HEADQUARTERS: 914 WEST PATAPSCO AVENUE • BALTIMORE, MARYLAND 21230 • PHONE (410) 354-3300 • FAX (410) 354-3313

May 16, 2019

Polycom Inc.
6001 America Center Drive
San Jose, CA 95002

Dear Tony Griffiths,

Enclosed is the EMC Wireless test report for compliance testing of the Polycom Inc., P011 as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Title 47 of the CFR, Part 15.407, Subpart E (UNII 2).

Thank you for using the services of Eurofins MET Labs, Inc If you have any questions regarding these results or if MET can be of further service to you, please feel free to contact me.

Sincerely yours,
EUROFINS MET LABS, INC

Joel Huna
Technical Writer

Reference: (\Polycom Inc.\EMCA102119-FCC407 UNII 2 Rev. 2)

Certificates and reports shall not be reproduced except in full, without the written permission of Eurofins MET Labs, Inc

HEADQUARTERS: 914 WEST PATAPSCO AVENUE • BALTIMORE, MARYLAND 21230 • PHONE (410) 354-3300 • FAX (410) 354-3313

Electromagnetic Compatibility Criteria
Test Report

for the

Polycom Inc.
Model P011

Tested under
theFCC Certification Rules
contained in
Title 47 of the CFR
15.407 Subpart E

MET Report: EMCA102119-FCC407 UNII 2 Rev. 2

May 16, 2019

Prepared For:

Polycom Inc.
6001 America Center Drive
San Jose, CA 95002

Prepared By:
Eurofins MET Labs, Inc
13501 McCallen Pass,
Austin, TX 78753

Electromagnetic Compatibility Criteria
Test Report

for the

Polycom Inc.
Model P011

Tested under
The FCC Certification Rules
contained in
Title 47 of the CFR
15.407 Subpart E

Giuliano Messina, Project Engineer
Electromagnetic Compatibility Lab

Joel Huna
Technical Writer

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of 15.407 of the FCC Rules under normal use and maintenance.

Jonathan Tavira,
Wireless Manager, Electromagnetic Compatibility Lab

 © 2019, Eurofins MET Labs, Inc

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	April 29, 2019	Initial Issue.
1	May 2, 2019	Max output power correction.
2	May 16, 2019	Updated power.

 © 2019, Eurofins MET Labs, Inc

Table of Contents

I. Executive Summary 1
A. Purpose of Test 2
B. Executive Summary 2
II. Equipment Configuration 3
A. Overview 4
B. References 5
C. Test Site 5
D. Measurement Uncertainty 5
E. Description of Test Sample 5
F. Equipment Configuration 6
G. Support Equipment 6
H. Ports and Cabling Information 6
I. Mode of Operation 7
J. Method of Monitoring EUT Operation 7
K. Modifications 7
a) Modifications to EUT 7
b) Modifications to Test Standard 7
L. Disposition of EUT 7
III. Electromagnetic Compatibility Criteria for Intentional Radiators 8
§15.203 Antenna Requirement 9
§15.403(i) 26 dB Bandwidth 10
§15.407(a)(2) Maximum Conducted Output Power 15
§15.407(a)(2) Maximum Power Spectral Density 20
§15.407(b)(2 – 3) & (6 - 7) Undesirable Emissions 25
§15.407(b)(6) Conducted Emissions 39
§ 15.247(i) Maximum Permissible Exposure 48
§15.407(g) Frequency Stability 50
IV. Test Equipment 51
V. Certification & User's Manual Information 53
A. Certification Information 59
B. Label and User's Manual Information 63

 © 2019, Eurofins MET Labs, Inc

List of Tables

Table 1. Executive Summary of EMC Part 15.407 Compliance Testing 2
Table 2. EUT Summary 4
Table 3. References 5
Table 4. Uncertainty Calculations Summary 5
Table 5. Equipment Configuration 6
Table 6. Support Equipment 6
Table 7. Ports and Cabling Information 6
Table 8. Occupied Bandwidth, UNII 2A, Test Results 11
Table 9. Occupied Bandwidth, UNII 2E, Test Results 12
Table 10. Output Power, UNII 2A, Test Results 16
Table 11. Output Power, UNII 2A, EIRP Calculation 16
Table 12. Output Power, UNII 2E, Test Results 18
Table 13. Output Power, UNII 2E, EIRP Calculation 18
Table 14. Power Spectral Density, UNII 2A, Test Results 21
Table 15. Power Spectral Density, UNII 2E, Test Results 22
Table 16. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a) 39
Table 17. Conducted Emissions, UNII 2A, Test Results, Phase Line 40
Table 18. Conducted Emissions, UNII 2A, Test Results, Neutral Line 42
Table 19. Conducted Emissions, UNII 2e, Test Results, Phase Line 44
Table 20. Conducted Emissions, UNII 2e, Test Results, Neutral Line 46
Table 21. Maximum Permissible Exposure, UNII 2A 49
Table 22. Maximum Permissible Exposure, UNII 2E 49
Table 23. Test Equipment List 52

List of Figures

Figure 1. Block Diagram of Test Configuration 6

List of Plots

Plot 1. Occupied Bandwidth, UNII 2A, 802.11ac 20, 5260, 26dB, 23.326MHz 13
Plot 2. Occupied Bandwidth, UNII 2A, 802.11ac 40, 5270, 26dB, 45.005MHz 13
Plot 3. Occupied Bandwidth, UNII 2A, 802.11ac 80, 5290, 26dB, 83.17MHz 13
Plot 4. Occupied Bandwidth, UNII 2E, 802.11ac 20, 5500, 26dB, 22.881MHz 14
Plot 5. Occupied Bandwidth, UNII 2E, 802.11ac 40, 5510, 26dB, 42.558MHz 14
Plot 6. Occupied Bandwidth, UNII 2E, 802.11ac 80, 5530, 26dB, 83.729MHz 14
Plot 7. Output Power, UNII 2A, 802.11ac 20, 5260, 12.69dBm 17
Plot 8. Output Power, UNII 2A, 802.11ac 40, 5270, 11.93dBm 17
Plot 9. Output Power, UNII 2A, 802.11ac 80, 5290, 13.11dBm 17
Plot 10. Output Power, UNII 2C, 802.11ac 20, 5500, 13.56dBm 19
Plot 11. Output Power, UNII 2C, 802.11ac 40, 5510, 12.41dBm 19
Plot 12. Output Power, UNII 2C, 802.11ac 80, 5530, 13.36dBm 19
Plot 13. Power Spectral Density, UNII 2A, 802.11ac 20, 5260, 2.086dBm 23
Plot 14. Power Spectral Density, UNII 2A, 802.11ac 40, 5270, -1.72dBm 23
Plot 15. Power Spectral Density, UNII 2A, 802.11ac 80, 5290, -4.341dBm 23
Plot 16. Power Spectral Density, UNII 2C, 802.11ac 20, 5500, 13.56dBm 24
Plot 17. Power Spectral Density, UNII 2C, 802.11ac 40, 5510, 12.41dBm 24
Plot 18. Power Spectral Density, UNII 2C, 802.11ac 80, 5530, 13.36dBm 24
Plot 19. Undesirable Emissions, Spur Emissions, 18-40GHz 26
Plot 20. Undesirable Emissions, 802.11a, Spur Emissions, 5260, 1-18GHz 27

 © 2019, Eurofins MET Labs, Inc

Plot 21. Undesirable Emissions, 802.11a, Spur Emissions, 5280, 1-18GHz....27
Plot 22. Undesirable Emissions, 802.11a, Spur Emissions, 5320, 1-18GHz....27
Plot 23. Undesirable Emissions, 802.11ac 20, Spur Emissions, 5260, 1-18GHz....28
Plot 24. Undesirable Emissions, 802.11ac 20, Spur Emissions, 5280, 1-18GHz....28
Plot 25. Undesirable Emissions, 802.11ac 20, Spur Emissions, 5320, 1-18GHz....28
Plot 26. Undesirable Emissions, 802.11ac 40, Spur Emissions, 5270, 1-18GHz....29
Plot 27. Undesirable Emissions, 802.11ac 40, Spur Emissions, 5310, 1-18GHz....29
Plot 28. Undesirable Emissions, 802.11ac 80, Spur Emissions, 5290, 1-18GHz....29
Plot 29. Undesirable Emissions, 802.11n 20, Spur Emissions, 5260, 1-18GHz....30
Plot 30. Undesirable Emissions, 802.11n 20, Spur Emissions, 5280, 1-18GHz....30
Plot 31. Undesirable Emissions, 802.11n 20, Spur Emissions, 5320, 1-18GHz....30
Plot 32. Undesirable Emissions, 802.11n 40, Spur Emissions, 5270, 1-18GHz....31
Plot 33. Undesirable Emissions, 802.11n 40, Spur Emissions, 5310, 1-18GHz....31
Plot 34. Undesirable Emissions, 802.11a, Spur Emissions, 30-1000MHz....32
Plot 35. Undesirable Emissions, 802.11ac 20, Spur Emissions, 30-1000MHz....32
Plot 36. Undesirable Emissions, 802.11ac 40, Spur Emissions, 30-1000MHz....32
Plot 37. Undesirable Emissions, 802.11n 40, Spur Emissions, 30-1000MHz....33
Plot 38. Undesirable Emissions, 802.11n 20, Spur Emissions, 30-1000MHz....33
Plot 39. Undesirable Emissions, 802.11ac 80, Spur Emissions, 30-1000MHz....33
Plot 40. Undesirable Emissions, 802.11a, Spur Emissions, 5320, Bandedge....34
Plot 41. Undesirable Emissions, 802.11a, Spur Emissions, 5260, Bandedge....34
Plot 42. Undesirable Emissions, 802.11ac 20, Spur Emissions, 5260, Bandedge....34
Plot 43. Undesirable Emissions, 802.11ac 20, Spur Emissions, 5320, Bandedge, Average....35
Plot 44. Undesirable Emissions, 802.11ac 20, Spur Emissions, 5320, Bandedge, Peak....35
Plot 45. Undesirable Emissions, 802.11ac 40, Spur Emissions, 5270, Bandedge....35
Plot 46. Undesirable Emissions, 802.11ac 40, Spur Emissions, 5310, Bandedge, Average....36
Plot 47. Undesirable Emissions, 802.11ac 40, Spur Emissions, 5310, Bandedge, Peak....36
Plot 48. Undesirable Emissions, 802.11ac 80, Spur Emissions, 5290, Bandedge, Average....36
Plot 49. Undesirable Emissions, 802.11ac 80, Spur Emissions, 5290, Bandedge, Peak....37
Plot 50. Undesirable Emissions, 802.11n 40, Spur Emissions, 5270, Bandedge....37
Plot 51. Undesirable Emissions, 802.11n 40, Spur Emissions, 5310, Bandedge, Average....37
Plot 52. Undesirable Emissions, 802.11n 40, Spur Emissions, 5310, Bandedge, Peak....38
Plot 53. Undesirable Emissions, 802.11n 20, Spur Emissions, 5260, Bandedge....38
Plot 54. Undesirable Emissions, 802.11n 20, Spur Emissions, 5320, Bandedge....38
Plot 55. Conducted Emissions, UNII 2A, Phase Line, 802.11ac 20 MHz, 5260 MHz....40
Plot 56. Conducted Emissions, UNII 2A, Phase Line, 802.11ac 40 MHz, 5270 MHz....41
Plot 57. Conducted Emissions, UNII 2A, Phase Line, 802.11ac 80 MHz, 5290 MHz....41
Plot 58. Conducted Emissions, UNII 2A, Neutral Line, 802.11ac 20 MHz, 5260 MHz....42
Plot 59. Conducted Emissions, UNII 2A, Neutral Line, 802.11ac 40 MHz, 5270 MHz....43
Plot 60. Conducted Emissions, UNII 2A, Neutral Line, 802.11ac 80 MHz, 5290 MHz....43
Plot 61. Conducted Emissions, UNII 2e, Phase Line, 802.11ac 20 MHz, 5500 MHz....44
Plot 62. Conducted Emissions, UNII 2e, Phase Line, 802.11ac 40 MHz, 5510 MHz....45
Plot 63. Conducted Emissions, UNII 2e, Phase Line, 802.11ac 80 MHz, 5530 MHz....45
Plot 64. Conducted Emissions, UNII 2e, Neutral Line, 802.11ac 20 MHz, 5500 MHz....46
Plot 65. Conducted Emissions, UNII 2e, Neutral Line, 802.11ac 40 MHz, 5510 MHz....47
Plot 66. Conducted Emissions, UNII 2e, Neutral Line, 802.11ac 80 MHz, 5530 MHz....47

List of Terms and Abbreviations

AC	**A**lternating **C**urrent
ACF	**A**ntenna **C**orrection **F**actor
Cal	**Cal**ibration
d	**M**easurement **D**istance
dB	**D**eci**b**els
dBµA	**D**eci**b**els above one **micro**amp
dBµV	**D**eci**b**els above one **micro**volt
dBµA/m	**D**eci**b**els above one **micro**amp **per m**eter
dBµV/m	**D**eci**b**els above one **micro**volt **per m**eter
DC	**D**irect **C**urrent
E	**E**lectric Field
DSL	**D**igital **S**ubscriber **L**ine
ESD	**E**lectro**s**tatic **D**ischarge
EUT	**E**quipment **U**nder **T**est
f	**F**requency
FCC	**F**ederal **C**ommunications **C**ommission
GRP	**G**round **R**eference **P**lane
H	Magnetic Field
HCP	**H**orizontal **C**oupling **P**lane
Hz	**H**ert**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
kHz	**k**ilo**h**ert**z**
kPa	**k**ilo**pa**scal
kV	**k**ilo**v**olt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**h**ertz
µ**H**	**microh**enry
µ	**microf**arad
µ**s**	**micros**econds
PRF	**P**ulse **R**epetition **F**requency
RF	**R**adio **F**requency
RMS	**R**oot-**M**ean-**S**quare
TWT	**T**raveling **W**ave **T**ube
V/m	**V**olts **per m**eter
VCP	**V**ertical **C**oupling **P**lane

 © 2019, Eurofins MET Labs, Inc

I. Executive Summary

 © 2019, Eurofins MET Labs, Inc

A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Polycom Inc. P011, with the requirements of Part 15, §15.407. All references are to the most current version of Title 47 of the Code of Federal Regulations in effect. In accordance with §2.1033, the following data is presented in support of the Certification of the P011. Polycom Inc. should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the P011, has been **permanently** discontinued.

B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, §15.407, in accordance with Polycom Inc., purchase order number 6090003000. All tests were conducted using measurement procedure ANSI C63.10-2013.

FCC Reference	Description	Results
§15.203	Antenna Requirement	Compliant
§15.403(i)	26 dB Occupied Bandwidth	Compliant
§15.407 (a)(2)	Maximum Conducted Output Power	Compliant
§15.407 (a)(2)	Maximum Power Spectral Density	Compliant
§15.407 (b)(2 – 3)& (6 - 7)	Undesirable Emissions	Compliant
§15.407(b)(6)	Conducted Emission	Compliant
§15.407(f)	RF Exposure	Compliant
§15.407(g)	Frequency Stability	Compliant – Manufacturer Declaration

Table 1. Executive Summary of EMC Part 15.407 Compliance Testing

 © 2019, Eurofins MET Labs, Inc

II. Equipment Configuration

A. Overview

Eurofins MET Labs, Inc was contracted by Polycom Inc. to perform testing on the P011, under Polycom Inc.'s purchase order number 6090003000.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Polycom Inc. P011.

The results obtained relate only to the item(s) tested.

Model(s) Tested:	P011	
Model(s) Covered:	P011	
EUT Specifications:	Primary Power: 120VAC	
	FCC ID: M72-P011	
	Type of Modulations:	OFDM
	Equipment Code:	NII
	Peak RF Output Power:	16.976 dBm
	EUT Frequency Ranges:	5250 – 5350 MHz, 5470 – 5725 MHz
Analysis:	The results obtained relate only to the item(s) tested.	
Environmental Test Conditions:	Temperature: 15-35º C	
	Relative Humidity: 30-60%	
	Barometric Pressure: 860-1060 mbar	
Type of Filing:	Original	
Evaluated by:	Giuliano Messina	
Report Date(s):	May 16, 2019	

Table 2. EUT Summary

 © 2019, Eurofins MET Labs, Inc

B. References

CFR 47, Part 15, Subpart E	Unlicensed National Information Infrastructure Devices (UNII)
ANSI C63.4:2014	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
ISO/IEC 17025:2005	General Requirements for the Competence of Testing and Calibration Laboratories
ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices
789033 D02 General UNII Test Procedures New Rules v02	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E
905462 DO2 UNII DFS Compliance Procedures New Rules v02	Compliance Measurement Procedures for Unlicensed-National Information Infrastructure Devices Operating in the 5250-5350 MHz and 5470-5725 MHz Bands Incorporating Dynamic Frequency Selection

Table 3. References

C. Test Site

All testing was performed at Eurofins MET Labs, Inc, 13501 McCallen Pass, Austin, TX 78753. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements were performed in a 10 meter semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

D. Measurement Uncertainty

Test Method	Typical Expanded Uncertainty	K	Confidence Level
RF Frequencies	±4.52 Hz	2	95%
RF Power Conducted Emissions	±2.97 dB	2	95%
RF Power Radiated Emissions	±2.95 dB	2	95%

Table 4. Uncertainty Calculations Summary

E. Description of Test Sample

The Polycom Inc. P011, Equipment Under Test (EUT), is a video CODEC with Wi-Fi and Bluetooth functions. It is intended to be used in enterprise environments.

