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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 3).

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
Documentation Department

Reference: (\Polycom Inc.\ EMCA102119-FCC407 UNII 3 Rev. 2)

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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

MET Report: EMCA102119-FCC407 UNII 3 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

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Model P011

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

Giuliano Messina, Project Engineer
Electromagnetic Compatibility Lab

Joel Huna
Documentation Department

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

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Report Status Sheet

Revision	Report Date	Reason for Revision
∅	April 30, 2019	Initial Issue.
1	May 2, 2019	Max output power correction.
2	May 16, 2019	Updated power

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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
µH	**Microh**enry
µ	**Microf**arad
µs	**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

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I. Executive Summary

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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 Bandwidth	Not Applicable
§15.407 (a)(3)	Maximum Conducted Output Power	Compliant
§15.407 (a)(3)	Maximum Power Spectral Density	Compliant
§15.407 (b)(4)& (6 - 7)	Undesirable Emissions	Compliant
§15.407(b)(6)	Conducted Emission Limits	Compliant
§15.407 (a)(3)	Max EIRP	Compliant
§15.407(e)	6 dB Bandwidth	Compliant
§15.407(f)	RF Exposure	Compliant
§15.407(g)	Frequency Stability	Compliant

Table 1. Executive Summary of EMC Part 15.407 Compliance Testing

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II. Equipment Configuration

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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
	Max. RF Output Power:	16.906 dBm
	EUT Frequency Ranges:	5725 – 5850 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	
Evaluated by:	Giuliano Messina	
Report Date(s):	May 16, 2019	

Table 2. EUT Summary

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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

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 Eurofins MET Labs.

D. 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.

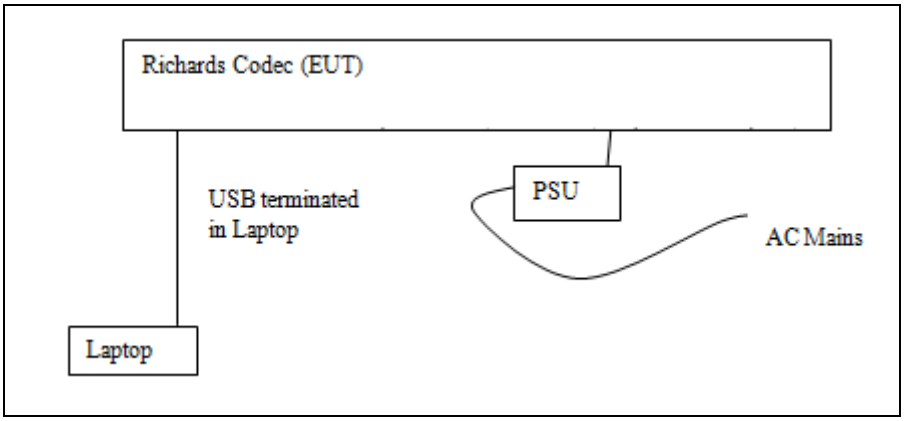

Figure 1. Block Diagram of Test Configuration

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Equipment Configuration

The EUT was set up as outlined in Figure 1, Block Diagram of Test Setup. 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 4. Equipment Configuration

E. 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 5. Support Equipment

F. 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 6. Ports and Cabling Information

G. 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.

H. Method of Monitoring EUT Operation

A spectrum analyzer was used to confirm proper transmitter operation.

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I. 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.

J. 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.

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III. Electromagnetic Compatibility Criteria for Intentional Radiators

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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

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Electromagnetic Compatibility Criteria for Intentional Radiators

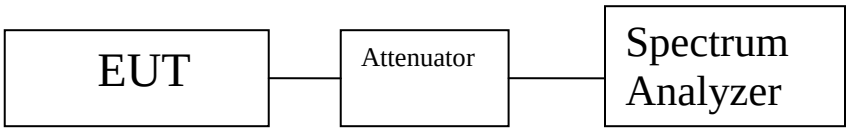
§ 15. 403(i) 26 dB Bandwidth

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 not applicable with the requirements of this section.

