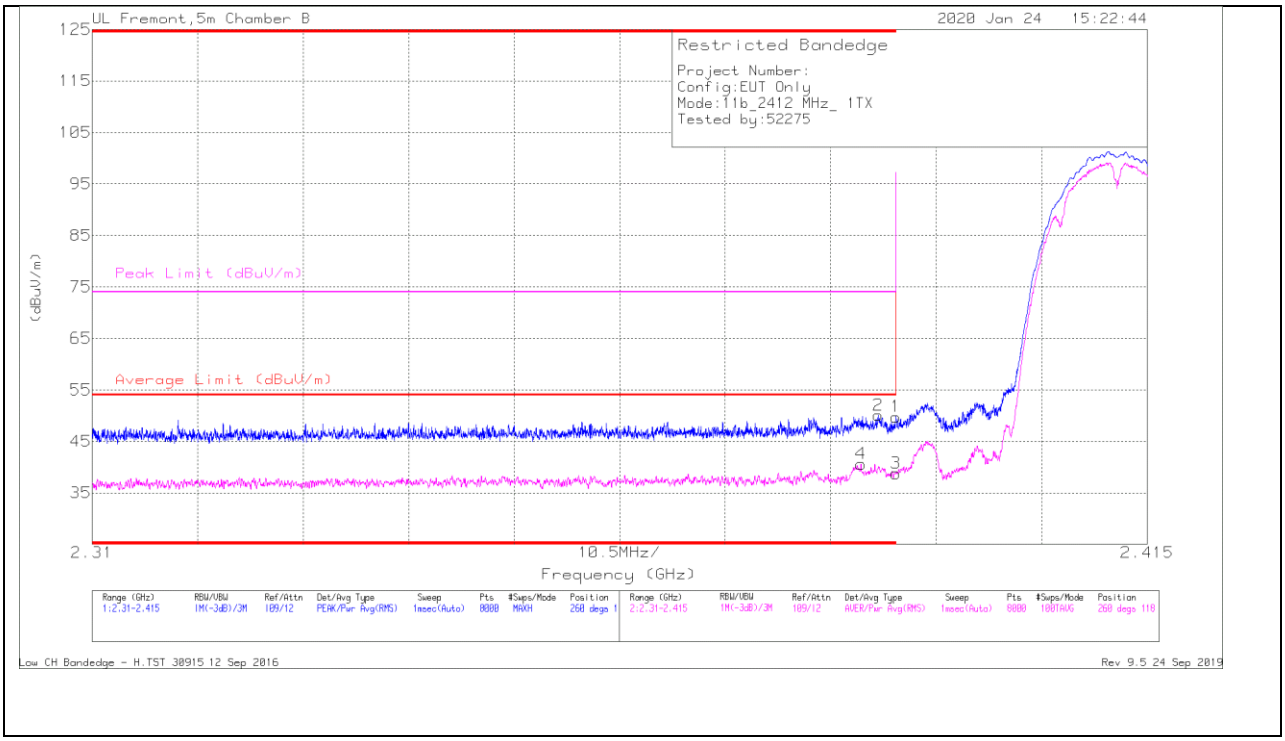
10.1. TRANSMITTER ABOVE 1 GHz

10.1.1. TX ABOVE 1 GHz 802.11b MODE IN THE 2.4 GHz BAND

BANDEDGE (LOW CHANNEL, CH 1)