 © 2019, Eurofins MET Labs, Inc

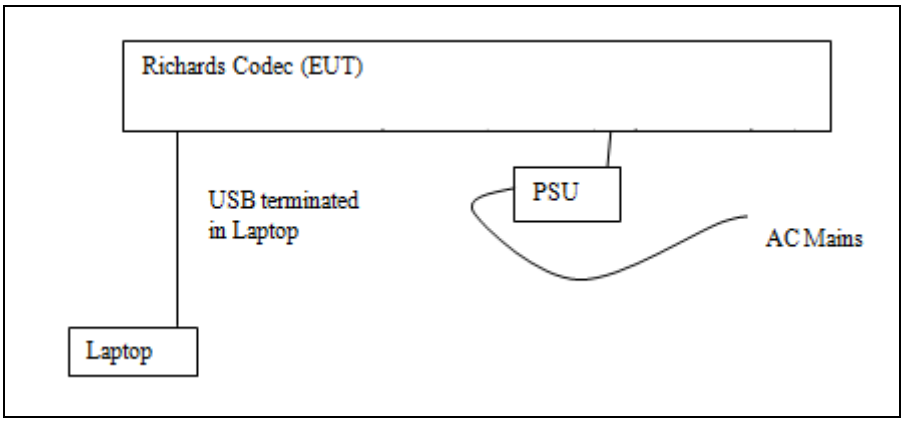


Figure 1. Block Diagram of Test Configuration

F. Equipment Configuration

All cards, racks, etc., incorporated as part of the EUT is included in the following list.

Ref. ID	Name / Description	Model Number	Part Number	Serial Number	Revision
1	P011 CODEC	--	2201-85340-001	8219024D0080F2	--

Table 5. Equipment Configuration

G. Support Equipment

Support equipment necessary for the operation and testing of the EUT is included in the following list.

Ref. ID	Name / Description	Manufacturer	Model Number	Customer Supplied Calibration Data
1	PSU	Sparkle FSP180-AWAN3	9NA1804503	--
2	Laptop	ASUS	X200M	--

Table 6. Support Equipment

H. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty	Length as tested (m)	Max Length (m)	Shielded? (Y/N)	Termination Box ID & Port Name
1	DC In	--	1	--	--	N	DC In
2	USB Type C	USB	1	--	--	--	Control system from laptop

Table 7. Ports and Cabling Information

 © 2019, Eurofins MET Labs, Inc

I. Mode of Operation

The support laptop provided a direct means of controlling transmitter parameters.

Note: Unless otherwise stated or shown, all tests were performed at worst-case modulation and data rates.

J. Method of Monitoring EUT Operation

A spectrum analyzer was used to confirm proper transmitter operation.

K. Modifications

a) Modifications to EUT

No modifications were made to the EUT.

b) Modifications to Test Standard

No modifications were made to the test standard.

L. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Polycom Inc. upon completion of testing.

 © 2019, Eurofins MET Labs, Inc

III. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.203 Antenna Requirement

Test Requirement: **§ 15.203:** An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

The structure and application of the EUT were analyzed to determine compliance with Section 15.203 of the Rules. Section 15.203 states that the subject device must meet at least one of the following criteria:

a.) Antenna must be permanently attached to the unit.

b.) Antenna must use a unique type of connector to attach to the EUT.

c.) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

Results: The EUT as tested is compliant the criteria of §15.203.

Antennas are not accessible by the end user.

Test Engineer(s): Giuliano Messina

Test Date(s): February 14, 2019

 © 2019, Eurofins MET Labs, Inc

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15. 403(i) 26dB Bandwidth

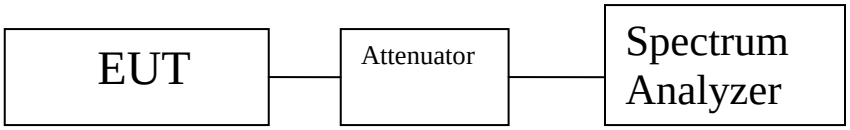
Test Requirements: **§ 15.403(i):** For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

Test Procedure: The transmitter was set to low, mid, and high operating frequencies at the highest output power and connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW approximately equal to 1% of the total emission bandwidth, VBW > RBW. The 26 dB Bandwidth was measured and recorded.

Test Results The 26 dB Bandwidth was compliant with the requirements of this section.

Test Engineer(s): Giuliano Messina

Test Date(s): February 14, 2019



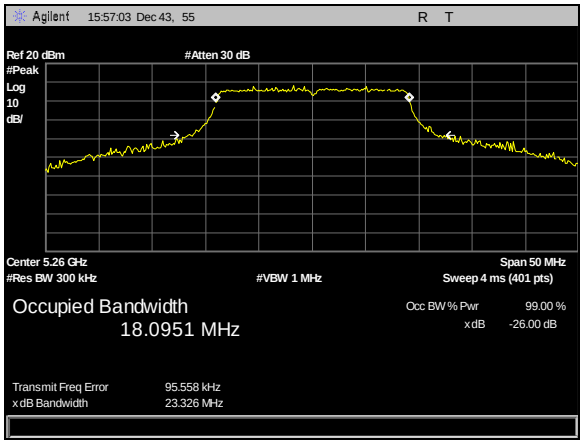
Mode	Freq (MHz)	-26dB Chain 1 (MHz)	99% Chain 1 (MHz)	-26dB Chain 2 (MHz)	99% Chain 2 (MHz)
802.11a	5260	24.061	16.97	23.522	16.96
802.11a	5280	23.23	16.84	23.601	16.86
802.11a	5320	23.307	16.84	23.278	16.88
802.11n 20	5260	24.282	17.93	25.099	17.96
802.11n 20	5280	24.212	17.95	24.315	17.96
802.11n 20	5320	24.38	17.92	24.267	17.86
802.11ac 20	5260	23.326	18.1	23.952	17.99
802.11ac 20	5280	24.354	18.07	24.214	18.03
802.11ac 20	5320	23.041	18.07	22.786	18.07
802.11n 40	5270	41.121	36.26	41.12	36.16
802.11n 40	5310	41.548	36.19	41.126	36.24
802.11ac 40	5270	45.005	36.51	43.535	36.38
802.11ac 40	5310	42.813	36.47	42.713	36.47
802.11ac 80	5290	83.17	75.75	84.059	75.95

Table 8. Occupied Bandwidth, UNII 2A, Test Results

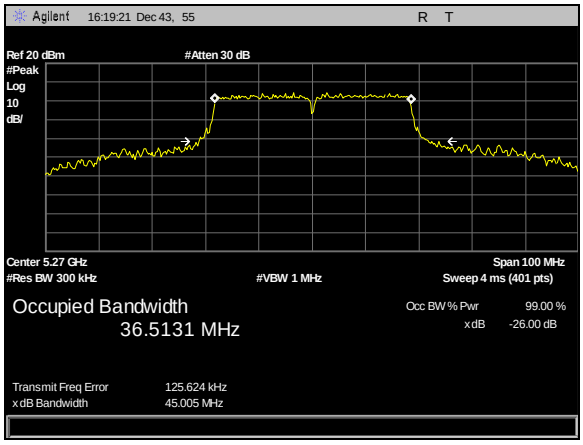
 © 2019, Eurofins MET Labs, Inc

Mode	Freq (MHz)	-26dB Chain 1 (MHz)	99% Chain 1 (MHz)	-26dB Chain 2 (MHz)	99% Chain 2 (MHz)
802.11a	5500	23.718	16.86	23.097	16.82
802.11a	5580	23.189	16.89	23.123	16.84
802.11a	5720	23.22	16.84	23.556	16.77
802.11n 20	5500	24.614	17.9	23.943	17.99
802.11n 20	5580	24.678	17.98	24.503	18
802.11n 20	5720	23.846	17.9	23.912	17.94
802.11ac 20	5500	22.881	18.06	23.195	18.05
802.11ac 20	5580	23.517	17.99	23.51	18.06
802.11ac 20	5720	22.989	18.05	22.846	18.07
802.11n 40	5510	41.341	36.2	41.383	36.19
802.11n 40	5590	41.066	36.2	41.218	36.19
802.11n 40	5710	41.221	36.16	41.225	36.21
802.11ac 40	5510	42.558	36.43	42.448	36.39
802.11ac 40	5590	43.363	36.62	44.009	36.46
802.11ac 40	5710	42.587	36.43	42.73	36.38
802.11ac 80	5530	83.729	75.69	83.523	75.77
802.11ac 80	5610	83.575	75.7	83.577	75.65
802.11ac 80	5690	83.553	75.87	84.026	75.83

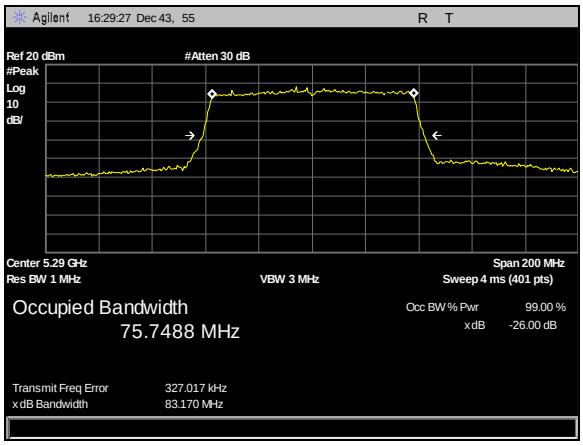
Table 9. Occupied Bandwidth, UNII 2E, Test Results



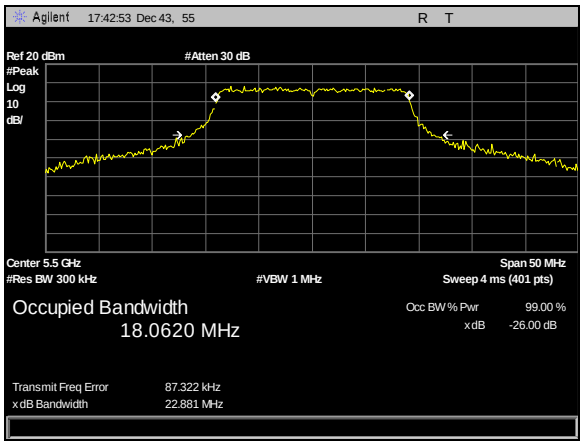
Plot 1. Occupied Bandwidth, UNII 2A, 802.11ac 20, 5260, 26dB, 23.326MHz



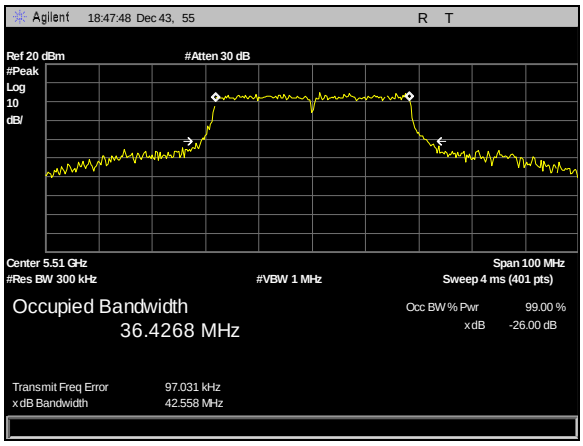
Plot 2. Occupied Bandwidth, UNII 2A, 802.11ac 40, 5270, 26dB, 45.005MHz



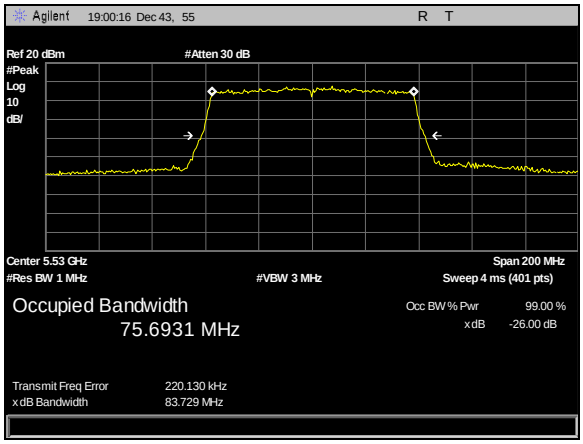
Plot 3. Occupied Bandwidth, UNII 2A, 802.11ac 80, 5290, 26dB, 83.17MHz



Plot 4. Occupied Bandwidth, UNII 2E, 802.11ac 20, 5500, 26dB, 22.881MHz



Plot 5. Occupied Bandwidth, UNII 2E, 802.11ac 40, 5510, 26dB, 42.558MHz



Plot 6. Occupied Bandwidth, UNII 2E, 802.11ac 80, 5530, 26dB, 83.729MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§15. 407(a)(2) Maximum Conducted Output Power

Test Requirements: **§15.407(a)(2):** For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz.
If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

§15.407(h)(1): Transmit power control (TPC). U-NII devices operating in the 5.25-5.35 GHz band and the 5.47-5.725 GHz band shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW.

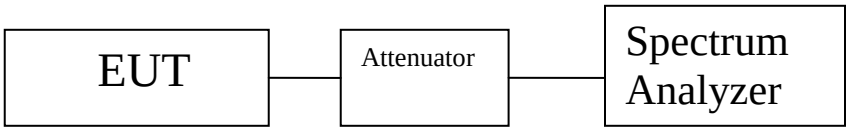
Test Procedure: The EUT was connected to a spectrum analyzer through a cable and attenuator. Measurements were taken with the EUT set to transmit continuously on its low, mid, and high channels. Its power was measured according to measurement method SA-1, as described in 789033 D02 General UNII Test Procedures v02.

To verify the TPC requirement of the rule part, observations using the same measurement method were made with the EUT set to a lower power setting.

Test Results: The EUT as tested is compliant with the requirements of this section.

Test Engineer(s): Giuliano Messina

Test Date(s): February 14, 2019



Mode	Freq (MHz)	Chain 1 (dBm)	Chain 2 (dBm)	Combined Power (dBm)
802.11a	5260	13.65	13.66	16.6653
802.11a	5280	13.6	13.64	16.63035
802.11a	5320	13.43	13.44	16.4453
802.11n 20	5260	13.38	13.4	16.40031
802.11n 20	5280	13.53	13.49	16.52035
802.11n 20	5320	13.2	13.2	16.2103
802.11ac 20	5260	12.69	12.82	15.76579
802.11ac 20	5280	12.95	12.92	15.94533
802.11ac 20	5320	11.93	12.84	15.41909
802.11n 40	5270	13.74	13.7	16.73035
802.11n 40	5310	13.55	13.78	16.67682
802.11ac 40	5270	11.93	11.97	14.96035
802.11ac 40	5310	11.72	11.95	14.84682
802.11ac 80	5290	13.11	12.95	16.04104

Table 10. Output Power, UNII 2A, Test Results

Max combined output power =

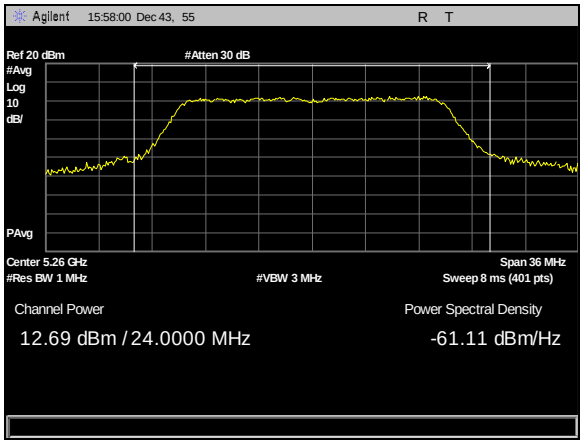
10 * log (10^(Ant1dBm/10) + (Ant2dBm/10))

Max combined output power = 16.73 dBm

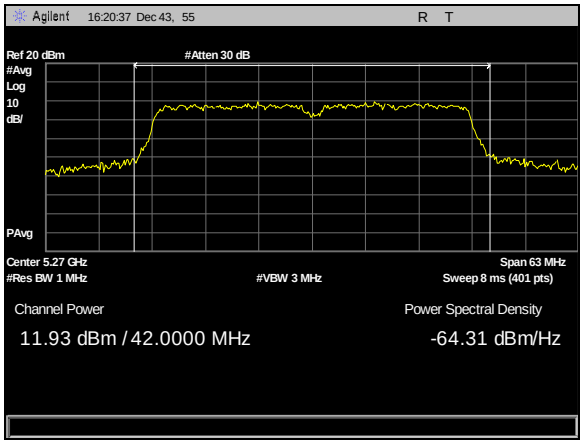
EIRP calculation:		Ant gain (dBi) =	3
Mode	Freq (MHz)	Chain 1 (dBm)	Chain 2 (dBm)
802.11n 40	5270	13.74	13.7
EIRP each =		16.74	16.7
EIRP Total = 19.73034601			