Per 15.407(a)(5), the 26dB BW would be larger than 500kHz, as shown in the 6 dB Bandwidth section.



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Electromagnetic Compatibility Criteria for Intentional Radiators

§15. 407(a)(3) Maximum Conducted Output Power

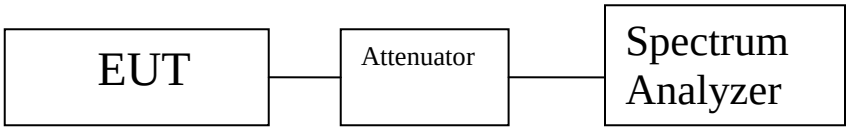
Test Requirements: **§15.407(a)(3):** For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.
If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power.

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.

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



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Mode	Freq (MHz)	Chain 1 (dBm)	Chain 2 (dBm)	Combined Power (dBm)
802.11a	5745	13.56	13.85	16.71772
802.11a	5785	13.6	13.63	16.62533
802.11a	5825	13.5	13.55	16.53537
802.11n 20	5745	13.45	13.73	16.60256
802.11n 20	5785	13.75	13.58	16.67613
802.11n 20	5825	13.5	13.39	16.45565
802.11ac 20	5745	12.28	12.96	15.6436
802.11ac 20	5785	12.66	12.67	15.6753
802.11ac 20	5825	12.59	12.44	15.52595
802.11n 40	5755	13.43	13.61	16.53123
802.11n 40	5795	13.84	13.95	16.90565
802.11ac 40	5755	11.69	11.8	14.75565
802.11ac 40	5795	11.45	11.66	14.56657
802.11ac 80	5775	12.64	12.78	15.72086

Table 7. Output Power, Test Results

Max combined output power =

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

Max combined output power = 16.906 dBm

EIRP calculation:		Ant gain (dBi) =	3
Mode	Freq (MHz)	Chain 1 (dBm)	Chain 2 (dBm)
802.11n 40	5795	13.84	13.95
EIRP each =		16.84	16.95
EIRP Total = 19.90564821			

Table 8. Output Power, EIRP Calculation

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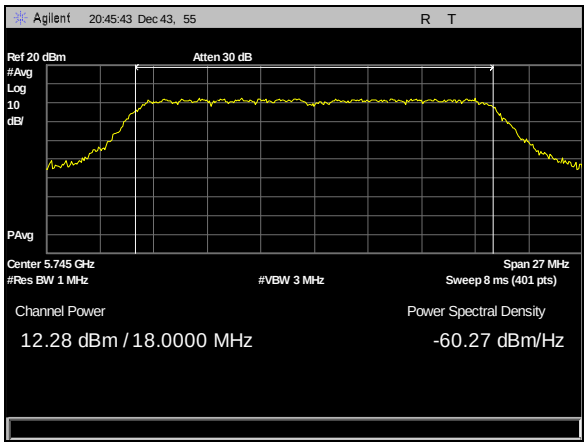
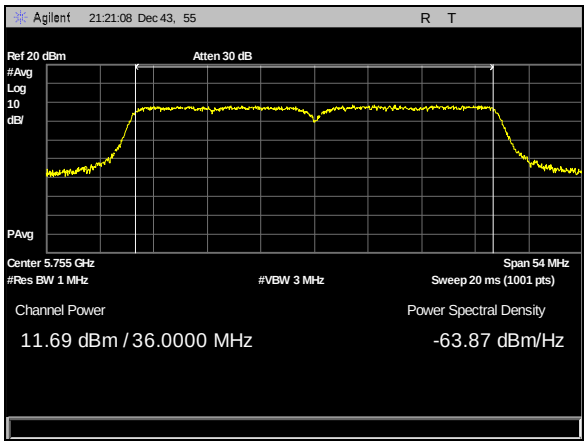
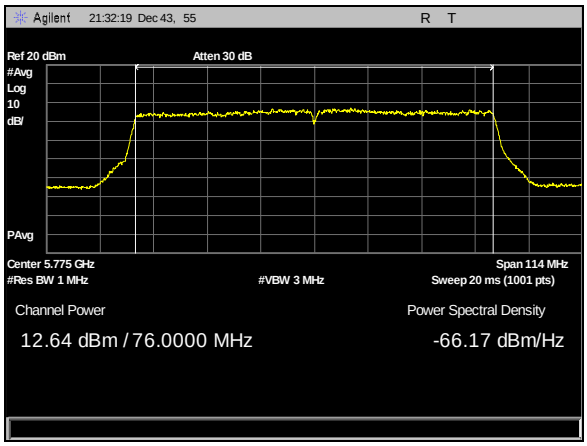