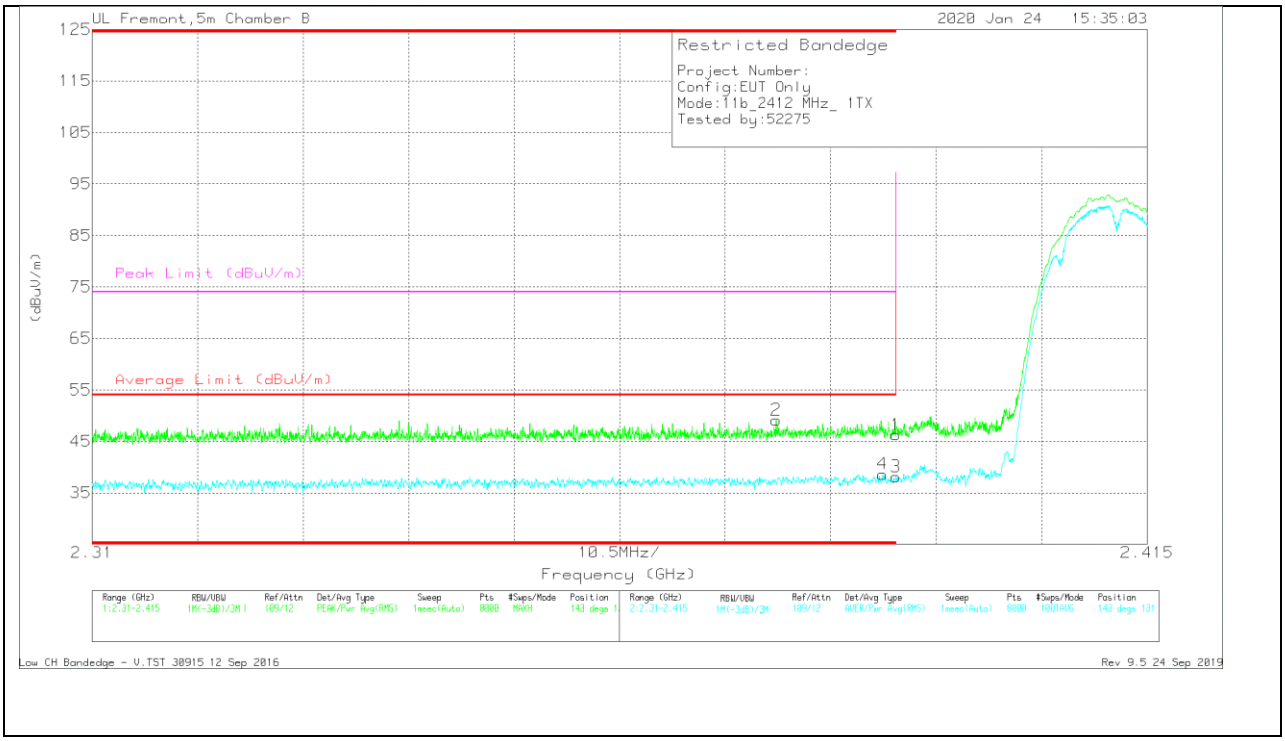
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0194893 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	38.38	Pk	30.3	-18.9	49.78	-	-	74	-24.22	260	118	H
2	* 2.38822	38.69	Pk	30.3	-18.9	50.09	-	-	74	-23.91	260	118	H
3	* 2.39	27.4	RMS	30.3	-18.9	38.8	54	-15.2	-	-	260	118	H
4	* 2.38652	29.32	RMS	30.2	-18.9	40.62	54	-13.38	-	-	260	118	H