Table 11. Output Power, UNII 2A, EIRP Calculation

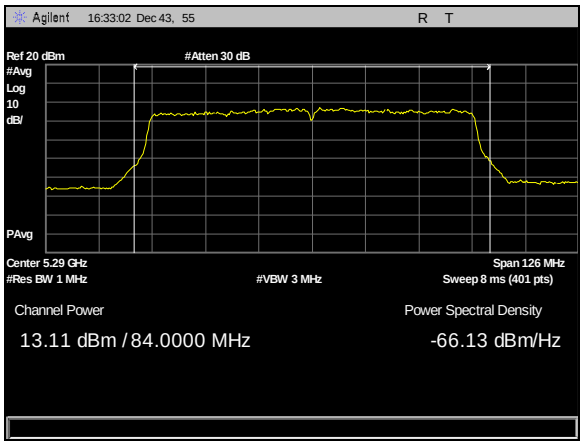
 © 2019, Eurofins MET Labs, Inc



Plot 7. Output Power, UNII 2A, 802.11ac 20, 5260, 12.69dBm



Plot 8. Output Power, UNII 2A, 802.11ac 40, 5270, 11.93dBm



Plot 9. Output Power, UNII 2A, 802.11ac 80, 5290, 13.11dBm

Mode	Freq (MHz)	Chain 1 (dBm)	Chain 2 (dBm)	Combined Power (dBm)
802.11a	5500	13.92	14.01	16.97553
802.11a	5580	13.87	14.04	16.96613
802.11a	5720	13.54	13.68	16.62086
802.11n 20	5500	13.9	13.89	16.9053
802.11n 20	5580	13.65	13.85	16.76145
802.11n 20	5720	13.43	13.52	16.48553
802.11ac 20	5500	13.56	13.44	16.51071
802.11ac 20	5580	13.26	13.44	16.36123
802.11ac 20	5720	13.03	13.17	16.11086
802.11n 40	5510	13.68	13.79	16.74565
802.11n 40	5590	14.06	13.85	16.96657
802.11n 40	5710	13.77	14.01	16.90196
802.11ac 40	5510	12.41	12.43	15.43031
802.11ac 40	5590	12.23	12.51	15.38256
802.11ac 40	5710	12	12.2	15.11145
802.11ac 80	5530	13.36	13.52	16.45104
802.11ac 80	5610	13.26	13.53	16.4074
802.11ac 80	5690	13	13.25	16.1371

Table 12. Output Power, UNII 2E, Test Results

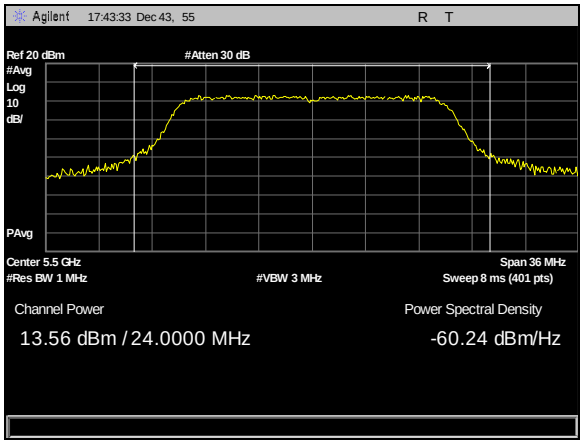
Max combined output power =

10 * log (10^(Ant1dBm/10) + (Ant2dBm/10))

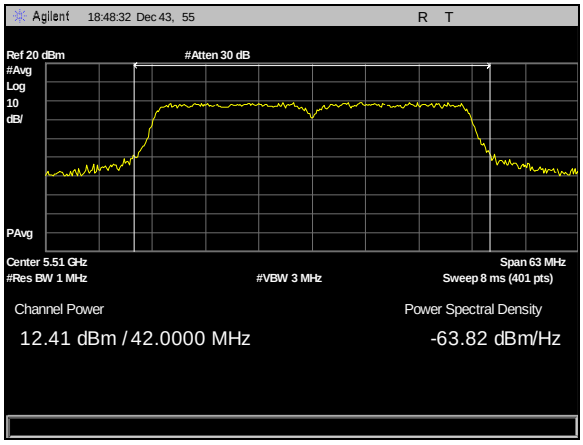
Max combined output power = 16.976 dBm

EIRP calculation:		Ant gain (dBi) =	3
Mode	Freq (MHz)	Chain 1 (dBm)	Chain 2 (dBm)
802.11a	5500	13.92	14.01
EIRP each =		16.92	17.01
EIRP Total = 19.97553309			

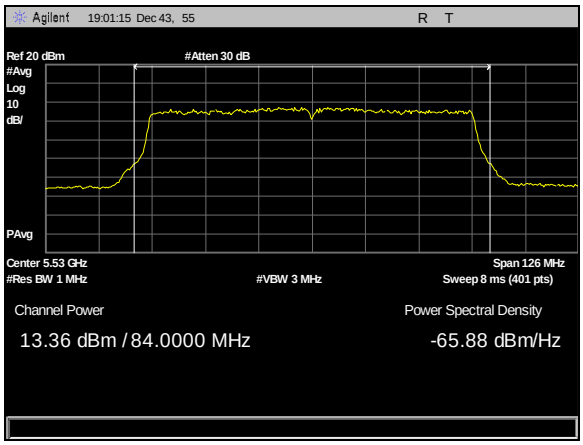
Table 13. Output Power, UNII 2E, EIRP Calculation



Plot 10. Output Power, UNII 2C, 802.11ac 20, 5500, 13.56dBm



Plot 11. Output Power, UNII 2C, 802.11ac 40, 5510, 12.41dBm



Plot 12. Output Power, UNII 2C, 802.11ac 80, 5530, 13.36dBm

Electromagnetic Compatibility Criteria for Intentional Radiators

§15.407(a)(2) Maximum Power Spectral Density

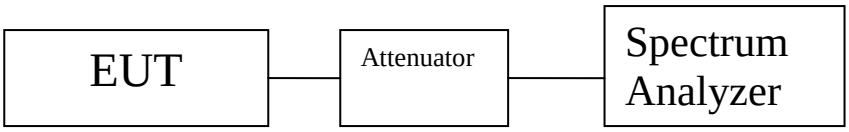
Test Requirements: **§15.407(a)(2):** In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Test Procedure: The EUT was connected to a spectrum analyzer through a cable and attenuator. Measurements were taken with the EUT set to transmit continuously on its low, mid, and high channels. Its power was measured according KDB 789033 D02 General UNII Test Procedures v02.

Test Results: The EUT as tested is compliant with the requirements of this section.

Test Engineer(s): Giuliano Messina

Test Date(s): February 14, 2019



Mode	Freq (MHz)	Chain 1 (dBm)	Chain 2 (dBm)	Combined PSD (dBm)
802.11a	5260	3.345	3.04	6.205477
802.11a	5280	3.49	3.47	6.490311
802.11a	5320	3.137	3.205	6.181433
802.11n 20	5260	2.571	2.986	5.793755
802.11n 20	5280	2.9	2.713	5.817806
802.11n 20	5320	2.777	2.788	5.792803
802.11ac 20	5260	2.086	1.926	5.017037
802.11ac 20	5280	2.257	2.006	5.143613
802.11ac 20	5320	1.939	2.065	5.012757
802.11n 40	5270	0.386	0.049	3.231068
802.11n 40	5310	0.236	0.343	3.300129
802.11ac 40	5270	-1.72	-1.406	1.450137
802.11ac 40	5310	-1.088	-1.953	1.5113
802.11ac 80	5290	-4.341	-3.976	-1.14437

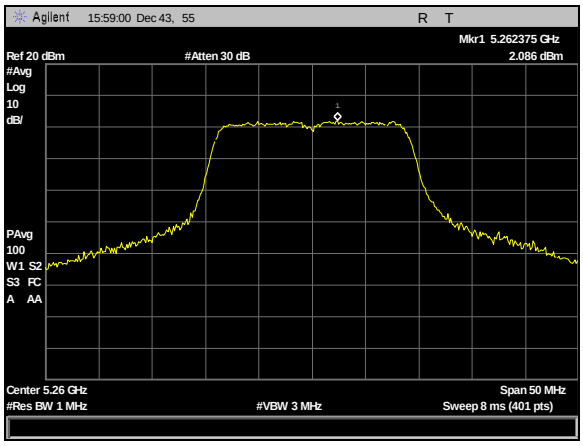
Table 14. Power Spectral Density, UNII 2A, Test Results

 © 2019, Eurofins MET Labs, Inc

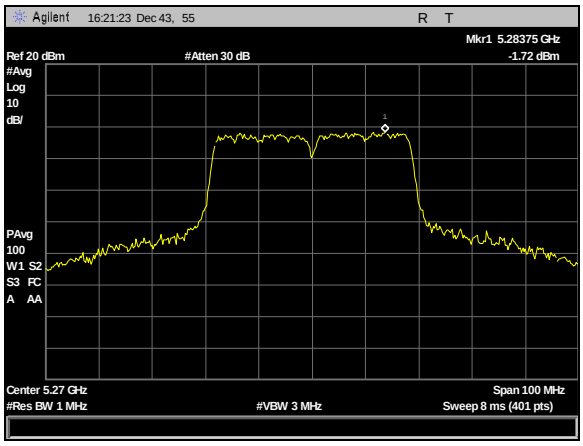
Mode	Freq (MHz)	Chain 1 (dBm)	Chain 2 (dBm)	Combined PSD (dBm)
802.11a	5500	3.48	3.794	6.650137
802.11a	5580	3.901	3.66	6.792471
802.11a	5720	3.236	3.314	6.285475
802.11n 20	5500	3.062	3.583	6.340608
802.11n 20	5580	3.004	3.294	6.16172
802.11n 20	5720	2.759	3.592	6.205741
802.11ac 20	5500	2.667	2.933	5.812336
802.11ac 20	5580	2.541	2.875	5.72151
802.11ac 20	5720	2.251	2.327	5.299466
802.11n 40	5510	0.267	0.365	3.326576
802.11n 40	5590	0.642	0.226	3.449279
802.11n 40	5710	0.555	1.114	3.853788
802.11ac 40	5510	-1.189	-0.673	2.086959
802.11ac 40	5590	-1.441	-0.727	1.940957
802.11ac 40	5710	-1.309	-1.147	1.783055
802.11ac 80	5530	-3.016	-2.635	0.188977
802.11ac 80	5610	-3.032	-3.32	-0.16331
802.11ac 80	5690	-3.321	-3.153	-0.22589

Table 15. Power Spectral Density, UNII 2E, Test Results

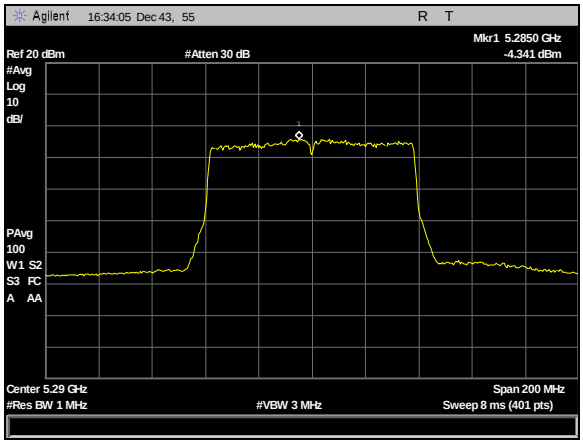
 © 2019, Eurofins MET Labs, Inc



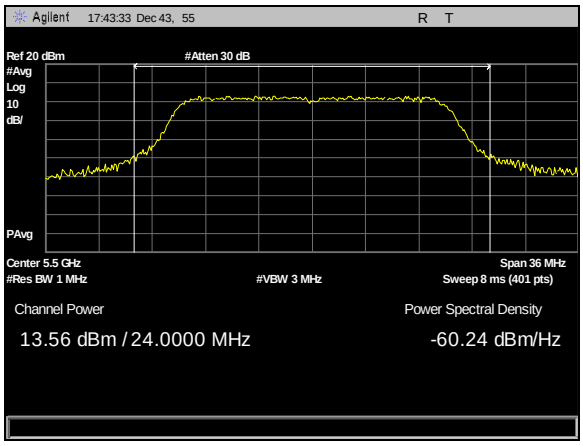
Plot 13. Power Spectral Density, UNII 2A, 802.11ac 20, 5260, 2.086dBm



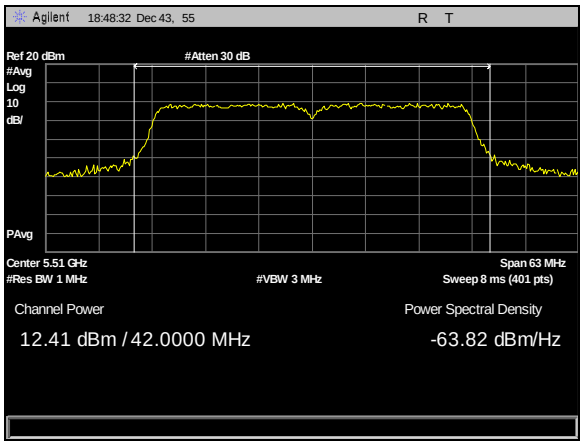
Plot 14. Power Spectral Density, UNII 2A, 802.11ac 40, 5270, -1.72dBm



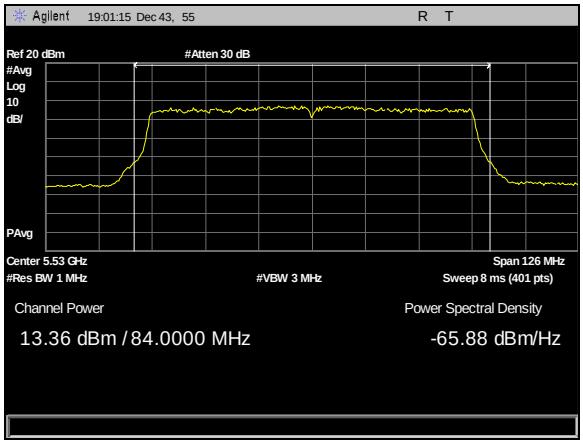
Plot 15. Power Spectral Density, UNII 2A, 802.11ac 80, 5290, -4.341dBm



Plot 16. Power Spectral Density, UNII 2C, 802.11ac 20, 5500, 13.56dBm



Plot 17. Power Spectral Density, UNII 2C, 802.11ac 40, 5510, 12.41dBm



Plot 18. Power Spectral Density, UNII 2C, 802.11ac 80, 5530, 13.36dBm

Electromagnetic Compatibility Criteria for Intentional Radiators

§15.407(b)(2 – 3) & (6 – 7) Undesirable Emissions

Test Requirements:

§ 15.407(b)(2): For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

§ 15.407(b)(3): For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

§ 15.407(b)(6): Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in Section 15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in Section 15.207.

§ 15.407(b)(7): The provisions of Section 15.205 of this part apply to intentional radiators operating under this section.

Test Procedure:

The EUT was placed on a non-conducting table on a turntable in a chamber. To find the maximum emission the EUT was set to transmit on low, mid, and high channels. Additionally, the turntable was rotated 360 degrees, the EUT was oriented through its three orthogonal axes, and the receive antenna height was varied in order to maximize emissions.

For frequencies from 30 MHz to 1 GHz, measurements were first made using a peak detector with a 100 kHz resolution bandwidth. Emissions which exceeded the limits were re-measured using a quasi-peak detector with a 120 kHz resolution bandwidth.

Above 1 GHz, measurements were made pursuant the method described in FCC KDB 789033 D02 General UNII Test Procedure New Rules v02. The equation, **EIRP= E + 20 log D – 104.8** was used to convert field strength to EIRP (**E** = field strength (dBµV/m) and **D** = Reference measurement distance**).**

For emissions above 1 GHz and in restricted bands, measurements of the field strength were made with a peak detector and an average detector and compared with the limits of 15.209.

As an alternative, according to FCC KDB 789033 D02 General UNII Test Procedure New Rules v02, all emissions above 1 GHz that comply with the peak and average limits of 15.209 satisfy the requirements of unwanted emissions in 15.407.

Test Results:

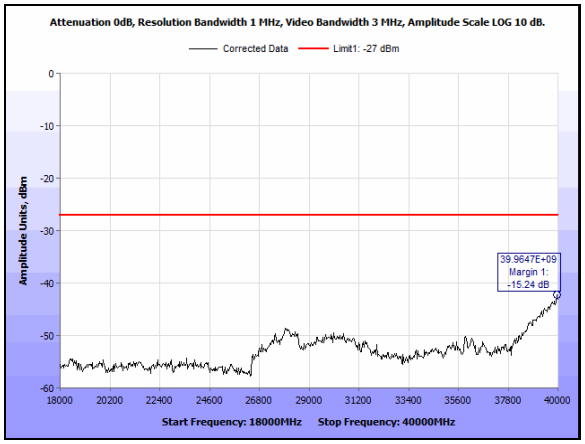
For below 1 GHz, the EUT was compliant with the requirements of this section.

For above 1 GHz, the EUT was compliant with the requirements of this section.

Test Engineer(s): Giuliano Messina

Test Date(s): March 1, 2019

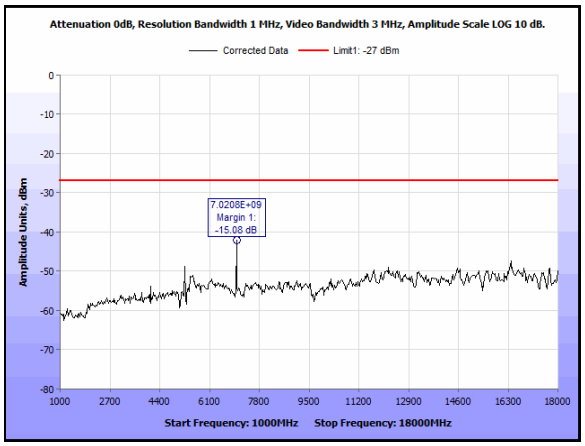
 © 2019, Eurofins MET Labs, Inc



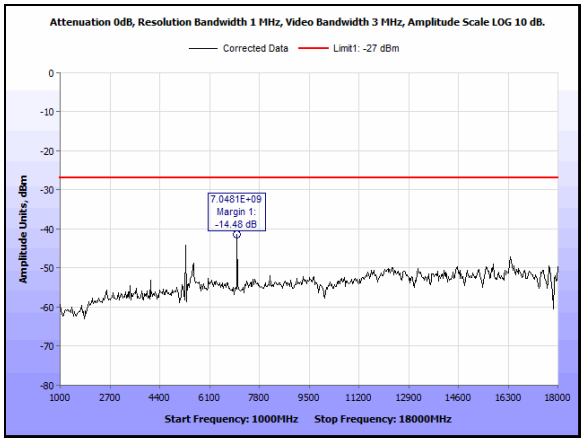
Plot 19. Undesirable Emissions, Spur Emissions, 18-40GHz

Note: The above plot represents all measurements above 18GHz, as none had any measurable spurious emissions above noise floor.