Plot 1. Output Power, 802.11ac 20, 5745, 12.28dBm



Plot 2. Output Power, 802.11ac 40, 5755, 11.69dBm



Plot 3. Output Power, 802.11ac 80, 5775, 12.64dBm

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Electromagnetic Compatibility Criteria for Intentional Radiators

§15.407(a)(3) Maximum Power Spectral Density

Test Requirements: **§15.407(a)(3):** In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz 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. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power.

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. A 300 kHz RBW was used during testing.

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

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Mode	Freq (MHz)	Chain 1 (dBm)	Chain 2 (dBm)	Combined PSD (dBm)
802.11a	5745	-0.873	-0.242	2.46425
802.11a	5785	-0.727	-0.66	2.316929
802.11a	5825	-0.695	-1.068	2.132803
802.11n 20	5745	-1.45	-1.185	1.694821
802.11n 20	5785	-0.902	-1.331	1.899095
802.11n 20	5825	-1.563	-1.568	1.444801
802.11ac 20	5745	-2.876	-2.327	0.417469
802.11ac 20	5785	-1.946	-2.027	1.023989
802.11ac 20	5825	-2.55	-2.48	0.495441
802.11n 40	5755	-4.237	-3.657	-0.92702
802.11n 40	5795	-3.416	-3.603	-0.49819
802.11ac 40	5755	-5.1	-5.445	-2.25878
802.11ac 40	5795	-5.238	-5.649	-2.42834
802.11ac 80	5775	-8.226	-7.482	-4.82779

Table 9. Power Spectral Density, Test Results

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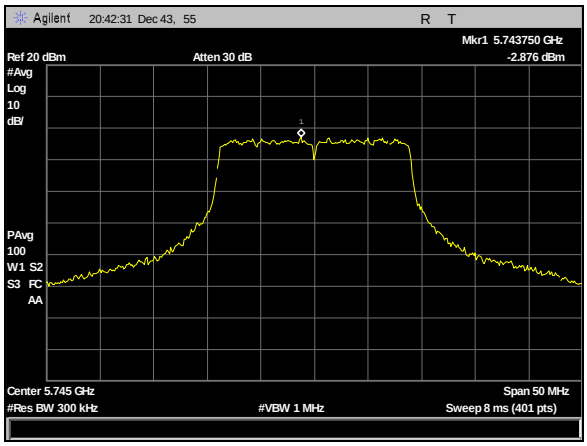
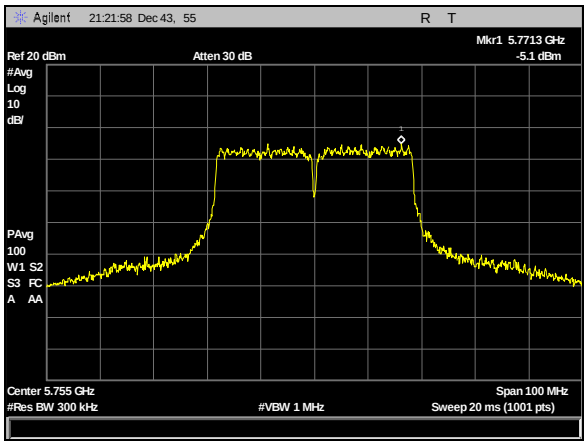
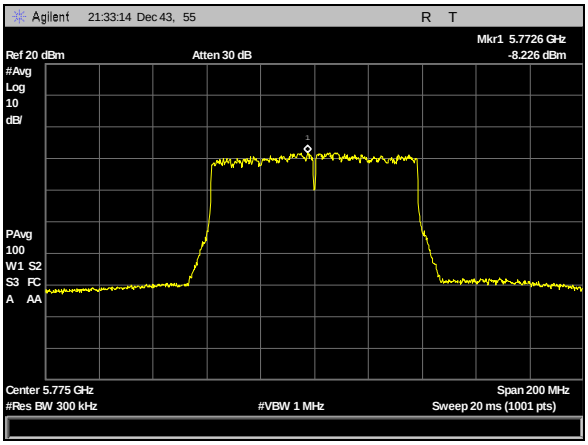