* - indicates frequency in CFR47 Pt 15
Pk - Peak detector
RMS - RMS detection

VERTICAL RESULT

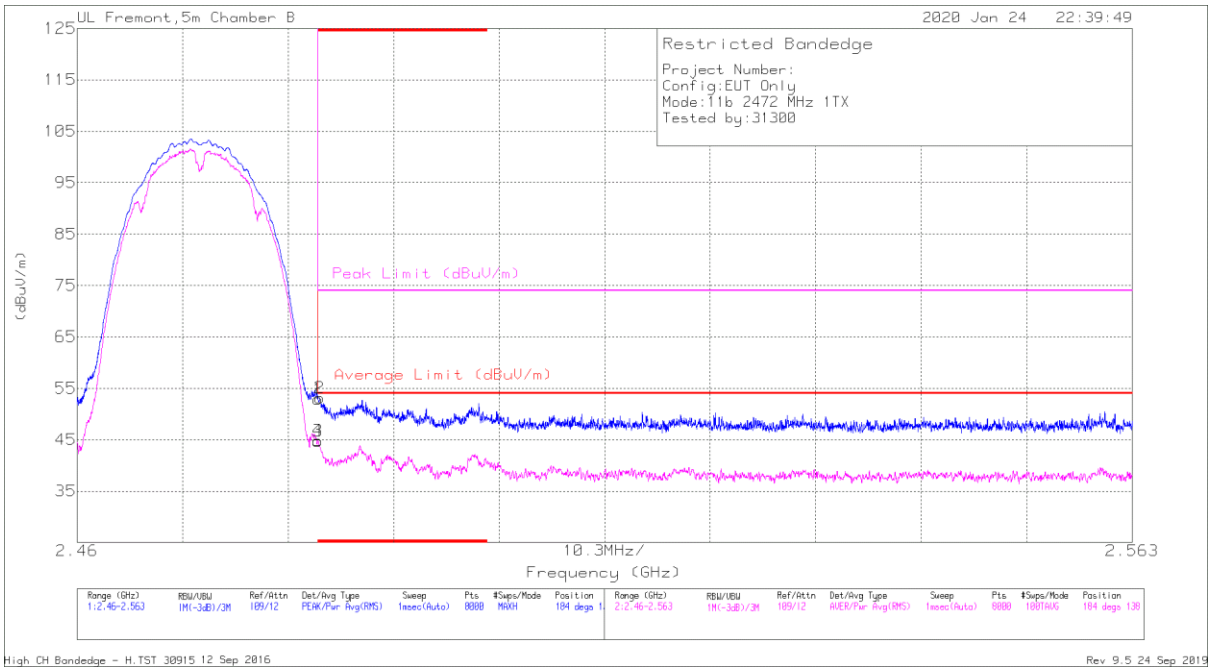


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0194893 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	34.88	Pk	30.3	-18.9	46.28	-	-	74	-27.72	143	131	V
2	* 2.37808	37.74	Pk	30.2	-18.8	49.14	-	-	74	-24.86	143	131	V
3	* 2.39	26.73	RMS	30.3	-18.9	38.13	54	-15.87	-	-	143	131	V
4	* 2.38867	27.26	RMS	30.3	-18.9	38.66	54	-15.34	-	-	143	131	V

* - indicates frequency in CFR47 Pt 15
Pk - Peak detector
RMS - RMS detection

BANDEDGE (HIGH CHANNEL, CH 13)

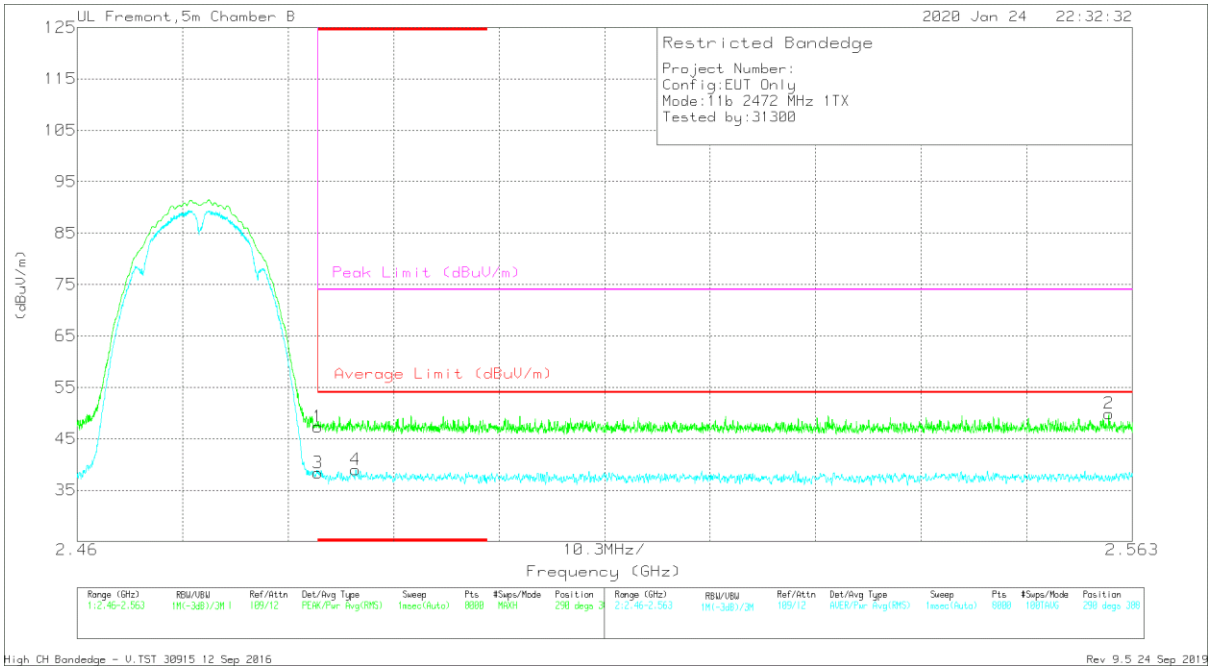
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0194893 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	41.56	Pk	30.2	-18.9	52.86	-	-	74	-21.14	184	138	H
2	* 2.48368	41.83	Pk	30.2	-18.9	53.13	-	-	74	-20.87	184	138	H
3	* 2.4835	33.45	RMS	30.2	-18.9	44.75	54	-9.25	-	-	184	138	H
4	* 2.48351	33.52	RMS	30.2	-18.9	44.82	54	-9.18	-	-	184	138	H