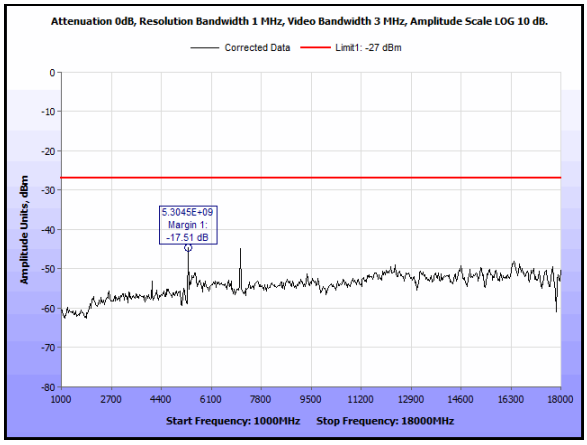
Spurious Emissions, 1-18GHz



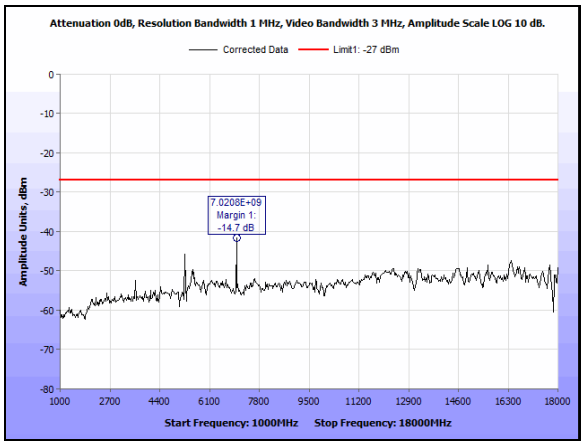
Plot 20. Undesirable Emissions, 802.11a, Spur Emissions, 5260, 1-18GHz



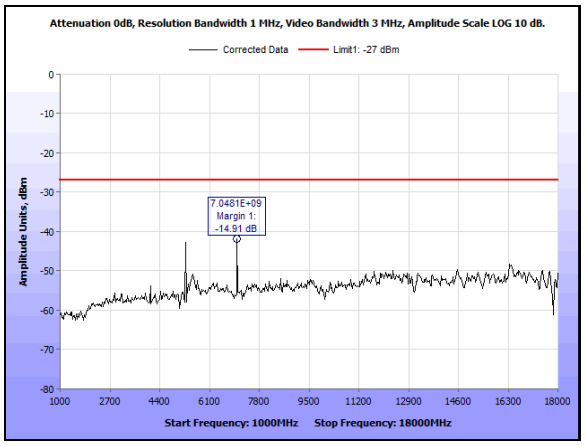
Plot 21. Undesirable Emissions, 802.11a, Spur Emissions, 5280, 1-18GHz



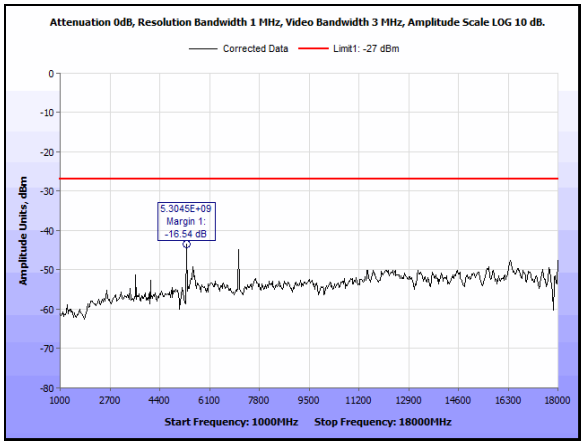
Plot 22. Undesirable Emissions, 802.11a, Spur Emissions, 5320, 1-18GHz



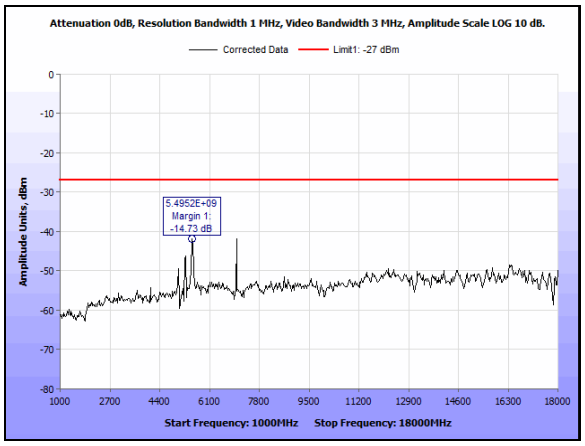
Plot 23. Undesirable Emissions, 802.11ac 20, Spur Emissions, 5260, 1-18GHz



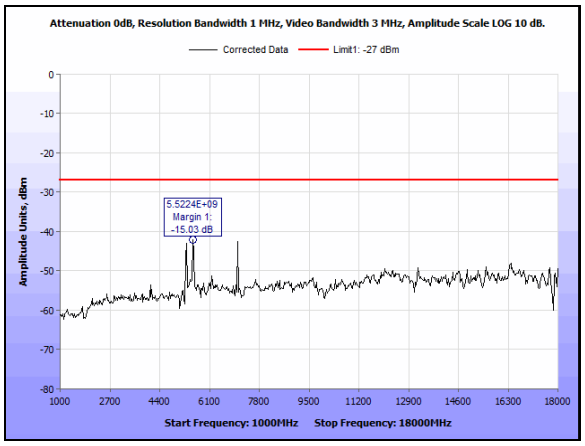
Plot 24. Undesirable Emissions, 802.11ac 20, Spur Emissions, 5280, 1-18GHz



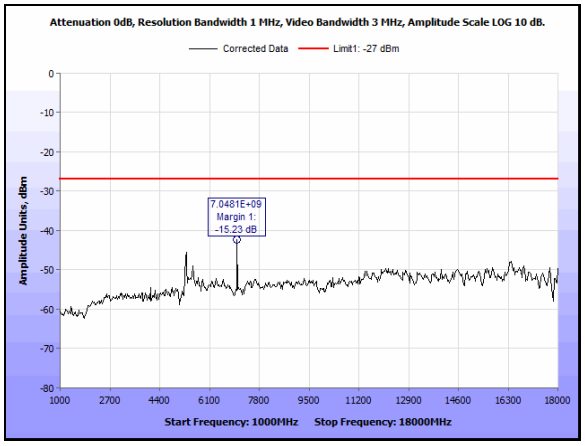
Plot 25. Undesirable Emissions, 802.11ac 20, Spur Emissions, 5320, 1-18GHz



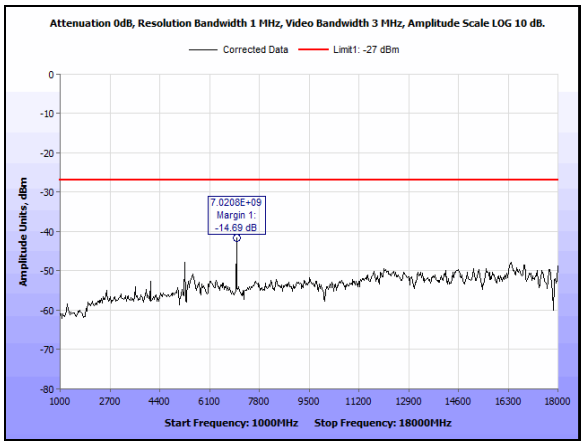
Plot 26. Undesirable Emissions, 802.11ac 40, Spur Emissions, 5270, 1-18GHz



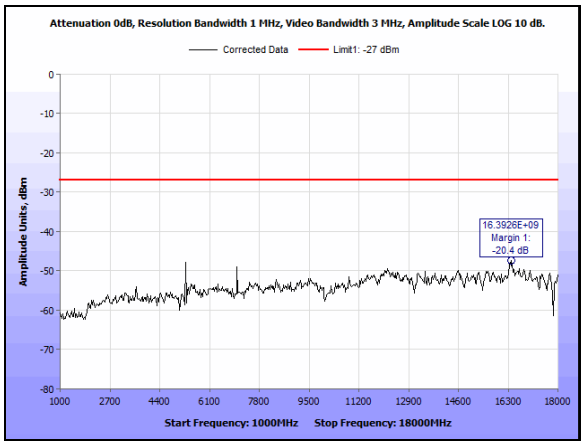
Plot 27. Undesirable Emissions, 802.11ac 40, Spur Emissions, 5310, 1-18GHz



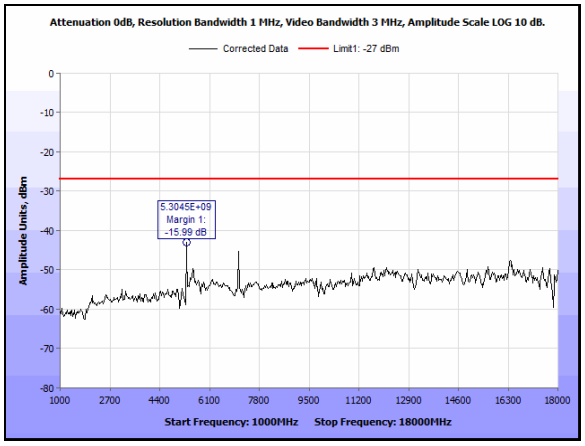
Plot 28. Undesirable Emissions, 802.11ac 80, Spur Emissions, 5290, 1-18GHz



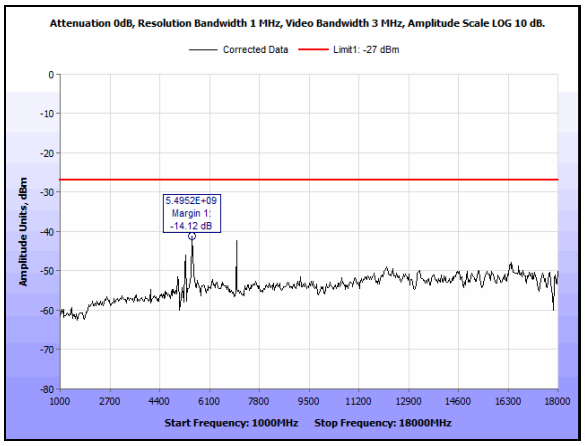
Plot 29. Undesirable Emissions, 802.11n 20, Spur Emissions, 5260, 1-18GHz



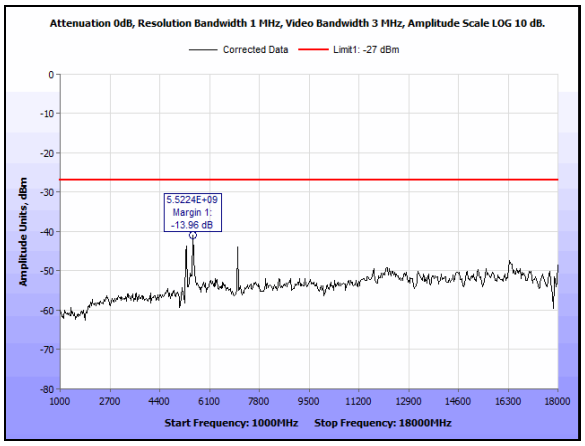
Plot 30. Undesirable Emissions, 802.11n 20, Spur Emissions, 5280, 1-18GHz



Plot 31. Undesirable Emissions, 802.11n 20, Spur Emissions, 5320, 1-18GHz



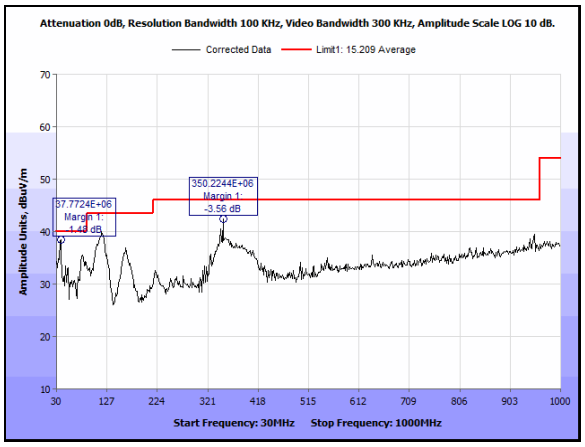
Plot 32. Undesirable Emissions, 802.11n 40, Spur Emissions, 5270, 1-18GHz



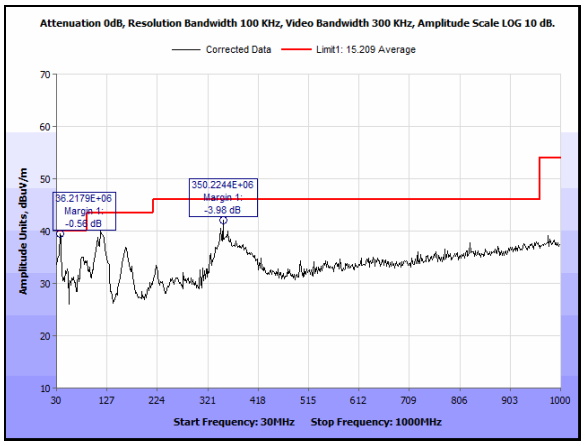
Plot 33. Undesirable Emissions, 802.11n 40, Spur Emissions, 5310, 1-18GHz

Spurious Emissions, 30-1000 MHz

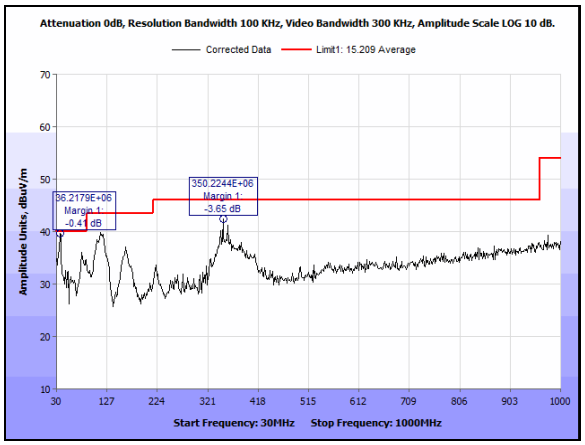
Note: One plot is shown below per mode, as variations in channel did not have any measurable effect in this frequency range.