Plot 4. Power Spectral Density, 802.11ac 20, 5745, -2.876dBm



Plot 5. Power Spectral Density, 802.11ac 40, 5755, -5.1dBm



Plot 6. Power Spectral Density, 802.11ac 80, 5775, -8.226dBm

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Electromagnetic Compatibility Criteria for Intentional Radiators

§15.407(b)(4) & (6 – 7) Undesirable Emissions

Test Requirements:

§ 15.407(b)(4): For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of −17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions 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

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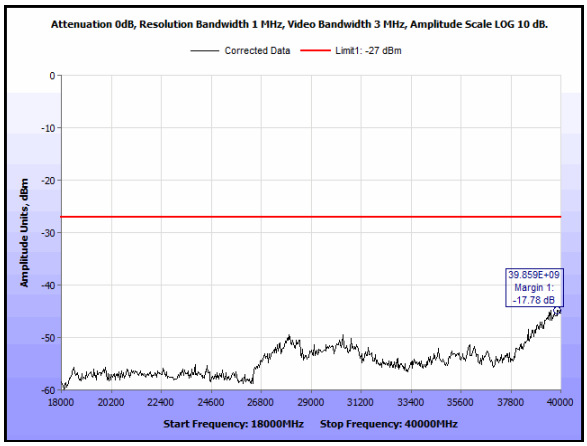

Plot 7. Undesirable Emissions, 802.11a, Spurious Emissions, 18-40GHz

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

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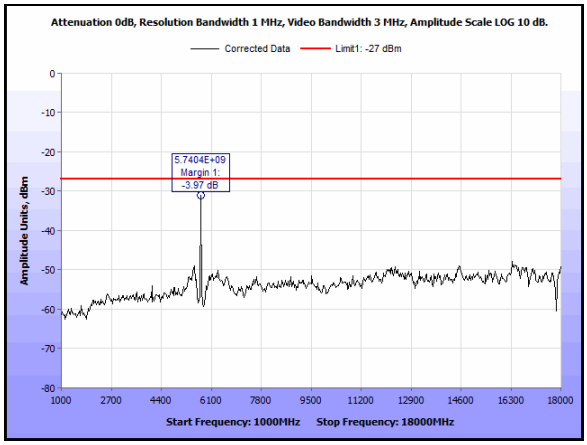
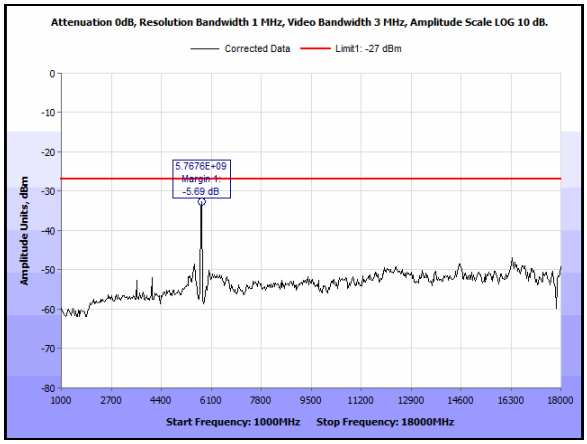
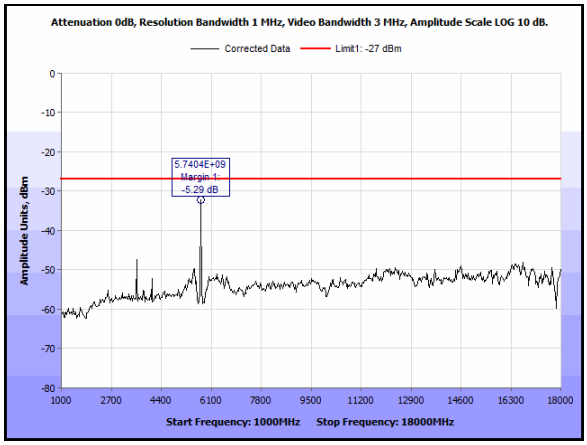
Above 1 GHz