* - indicates frequency in CFR47 Pt 15
Pk - Peak detector
RMS - RMS detection

VERTICAL RESULT

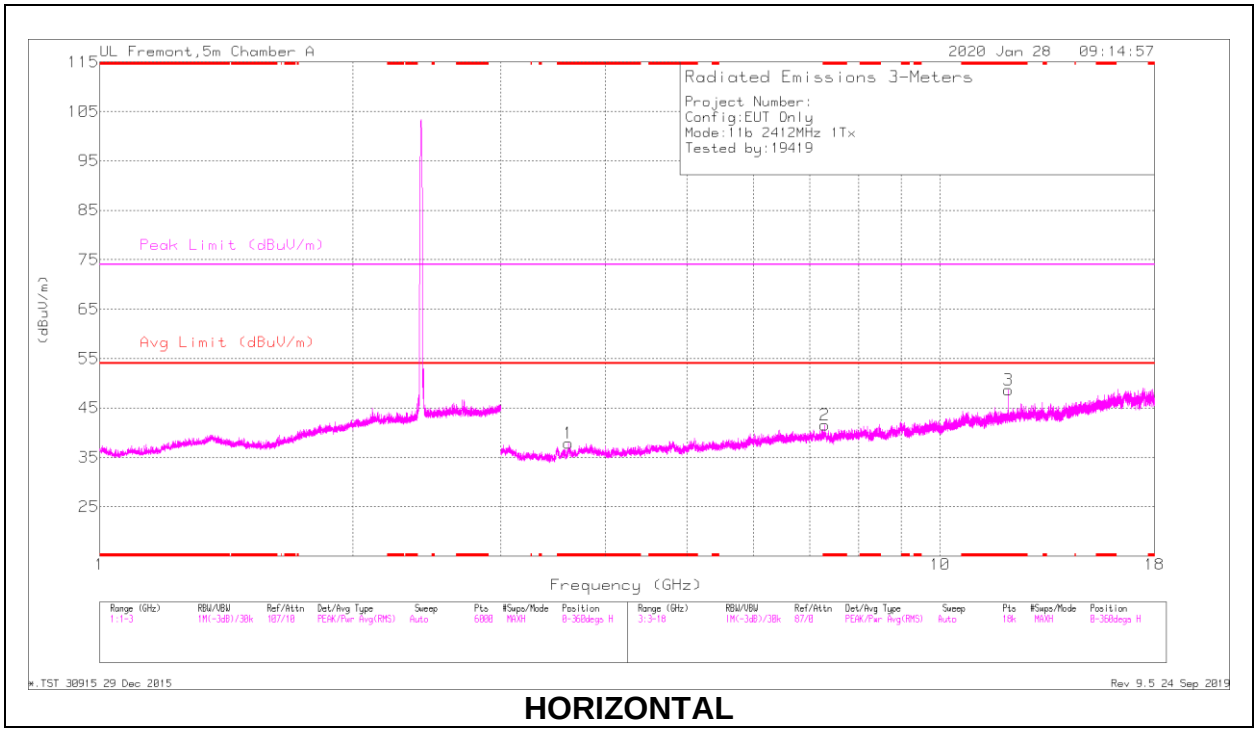


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF PRE0194893 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	36.05	Pk	30.2	-18.9	47.35	-	-	74	-26.65	290	388	V
3	* 2.4835	27.07	RMS	30.2	-18.9	38.37	54	-15.63	-	-	290	388	V
4	* 2.4872	27.69	RMS	30.2	-18.9	38.99	54	-15.01	-	-	290	388	V
2	2.56071	38.6	Pk	30.1	-18.8	49.9	-	-	74	-24.1	290	388	V

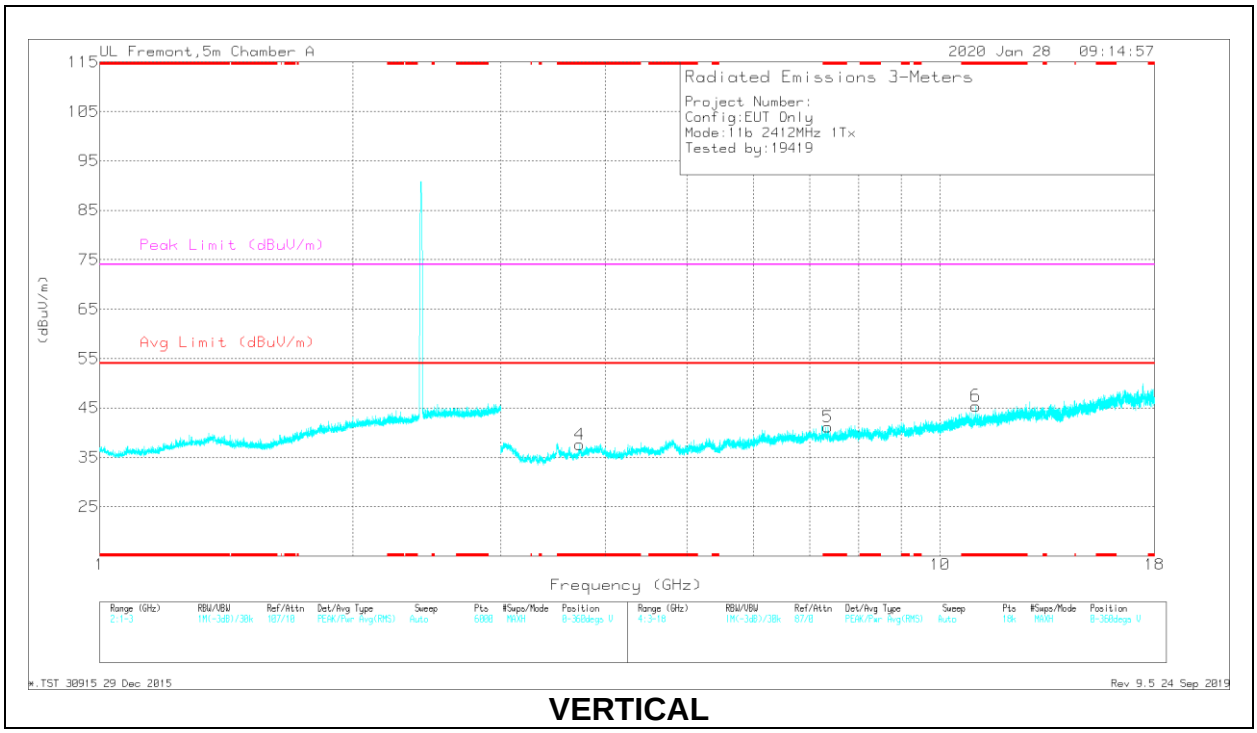
* - indicates frequency in CFR47 Pt 15
Pk - Peak detector
RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL, CH 1 RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 3.61175	39.61	PK2	33.2	-29.5	43.31	-	-	74	-30.69	-	135	H