Plot 34. Undesirable Emissions, 802.11a, Spur Emissions, 30-1000MHz

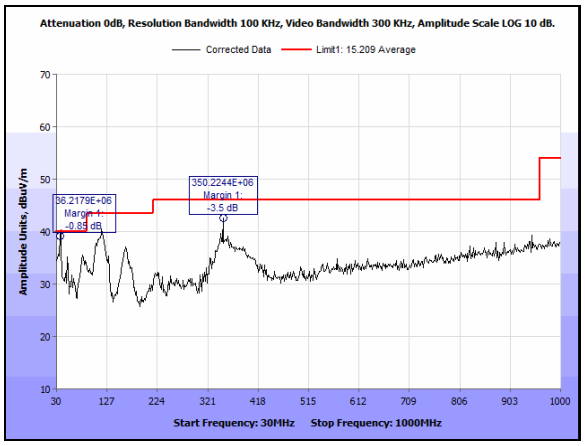


Plot 35. Undesirable Emissions, 802.11ac 20, Spur Emissions, 30-1000MHz

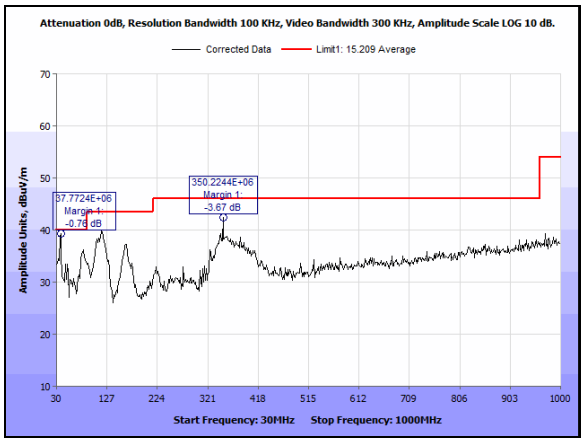


Plot 36. Undesirable Emissions, 802.11ac 40, Spur Emissions, 30-1000MHz

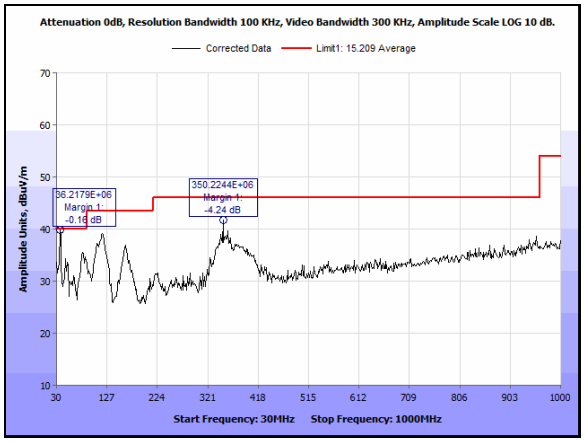
 © 2019, Eurofins MET Labs, Inc



Plot 37. Undesirable Emissions, 802.11n 40, Spur Emissions, 30-1000MHz

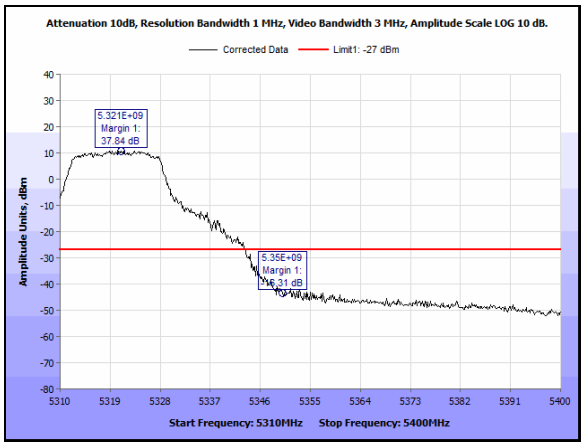


Plot 38. Undesirable Emissions, 802.11n 20, Spur Emissions, 30-1000MHz

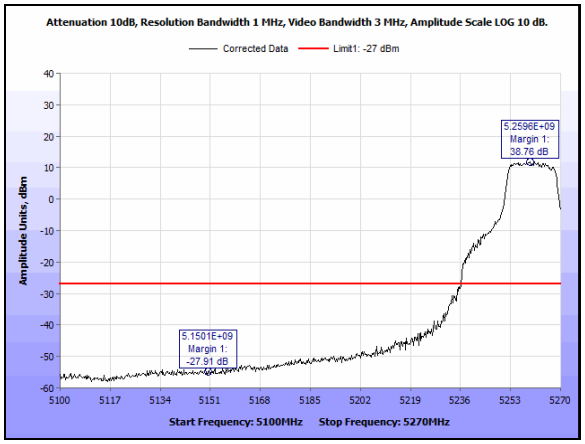


Plot 39. Undesirable Emissions, 802.11ac 80, Spur Emissions, 30-1000MHz

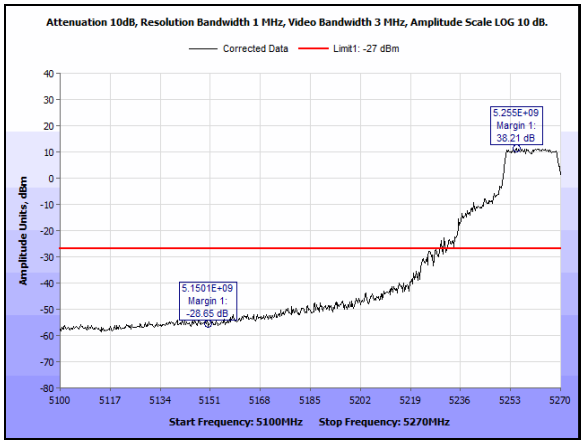
Bandedge



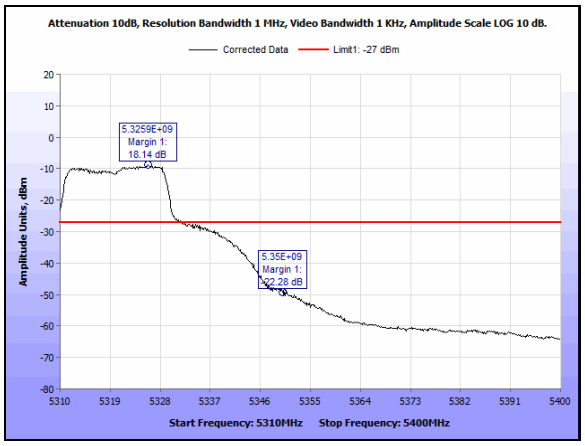
Plot 40. Undesirable Emissions, 802.11a, Spur Emissions, 5320, Bandedge



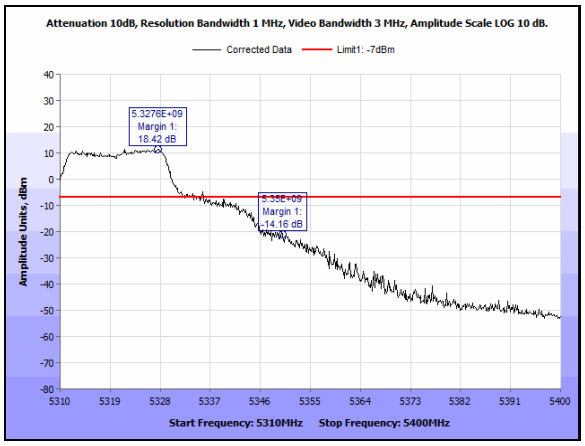
Plot 41. Undesirable Emissions, 802.11a, Spur Emissions, 5260, Bandedge



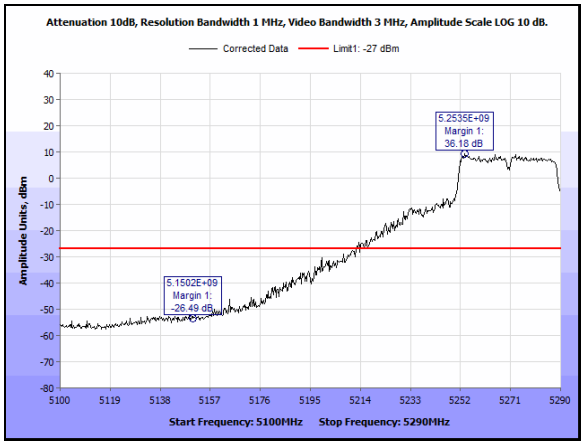
Plot 42. Undesirable Emissions, 802.11ac 20, Spur Emissions, 5260, Bandedge



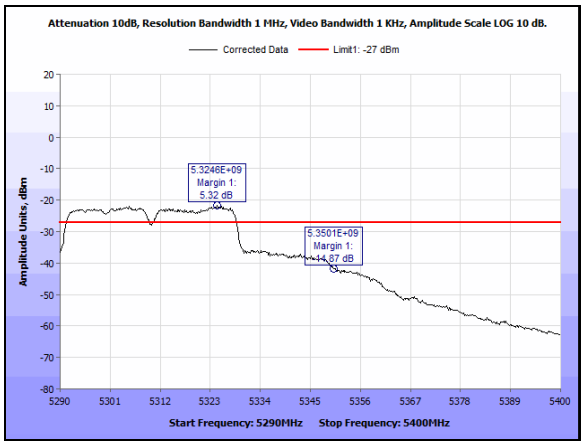
Plot 43. Undesirable Emissions, 802.11ac 20, Spur Emissions, 5320, Bandedge, Average



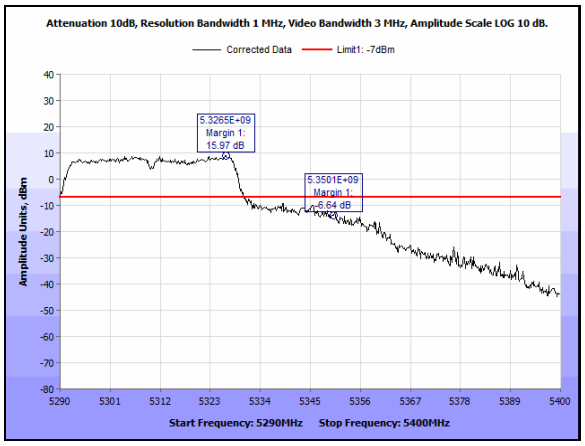
Plot 44. Undesirable Emissions, 802.11ac 20, Spur Emissions, 5320, Bandedge, Peak



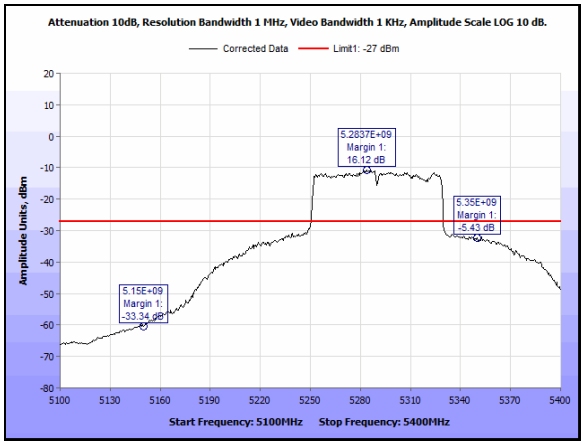
Plot 45. Undesirable Emissions, 802.11ac 40, Spur Emissions, 5270, Bandedge



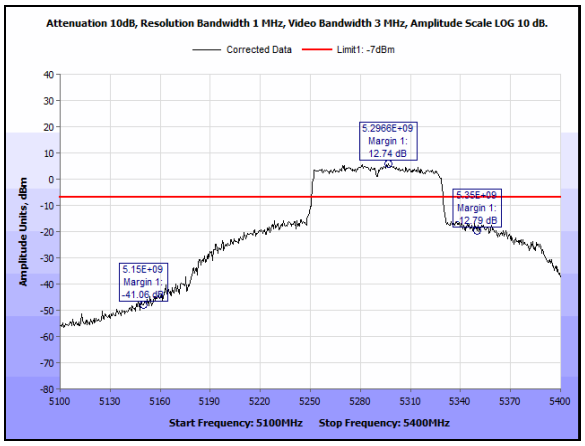
Plot 46. Undesirable Emissions, 802.11ac 40, Spur Emissions, 5310, Bandedge, Average



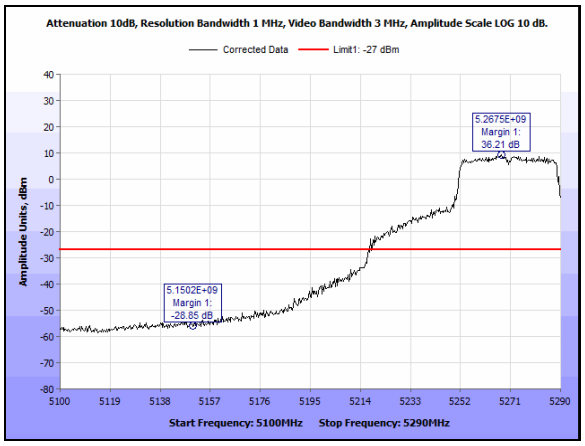
Plot 47. Undesirable Emissions, 802.11ac 40, Spur Emissions, 5310, Bandedge, Peak



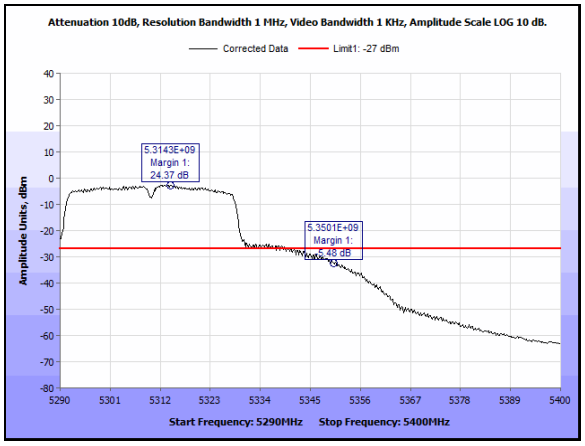
Plot 48. Undesirable Emissions, 802.11ac 80, Spur Emissions, 5290, Bandedge, Average



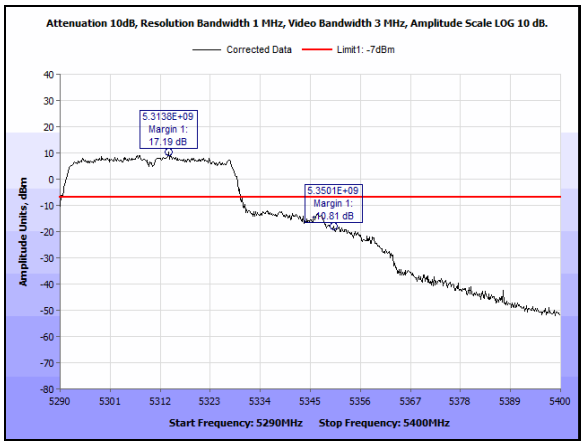
Plot 49. Undesirable Emissions, 802.11ac 80, Spur Emissions, 5290, Bandedge, Peak



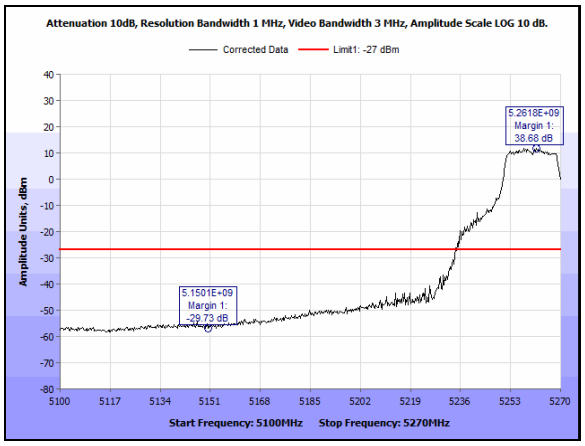
Plot 50. Undesirable Emissions, 802.11n 40, Spur Emissions, 5270, Bandedge



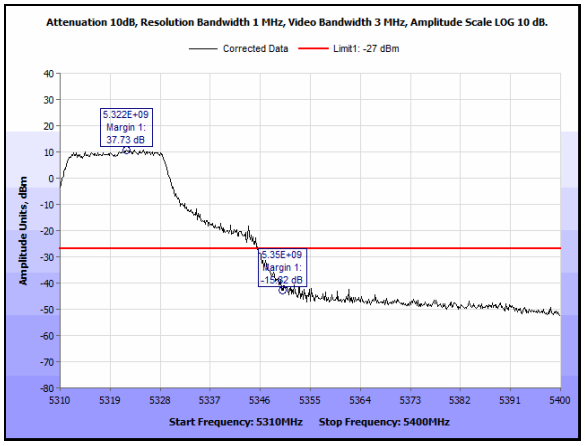
Plot 51. Undesirable Emissions, 802.11n 40, Spur Emissions, 5310, Bandedge, Average



Plot 52. Undesirable Emissions, 802.11n 40, Spur Emissions, 5310, Bandedge, Peak



Plot 53. Undesirable Emissions, 802.11n 20, Spur Emissions, 5260, Bandedge



Plot 54. Undesirable Emissions, 802.11n 20, Spur Emissions, 5320, Bandedge

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(b)(6) Conducted Emissions

Test Requirement(s): **§ 15.407 (b)(6):** Any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

§ 15.207 (a): For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 Σ line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency range (MHz)	§ 15.207(a), Conducted Limit (dBμV)	
	Quasi-Peak	Average
* 0.15 - 0.5	66 - 56	56 - 46
0.5 - 5	56	46
5 - 30	60	50

Table 16. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)

Note: *Decreases with the logarithm of the frequency.

Test Procedure: The EUT was placed on a non-metallic table inside a screen room. The EUT was situated such that the back of the EUT was 0.4 m from one wall of the vertical ground plane, and the remaining sides of the EUT were no closer than 0.8 m from any other conductive surface. The EUT was powered from a 50 Ω/50 μH Line Impedance Stabilization Network (LISN). The EMC receiver scanned the frequency range from 150 kHz to 30 MHz. Conducted Emissions measurements were made in accordance with *ANSI C63.4-2014 "Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz"*. Scans were performed with the transmitter on.

Test Results: The EUT was compliant with requirements of this section.

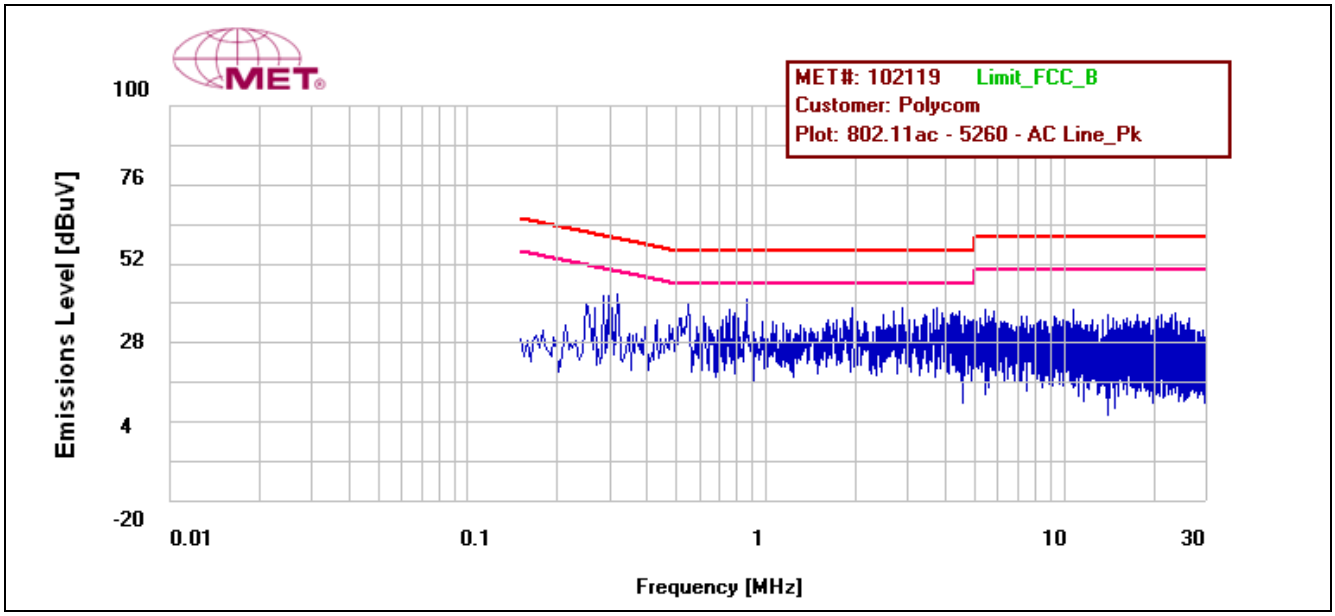
Test Engineer(s): Giuliano Messina

Test Date(s): 2/19/19

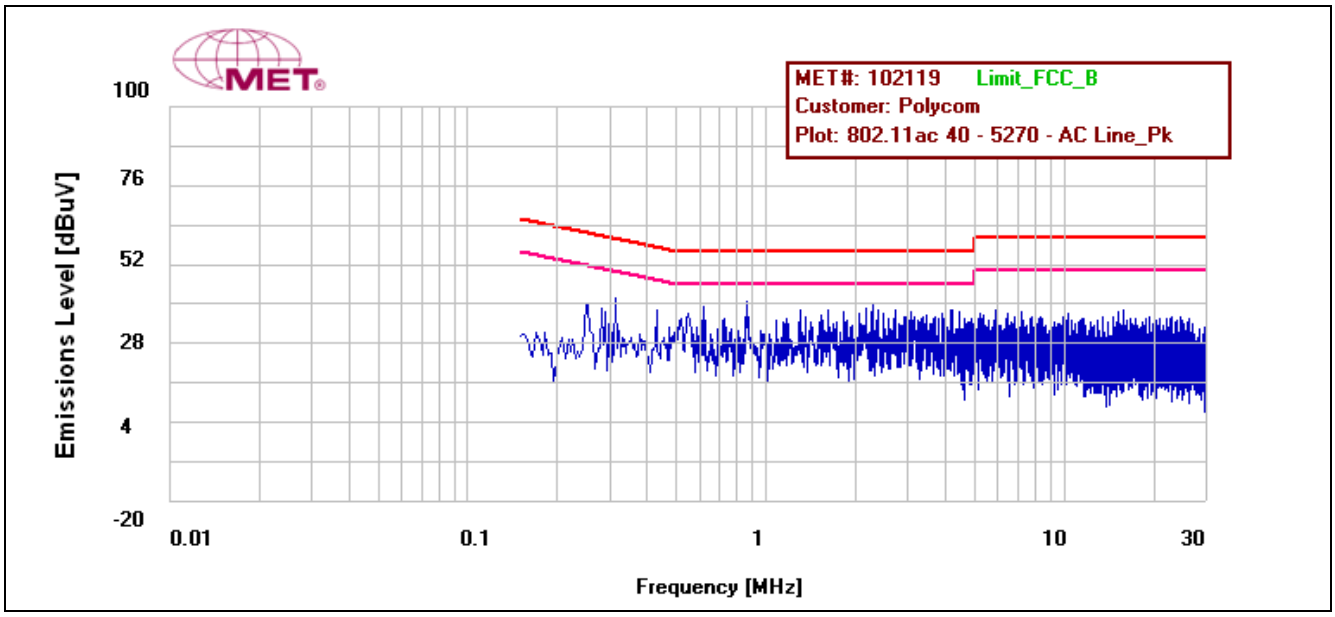
 © 2019, Eurofins MET Labs, Inc

Line	Freq (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
802.11ac - 5260 - AC Line	0.318	40.3	59.776	-19.476	Pass	28.3	49.776	-21.476	Pass
802.11ac - 5260 - AC Line	0.298	39.3	60.314	-21.014	Pass	25	50.314	-25.314	Pass
802.11ac - 5260 - AC Line	0.866	39.8	56	-16.2	Pass	33.1	46	-12.9	Pass
802.11ac - 5260 - AC Line	0.250	38.3	61.769	-23.469	Pass	37.4	51.769	-14.369	Pass
802.11ac - 5260 - AC Line	0.550	37	56	-19	Pass	28.7	46	-17.3	Pass
802.11ac - 5260 - AC Line	1.946	35.8	56	-20.2	Pass	28.9	46	-17.1	Pass
802.11ac 40 - 5270 - AC Line	0.314	40.3	59.881	-19.581	Pass	25.3	49.881	-24.581	Pass
802.11ac 40 - 5270 - AC Line	0.870	40	56	-16	Pass	33.5	46	-12.5	Pass
802.11ac 40 - 5270 - AC Line	0.302	39.5	60.204	-20.704	Pass	24.7	50.204	-25.504	Pass
802.11ac 40 - 5270 - AC Line	0.254	37.6	61.637	-24.037	Pass	36.6	51.637	-15.037	Pass
802.11ac 40 - 5270 - AC Line	2.282	35.8	56	-20.2	Pass	27.3	46	-18.7	Pass
802.11ac 40 - 5270 - AC Line	0.622	35.3	56	-20.7	Pass	28.6	46	-17.4	Pass
802.11ac 80 - 5290 - AC Line	0.326	40.3	59.57	-19.27	Pass	33.7	49.57	-15.87	Pass
802.11ac 80 - 5290 - AC Line	0.294	39.1	60.426	-21.326	Pass	25.2	50.426	-25.226	Pass
802.11ac 80 - 5290 - AC Line	0.434	39.9	57.2	-17.3	Pass	33	47.2	-14.2	Pass
802.11ac 80 - 5290 - AC Line	0.586	36.7	56	-19.3	Pass	25.9	46	-20.1	Pass
802.11ac 80 - 5290 - AC Line	2.698	35	56	-21	Pass	27.3	46	-18.7	Pass
802.11ac 80 - 5290 - AC Line	2.906	35.4	56	-20.6	Pass	28.4	46	-17.6	Pass

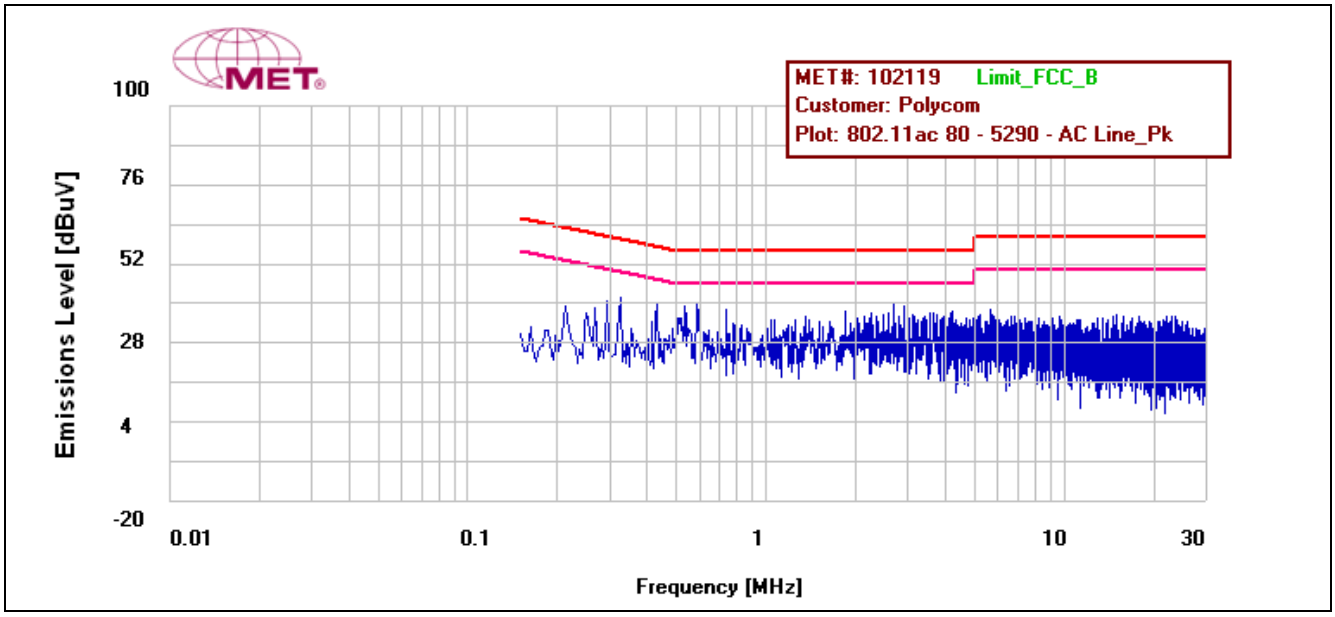
Table 17. Conducted Emissions, UNII 2A, Test Results, Phase Line



Plot 55. Conducted Emissions, UNII 2A, Phase Line, 802.11ac 20 MHz, 5260 MHz



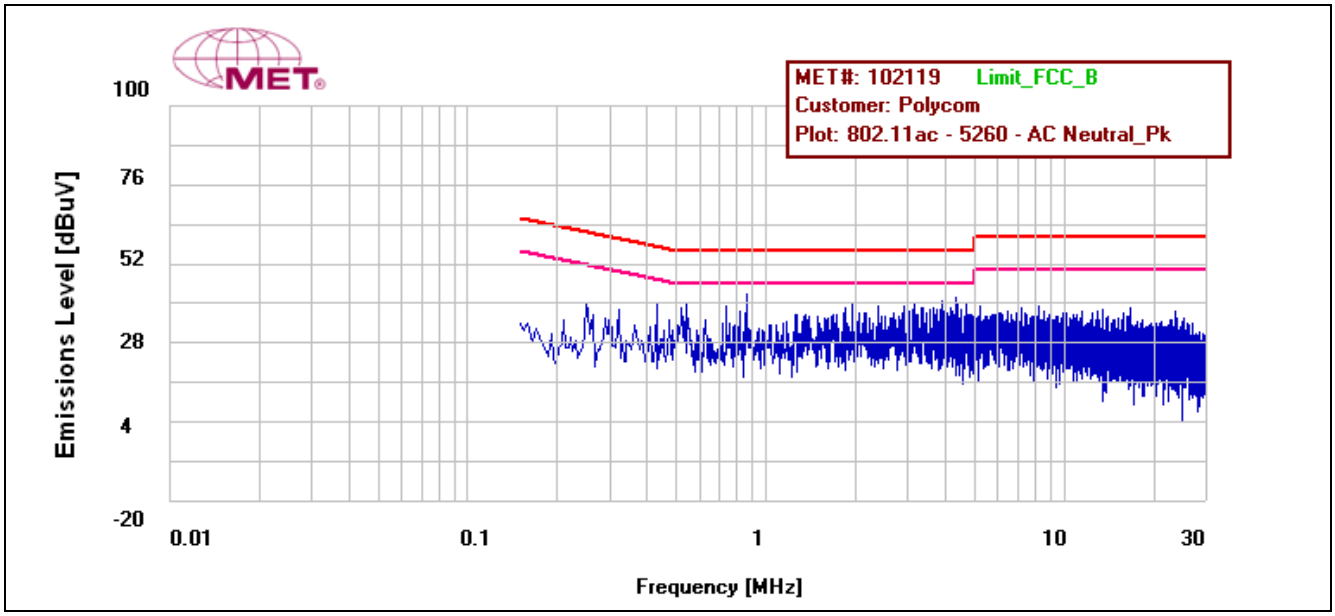
Plot 56. Conducted Emissions, UNII 2A, Phase Line, 802.11ac 40 MHz, 5270 MHz



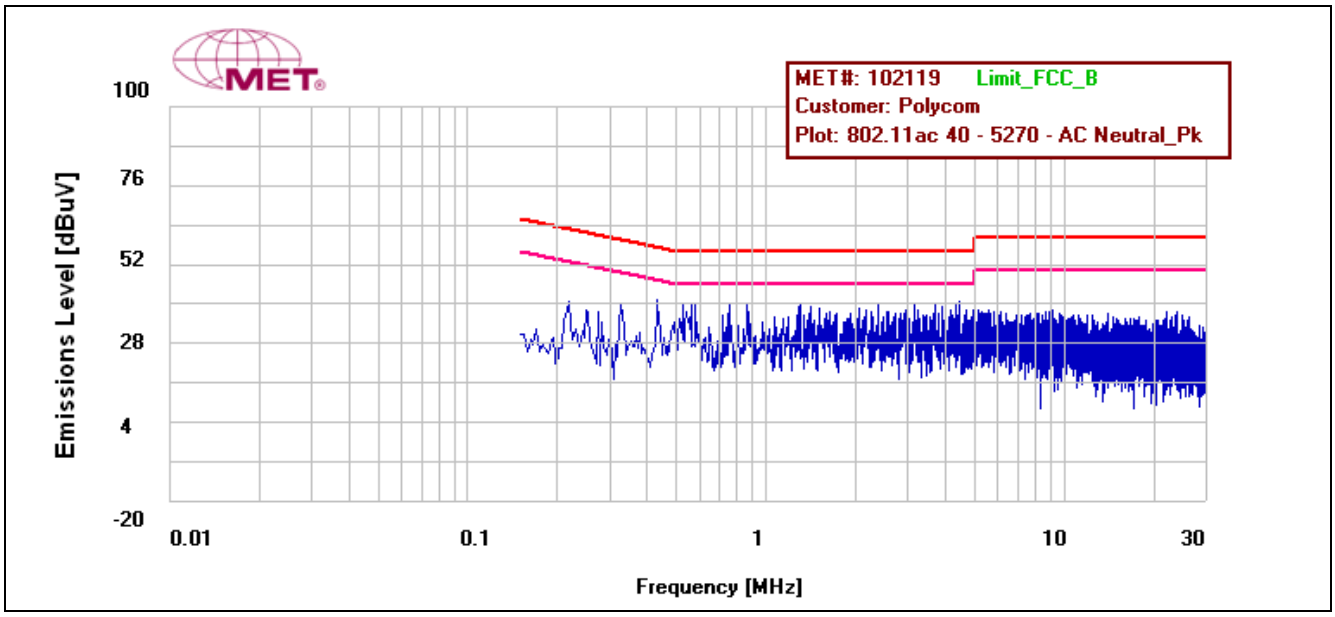
Plot 57. Conducted Emissions, UNII 2A, Phase Line, 802.11ac 80 MHz, 5290 MHz

Line	Freq (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
802.11ac - 5260 - AC Neutral	0.866	41.5	56	-14.5	Pass	34.7	46	-11.3	Pass
802.11ac - 5260 - AC Neutral	4.346	35.2	56	-20.8	Pass	26.1	46	-19.9	Pass
802.11ac - 5260 - AC Neutral	3.918	36	56	-20	Pass	30.2	46	-15.8	Pass
802.11ac - 5260 - AC Neutral	4.722	36.2	56	-19.8	Pass	29.7	46	-16.3	Pass
802.11ac - 5260 - AC Neutral	0.430	39	57.277	-18.277	Pass	32.1	47.277	-15.177	Pass
802.11ac - 5260 - AC Neutral	1.958	36.9	56	-19.1	Pass	27.5	46	-18.5	Pass
802.11ac 40 - 5270 - AC Neutral	0.434	40	57.2	-17.2	Pass	33.8	47.2	-13.4	Pass
802.11ac 40 - 5270 - AC Neutral	0.218	40.9	62.903	-22.003	Pass	34.4	52.903	-18.503	Pass
802.11ac 40 - 5270 - AC Neutral	4.466	36.7	56	-19.3	Pass	30.2	46	-15.8	Pass
802.11ac 40 - 5270 - AC Neutral	1.302	39.1	56	-16.9	Pass	30.6	46	-15.4	Pass
802.11ac 40 - 5270 - AC Neutral	0.562	37.2	56	-18.8	Pass	26.7	46	-19.3	Pass
802.11ac 40 - 5270 - AC Neutral	2.386	38	56	-18	Pass	30.6	46	-15.4	Pass
802.11ac 80 - 5290 - AC Neutral	2.906	37.6	56	-18.4	Pass	30.2	46	-15.8	Pass
802.11ac 80 - 5290 - AC Neutral	0.322	40.7	59.672	-18.972	Pass	34.2	49.672	-15.472	Pass
802.11ac 80 - 5290 - AC Neutral	0.862	41	56	-15	Pass	34.4	46	-11.6	Pass
802.11ac 80 - 5290 - AC Neutral	0.290	38.4	60.539	-22.139	Pass	25.6	50.539	-24.939	Pass
802.11ac 80 - 5290 - AC Neutral	2.046	37.5	56	-18.5	Pass	29	46	-17	Pass
802.11ac 80 - 5290 - AC Neutral	1.842	37.6	56	-18.4	Pass	29.5	46	-16.5	Pass

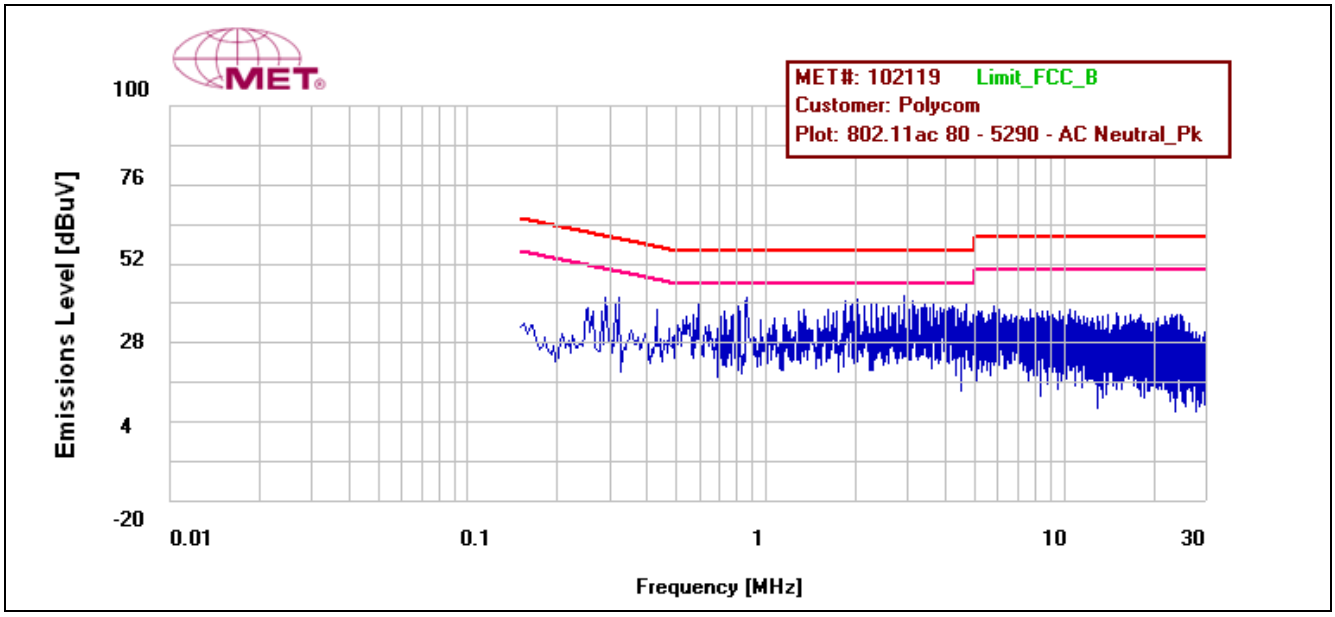
Table 18. Conducted Emissions, UNII 2A, Test Results, Neutral Line