	* 3.61434	28.19	MAv1	33.2	-29.4	31.99	54	-22.01	-	-	-	135	H
2	* 7.28786	35.25	PK2	35.8	-23.1	47.95	-	-	74	-26.05	208	157	H
	* 7.28758	22.07	MAv1	35.8	-23.1	34.77	54	-19.23	-	-	208	157	H
3	* 12.05845	35.86	PK2	38.7	-19.7	54.86	-	-	74	-19.14	47	104	H
	* 12.05893	24.81	MAv1	38.7	-19.7	43.81	54	-10.19	-	-	47	104	H
4	* 3.7256	39.5	PK2	33.4	-29.1	43.8	-	-	74	-30.2	99	144	V
	* 3.72654	27.57	MAv1	33.4	-29.1	31.87	54	-22.13	-	-	99	144	V
5	* 7.35945	35.51	PK2	35.7	-23.1	48.11	-	-	74	-25.89	0	149	V
	* 7.36522	21.95	MAv1	35.7	-23.3	34.35	54	-19.65	-	-	0	149	V
6	* 11.03863	34.78	PK2	37.9	-20	52.68	-	-	74	-21.32	305	208	V
	* 11.04027	19.36	MAv1	37.9	-20	37.26	54	-16.74	-	-	305	208	V