Plot 58. Conducted Emissions, UNII 2A, Neutral Line, 802.11ac 20 MHz, 5260 MHz



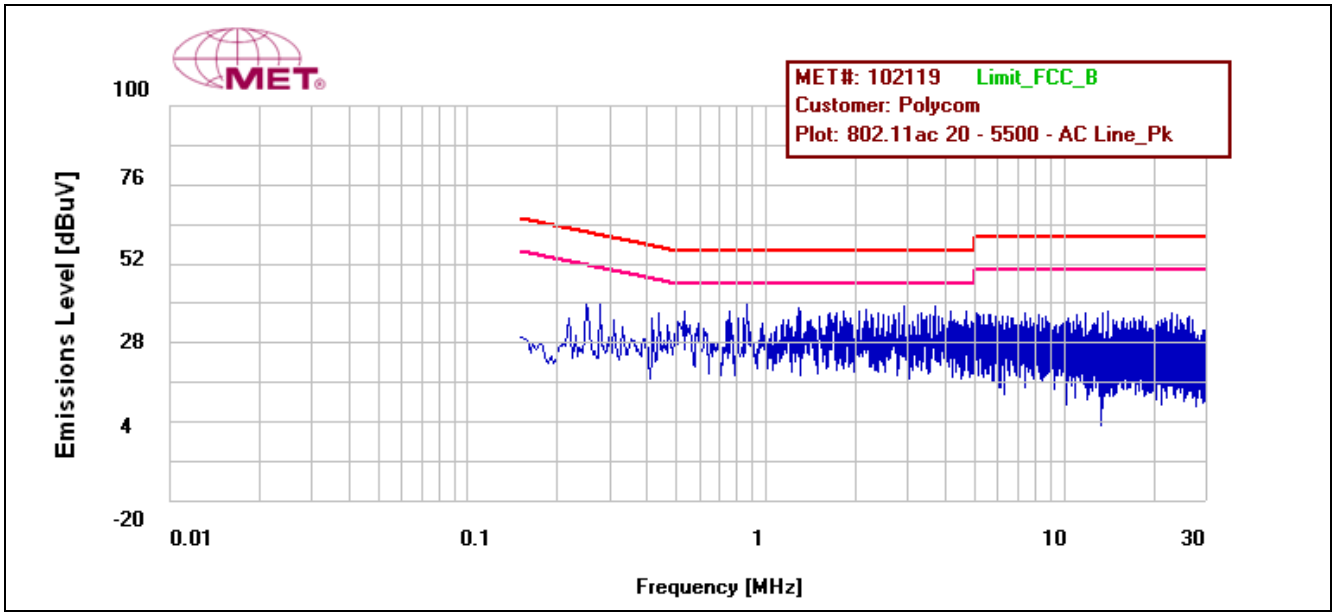
Plot 59. Conducted Emissions, UNII 2A, Neutral Line, 802.11ac 40 MHz, 5270 MHz



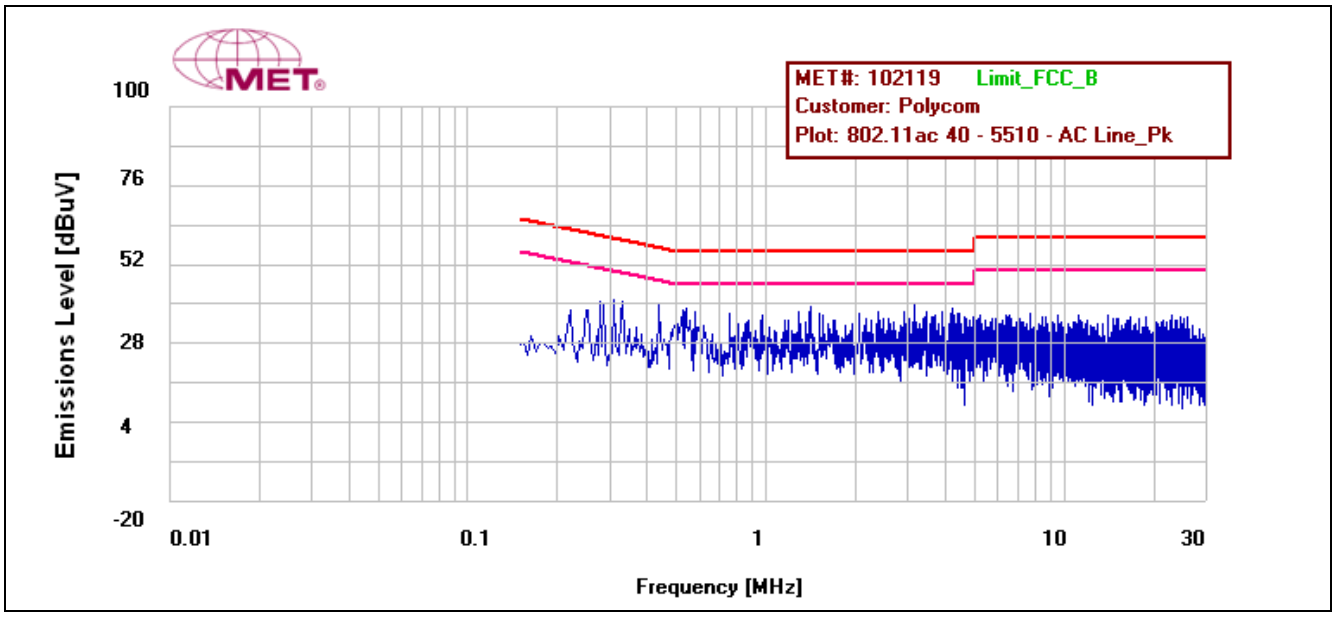
Plot 60. Conducted Emissions, UNII 2A, Neutral Line, 802.11ac 80 MHz, 5290 MHz

Line	Freq (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
802.11ac 20 - 5500 - AC Line	0.870	39.9	56	-16.1	Pass	31.5	46	-14.5	Pass
802.11ac 20 - 5500 - AC Line	0.278	36.8	60.889	-24.089	Pass	24.4	50.889	-26.489	Pass
802.11ac 20 - 5500 - AC Line	3.690	35.5	56	-20.5	Pass	28.9	46	-17.1	Pass
802.11ac 20 - 5500 - AC Line	0.602	35.8	56	-20.2	Pass	23	46	-23	Pass
802.11ac 20 - 5500 - AC Line	2.922	35.1	56	-20.9	Pass	28.1	46	-17.9	Pass
802.11ac 20 - 5500 - AC Line	1.298	37.1	56	-18.9	Pass	29.2	46	-16.8	Pass
802.11ac 40 - 5510 - AC Line	0.310	39.9	59.987	-20.087	Pass	24.8	49.987	-25.187	Pass
802.11ac 40 - 5510 - AC Line	0.278	37.2	60.889	-23.689	Pass	25.6	50.889	-25.289	Pass
802.11ac 40 - 5510 - AC Line	0.330	38.4	59.469	-21.069	Pass	30.9	49.469	-18.569	Pass
802.11ac 40 - 5510 - AC Line	3.166	35.1	56	-20.9	Pass	27.6	46	-18.4	Pass
802.11ac 40 - 5510 - AC Line	0.286	38.5	60.654	-22.154	Pass	24.9	50.654	-25.754	Pass
802.11ac 40 - 5510 - AC Line	0.438	39.1	57.124	-18.024	Pass	31.6	47.124	-15.524	Pass
802.11ac 80 - 5530 - AC Line	0.866	40.1	56	-15.9	Pass	32.9	46	-13.1	Pass
802.11ac 80 - 5530 - AC Line	0.326	40.3	59.57	-19.27	Pass	33.5	49.57	-16.07	Pass
802.11ac 80 - 5530 - AC Line	0.566	36.7	56	-19.3	Pass	25.1	46	-20.9	Pass
802.11ac 80 - 5530 - AC Line	3.690	34.7	56	-21.3	Pass	28.1	46	-17.9	Pass
802.11ac 80 - 5530 - AC Line	1.294	37.1	56	-18.9	Pass	28.6	46	-17.4	Pass
802.11ac 80 - 5530 - AC Line	1.186	35.4	56	-20.6	Pass	29	46	-17	Pass

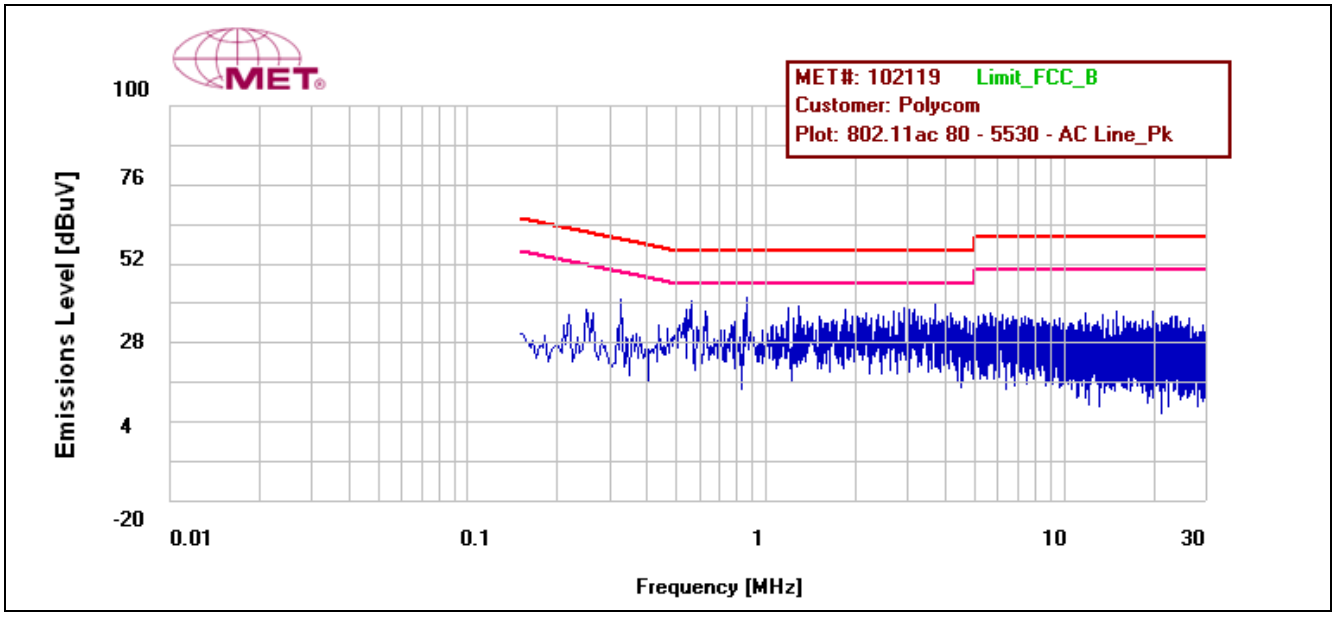
Table 19. Conducted Emissions, UNII 2e, Test Results, Phase Line



Plot 61. Conducted Emissions, UNII 2e, Phase Line, 802.11ac 20 MHz, 5500 MHz



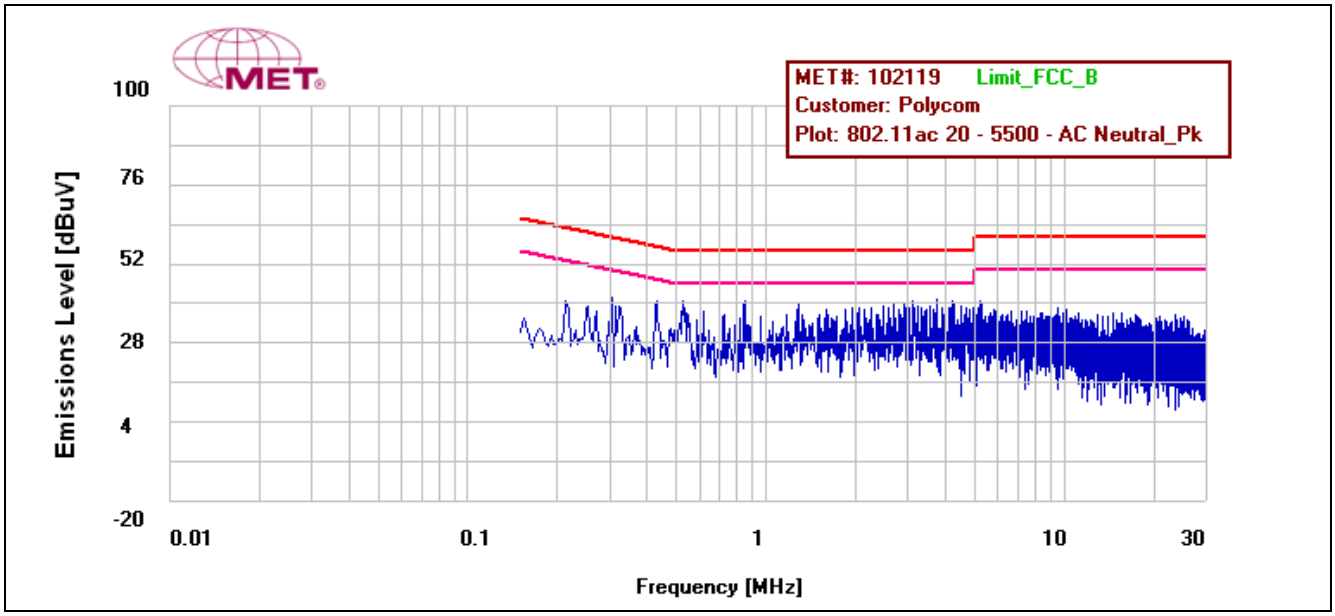
Plot 62. Conducted Emissions, UNII 2e, Phase Line, 802.11ac 40 MHz, 5510 MHz



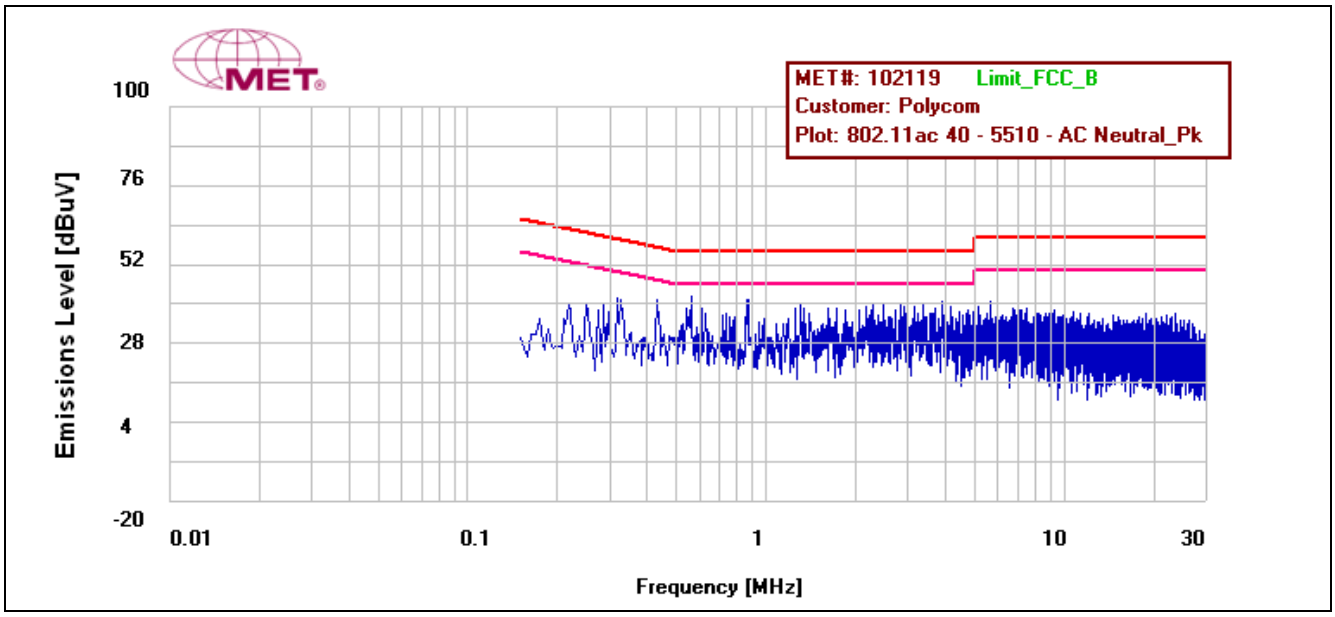
Plot 63. Conducted Emissions, UNII 2e, Phase Line, 802.11ac 80 MHz, 5530 MHz

Line	Freq (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
802.11ac 20 - 5500 - AC Neutral	0.306	39	60.095	-21.095	Pass	25.2	50.095	-24.895	Pass
802.11ac 20 - 5500 - AC Neutral	3.782	36.1	56	-19.9	Pass	27.7	46	-18.3	Pass
802.11ac 20 - 5500 - AC Neutral	4.214	37.3	56	-18.7	Pass	30.8	46	-15.2	Pass
802.11ac 20 - 5500 - AC Neutral	0.526	37.2	56	-18.8	Pass	29	46	-17	Pass
802.11ac 20 - 5500 - AC Neutral	5.242	36.3	60	-23.7	Pass	29.6	50	-20.4	Pass
802.11ac 20 - 5500 - AC Neutral	0.430	39.1	57.277	-18.177	Pass	32.2	47.277	-15.077	Pass
802.11ac 40 - 5510 - AC Neutral	0.562	37.4	56	-18.6	Pass	26.7	46	-19.3	Pass
802.11ac 40 - 5510 - AC Neutral	0.318	40.3	59.776	-19.476	Pass	26.6	49.776	-23.176	Pass
802.11ac 40 - 5510 - AC Neutral	0.874	41.7	56	-14.3	Pass	33.3	46	-12.7	Pass
802.11ac 40 - 5510 - AC Neutral	0.434	39.9	57.2	-17.3	Pass	33.6	47.2	-13.6	Pass
802.11ac 40 - 5510 - AC Neutral	3.910	37.9	56	-18.1	Pass	30.5	46	-15.5	Pass
802.11ac 40 - 5510 - AC Neutral	5.726	35.3	60	-24.7	Pass	29.3	50	-20.7	Pass
802.11ac 80 - 5530 - AC Neutral	4.198	38.2	56	-17.8	Pass	31.5	46	-14.5	Pass
802.11ac 80 - 5530 - AC Neutral	0.310	39.8	59.987	-20.187	Pass	25.3	49.987	-24.687	Pass
802.11ac 80 - 5530 - AC Neutral	0.434	40	57.2	-17.2	Pass	33.1	47.2	-14.1	Pass
802.11ac 80 - 5530 - AC Neutral	0.866	41.7	56	-14.3	Pass	34.2	46	-11.8	Pass
802.11ac 80 - 5530 - AC Neutral	3.690	36.9	56	-19.1	Pass	36.8	46	-9.2	Pass
802.11ac 80 - 5530 - AC Neutral	3.118	35.5	56	-20.5	Pass	27.3	46	-18.7	Pass

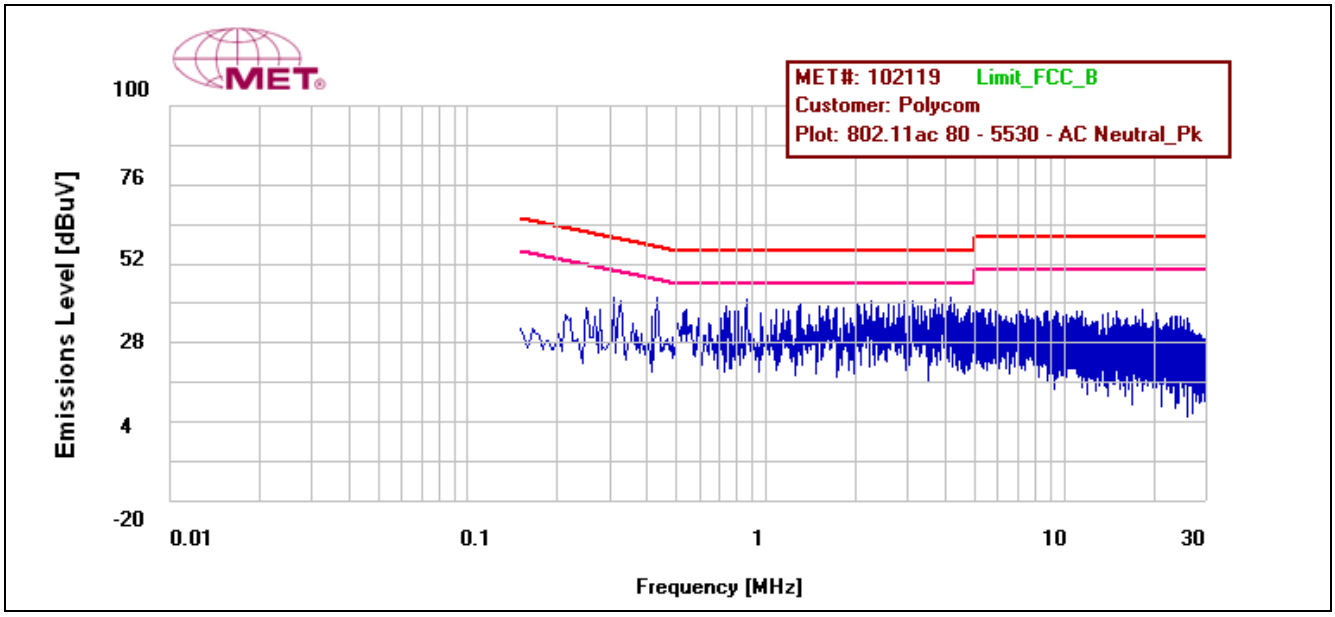
Table 20. Conducted Emissions, UNII 2e, Test Results, Neutral Line



Plot 64. Conducted Emissions, UNII 2e, Neutral Line, 802.11ac 20 MHz, 5500 MHz



Plot 65. Conducted Emissions, UNII 2e, Neutral Line, 802.11ac 40 MHz, 5510 MHz



Plot 66. Conducted Emissions, UNII 2e, Neutral Line, 802.11ac 80 MHz, 5530 MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(f) Maximum Permissible Exposure

Test Requirement(s): **§15.407(f):** U-NII devices are subject to the radio frequency radiation exposure requirements specified in §1.1307(b), §2.1091 and §2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment.

RF Exposure Requirements: **§1.1307(b)(1) and §1.1307(b)(2):** Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

RF Radiation Exposure Limit: **§1.1310:** As specified in this section, the Maximum Permissible Exposure (MPE) Limit shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Sec. 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Sec. 2.1093 of this chapter.

MPE Limit: EUT's operating frequencies @ 5250-5350 MHz and 5470 – 5725 MHz; **Limit for Uncontrolled exposure: 1 mW/cm^2 or 10 W/m^2**

Equation from page 18 of OET 65, Edition 97-01

$$S = PG / 4\pi R^2 \quad \text{or} \quad R = \sqrt{(PG / 4\pi S)}$$

where, S = Power Density (mW/cm^2)
P = Power Input to antenna (mW)
G = Antenna Gain (numeric value)
R = Distance (cm)

 © 2019, Eurofins MET Labs, Inc

Test Results:

FCC									
Frequency (MHz)	**Con. Pwr. (dBm)**	**Con. Pwr. (mW)**	**Ant. Gain (dBi)**	**Ant. Gain numeric**	**Pwr. Density (mW/cm^2)**	**Limit (mW/cm^2)**	**Margin**	**Distance (cm)**	**Result**
5270	16.73	47.098	3	1.995	0.0187	1	0.9813	20	Pass

Table 21. Maximum Permissible Exposure, UNII 2A

FCC									
Frequency (MHz)	**Con. Pwr. (dBm)**	**Con. Pwr. (mW)**	**Ant. Gain (dBi)**	**Ant. Gain numeric**	**Pwr. Density (mW/cm^2)**	**Limit (mW/cm^2)**	**Margin**	**Distance (cm)**	**Result**
5500	16.976	49.843	3	1.995	0.01978	1	0.98022	20	Pass

Table 22. Maximum Permissible Exposure, UNII 2E

The safe distance where Power Density is less than the MPE Limit listed above was found to be 20 cm.

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(g) Frequency Stability

Test Requirements: Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

Test Procedure: The EUT was connected directly to a spectrum analyzer through an attenuator. The 1st trace of the Spectrum Analyzer was taken at ambient conditions and used as a reference. A 2nd trace was used to show the drift of the carrier at extreme conditions. A delta marker was used to find the drift at a given extreme condition.

Test Results: The EUT was compliant with the requirements of this section. TX emission is maintained within the band of operation under all conditions of normal operation.

 © 2019, Eurofins MET Labs, Inc

IV. Test Equipment

Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2005.

Test Equipment				**Test Date(s):**	Jan-Feb, 2019
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1A1065	EMI RECEIVER	ROHDE & SCHWARZ	ESCI	3/23/2018	3/23/2019
1A1119	TEST AREA	CUSTOM MADE	N/A	SEE NOTE	
1A1122	LISN	TESEQ	NNB 51	7/18/2018	7/18/2019
1A1149	MILLIOHM METER	GW INSTEK	GOM-802	4/20/2018	4/20/2019
1A1079	CONDUCTED COMB GENERATOR	COM-POWER CORP	CGC-255	SEE NOTE	
1A1087	PULSE LIMITER	ROHDE & SCHWARZ	ESH3Z2	4/4/2018	4/4/2019
1A1105	ISN	FISCHER CUSTOM	F-071115-1057-1-09	1/11/2019	1/11/2020
1A1184	SPECTRUM ANALYZER	AGILENT	E4407B	4/20/2018	4/20/2019
1A1083	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESU40	10/17/2018	10/17/2019
1A1106	10M CHAMBER (FCC)	ETS	SEMI-ANECHOIC	SEE NOTE	
1A1050	BILOG ANTENNA (30MHZ TO 1GHZ)	SCHAFFNER	CBL 6112D	8/29/2018	2/29/2020
1A1050-A	ATTENUATOR	FAIRVIEW MICROWAVE	SA6N5WA-04	8/29/2018	2/29/2020
1A1047	HORN ANTENNA	ETS	3117	10/30/2018	4/30/2020
1A1161	DRG HORN ANTENNA	ETS	3116C-PA	10/9/2018	4/9/2020
1A1099	GENERATOR	COM-POWER CORP	CGO-51000	SEE NOTE	
1A1088	PRE-AMP	ROHDE & SCHWARZ	TS-PR1	SEE NOTE	
1A1180	PRE-AMP	MITEQ	AMF-7D-01001800-22-10P	SEE NOTE	
1A1044	GENERATOR	COM-POWER CORP	CG-520	SEE NOTE	
1A1073	MULTI DEVICE CONTROLLER	ETS EMCO	2090	SEE NOTE	
1A1074	SYSTEM CONTROLLER	PANASONIC	WV-CU101	SEE NOTE	
1A1080	MULTI DEVICE CONTROLLER	ETS EMCO	2090	SEE NOTE	

Table 23. Test Equipment List

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

 © 2019, Eurofins MET Labs, Inc

V. Certification & User's Manual Information

Certification & User's Manual Information

M. Certification Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart I — Marketing of Radio frequency devices:

§ 2.801 Radio-frequency device defined.

As used in this part, a radio-frequency device is any device which in its operation is capable of Emitting radio-frequency energy by radiation, conduction, or other means. Radio- frequency devices include, but are not limited to:

(a) The various types of radio communication transmitting devices described throughout this chapter.

(b) The incidental, unintentional and intentional radiators defined in Part 15 of this chapter.

(c) The industrial, scientific, and medical equipment described in Part 18 of this chapter.

(d) Any part or component thereof which in use emits radio-frequency energy by radiation, conduction, or other means.

§ 2.803 Marketing of radio frequency devices prior to equipment authorization.

(a) Except as provided elsewhere in this chapter, no person shall sell or lease, or offer for sale or lease (including advertising for sale or lease), or import, ship or distribute for the purpose of selling or leasing or offering for sale or lease, any radio frequency device unless:

(1) In the case of a device subject to certification, such device has been authorized by the Commission in accordance with the rules in this chapter and is properly identified and labeled as required by §2.925 and other relevant sections in this chapter; or

(2) In the case of a device that is not required to have a grant of equipment authorization issued by the Commission, but which must comply with the specified technical standards prior to use, such device also complies with all applicable administrative (including verification of the equipment or authorization under a Declaration of Conformity, where required), technical, labeling and identification requirements specified in this chapter.

(d) Notwithstanding the provisions of paragraph (a) of this section, the offer for sale solely to business, commercial, industrial, scientific or medical users (but not an offer for sale to other parties or to end users located in a residential environment) of a radio frequency device that is in the conceptual, developmental, design or pre-production stage is permitted prior to equipment authorization or, for devices not subject to the equipment authorization requirements, prior to a determination of compliance with the applicable technical requirements *provided* that the prospective buyer is advised in writing at the time of the offer for sale that the equipment is subject to the FCC rules and that the equipment will comply with the appropriate rules before delivery to the buyer or to centers of distribution.

 © 2019, Eurofins MET Labs, Inc

(e)(1) Notwithstanding the provisions of paragraph (a) of this section, prior to equipment authorization or determination of compliance with the applicable technical requirements any radio frequency device may be operated, but not marketed, for the following purposes and under the following conditions:

(i) Compliance testing;

(ii) Demonstrations at a trade show provided the notice contained in paragraph (c) of this section is displayed in a conspicuous location on, or immediately adjacent to, the device;

(iii) Demonstrations at an exhibition conducted at a business, commercial, industrial, scientific or medical location, but excluding locations in a residential environment, provided the notice contained in paragraphs (c) or (d) of this section, as appropriate, is displayed in a conspicuous location on, or immediately adjacent to, the device;

(iv) Evaluation of product performance and determination of customer acceptability, provided such operation takes place at the manufacturer's facilities during developmental, design or pre-production states; or

(v) Evaluation of product performance and determination of customer acceptability where customer acceptability of a radio frequency device cannot be determined at the manufacturer's facilities because of size or unique capability of the device, provided the device is operated at a business, commercial, industrial, scientific or medical user's site, but not at a residential site, during the development, design or pre-production stages.

(e)(2) For the purpose of paragraphs (e)(1)(iv) and (e)(1)(v) of this section, the term *manufacturer's facilities* includes the facilities of the party responsible for compliance with the regulations and the manufacturer's premises, as well as the facilities of other entities working under the authorization of the responsible party in connection with the development and manufacture, but not the marketing, of the equipment.

(f) For radio frequency devices subject to verification and sold solely to business, commercial, industrial, scientific and medical users (excluding products sold to other parties or for operation in a residential environment), parties responsible for verification of the devices shall have the option of ensuring compliance with the applicable technical specifications of this chapter at each end user's location after installation, provided that the purchase or lease agreement includes a proviso that such a determination of compliance be made and is the responsibility of the party responsible for verification of the equipment.

Certification & User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart J — Equipment Authorization Procedures:

§ 2.901 Basis and Purpose

(a) In order to carry out its responsibilities under the Communications Act and the various treaties and international regulations, and in order to promote efficient use of the radio spectrum, the Commission has developed technical standards for radio frequency equipment and parts or components thereof. The technical standards applicable to individual types of equipment are found in that part of the rules governing the service wherein the equipment is to be operated.[1] *In addition to the technical standards provided, the rules governing the service may require that such equipment be verified by the manufacturer or importer*, be authorized under a Declaration of Conformity, or receive an equipment authorization from the Commission by one of the following procedures: certification or registration.

(b) The following sections describe the verification procedure, the procedure for a Declaration of Conformity, and the procedures to be followed in obtaining certification from the Commission and the conditions attendant to such a grant.

§ 2.907 Certification.

(a) Certification is an equipment authorization issued by the Commission, based on representation and test data submitted by the applicant.

(b) Certification attaches to all units subsequently marketed by the grantee which are identical (see Section 2.908) to the sample tested except for permissive changes or other variations authorized by the Commission pursuant to Section 2.1043.

[1] In this case, the equipment is subject to the rules of Part 15. More specifically, the equipment falls under Subpart B (of Part 15), which deals with unintentional radiators.

 © 2019, Eurofins MET Labs, Inc

Certification & User's Manual Information

§ 2.948 Description of measurement facilities.

(a) Each party making measurements of equipment that is subject to an equipment authorization under Part 15 or Part 18 of this chapter, regardless of whether the measurements are filed with the Commission or kept on file by the party responsible for compliance of equipment marketed within the U.S. or its possessions, shall compile a description of the measurement facilities employed.

(1) If the measured equipment is subject to the verification procedure, the description of the measurement facilities shall be retained by the party responsible for verification of the equipment.

(i) If the equipment is verified through measurements performed by an independent laboratory, it is acceptable for the party responsible for verification of the equipment to rely upon the description of the measurement facilities retained by or placed on file with the Commission by that laboratory. In this situation, the party responsible for the verification of the equipment is not required to retain a duplicate copy of the description of the measurement facilities.

(ii) If the equipment is verified based on measurements performed at the installation site of the equipment, no specific site calibration data is required. It is acceptable to retain the description of the measurement facilities at the site at which the measurements were performed.

(2) If the equipment is to be authorized by the Commission under the certification procedure, the description of the measurement facilities shall be filed with the Commission's Laboratory in Columbia, Maryland. The data describing the measurement facilities need only be filed once but must be updated as changes are made to the measurement facilities or as otherwise described in this section. At least every three years, the organization responsible for filing the data with the Commission shall certify that the data on file is current.

 © 2019, Eurofins MET Labs, Inc

Certification & User's Manual Information

Label and User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart A — General:

§ 15.19 Labeling requirements.

(a) In addition to the requirements in Part 2 of this chapter, a device subject to certification or verification shall be labeled as follows:

(1) Receivers associated with the operation of a licensed radio service, e.g., FM broadcast under Part 73 of this chapter, land mobile operation under Part 90, etc., shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

(2) A stand-alone cable input selector switch, shall bear the following statement in a conspicuous location on the device:

This device is verified to comply with Part 15 of the FCC Rules for use with cable television service.

(3) All other devices shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

(4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified under paragraph (a) of this section is required to be affixed only to the main control unit.

(5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

§ 15.21 Information to user.

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

 © 2019, Eurofins MET Labs, Inc

Verification & User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart B — Unintentional Radiators:

§ 15.105 Information to the user.

(a) For a Class A digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at own expense.

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

– Reorient or relocate the receiving antenna.

– Increase the separation between the equipment and receiver.

– Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

– Consult the dealer or an experienced radio/TV technician for help.

 © 2019, Eurofins MET Labs, Inc

End of Report

 © 2019, Eurofins MET Labs, Inc