* - indicates frequency in CFR47 Pt 15
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

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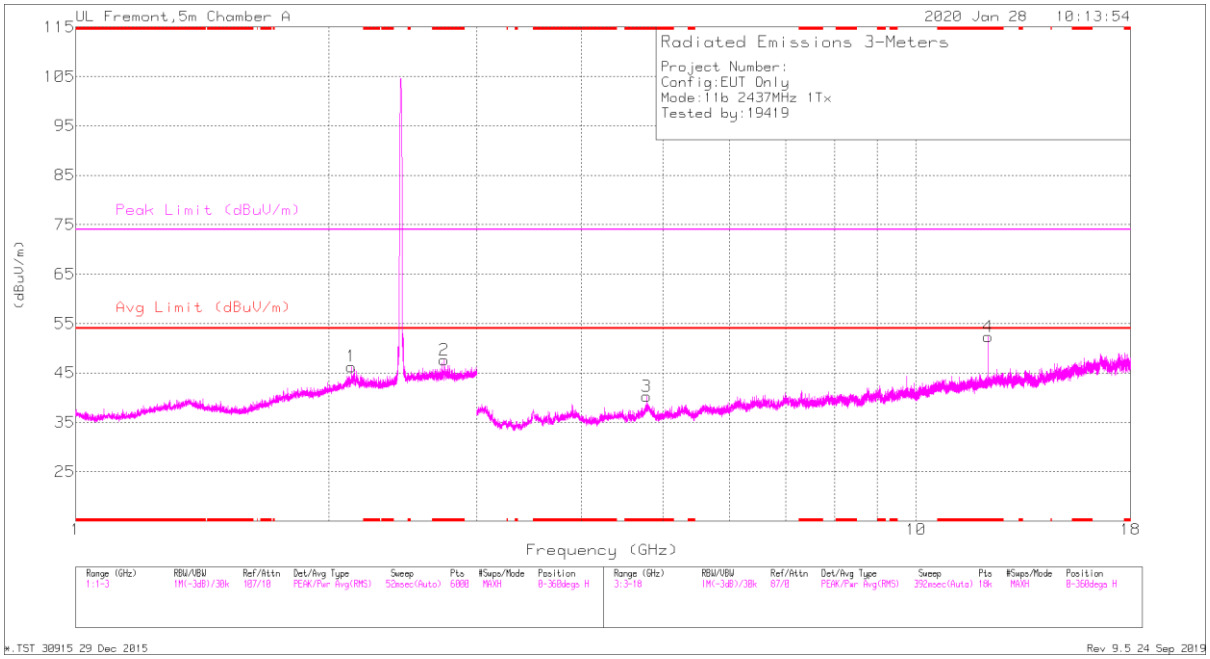
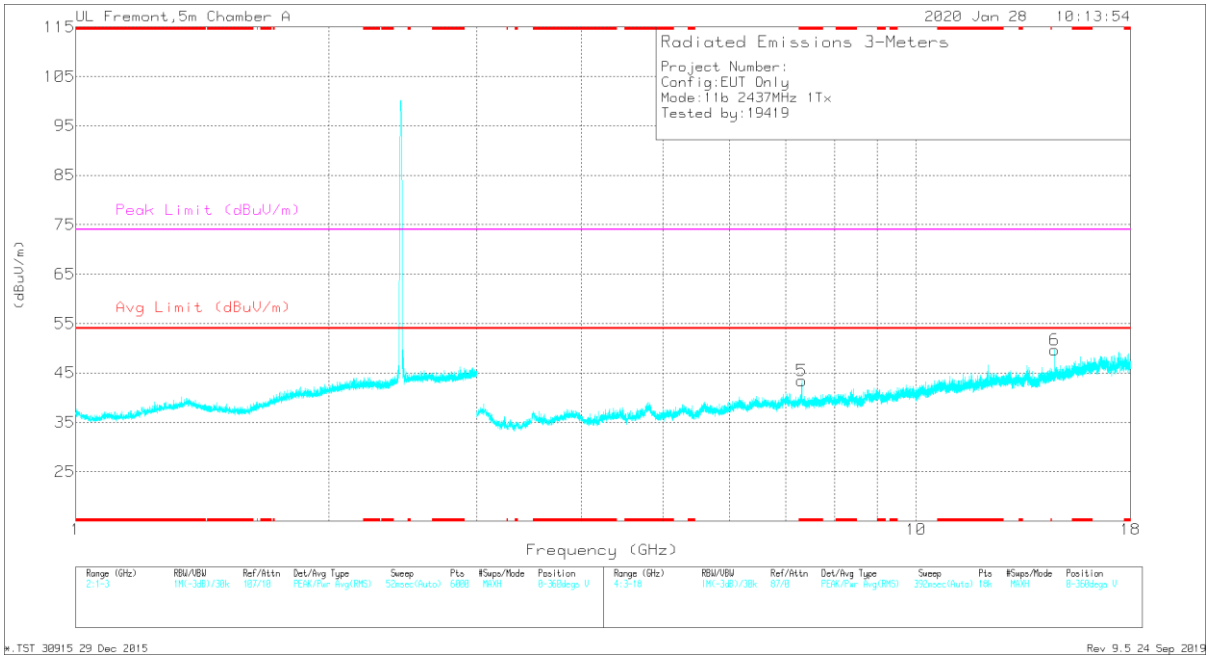
MID CHANNEL, CH 6 RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T346 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.7444	44.32	PK2	32.4	-22.9	53.82	-	-	74	-20.18	176	109	H
	* 2.74448	32.5	MAv1	32.4	-22.9	42	54	-12	-	-	176	109	H
2	2.12988	44.79	PK2	31.7	-23.7	52.79	-	-	-	-	194	148	H
3	* 4.77943	39.86	PK2	34.2	-27.5	46.56	-	-	74	-27.44	232	381	H
	* 4.77894	27.43	MAv1	34.2	-27.5	34.13	54	-19.87	-	-	232	381	H
4	* 12.18626	37.07	PK2	38.9	-19.8	56.17	-	-	74	-17.83	73	109	H
	* 12.18584	28.6	MAv1	38.9	-19.8	47.7	54	-6.3	-	-	73	109	H
5	* 7.30886	37.83	PK2	35.8	-23.4	50.23	-	-	74	-23.77	0	111	V
	* 7.30977	27.76	MAv1	35.8	-23.4	40.16	54	-13.84	-	-	0	111	V
6	14.62155	33.93	PK2	39.6	-19.7	53.83	-	-	-	-	214	217	V

* - indicates frequency in CFR47 Pt 15
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

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