Plot 8. Undesirable Emissions, 802.11a, Spurious Emissions, 5745, 1-18GHz



Plot 9. Undesirable Emissions, 802.11a, Spurious Emissions, 5765, 1-18GHz



Plot 10. Undesirable Emissions, 802.11ac 20, Spurious Emissions, 5745, 1-18GHz

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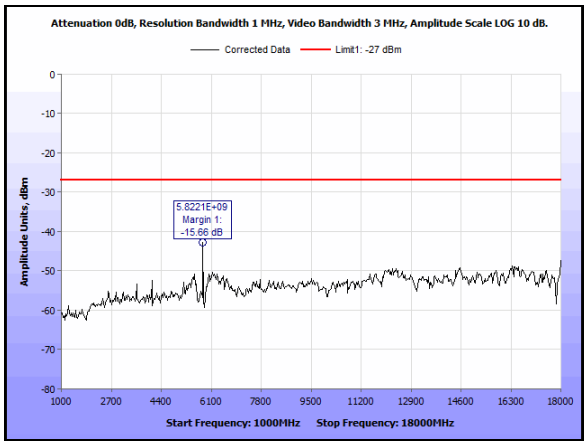
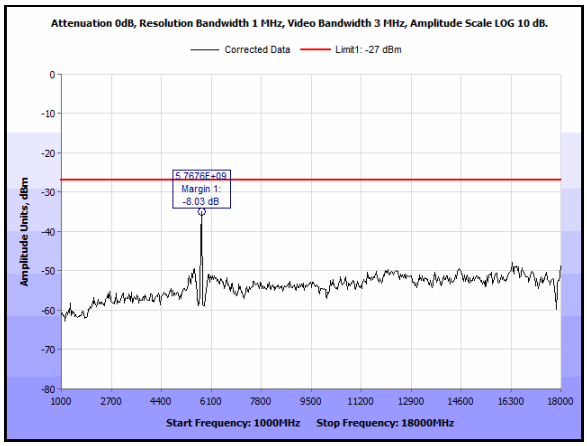
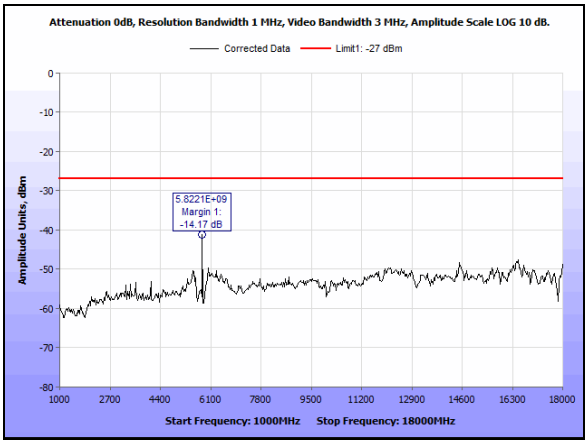


Plot 11. Undesirable Emissions, 802.11a, Spurious Emissions, 5825, 1-18GHz



Plot 12. Undesirable Emissions, 802.11ac 20, Spurious Emissions, 5765, 1-18GHz



Plot 13. Undesirable Emissions, 802.11ac 20, Spurious Emissions, 5825, 1-18GHz

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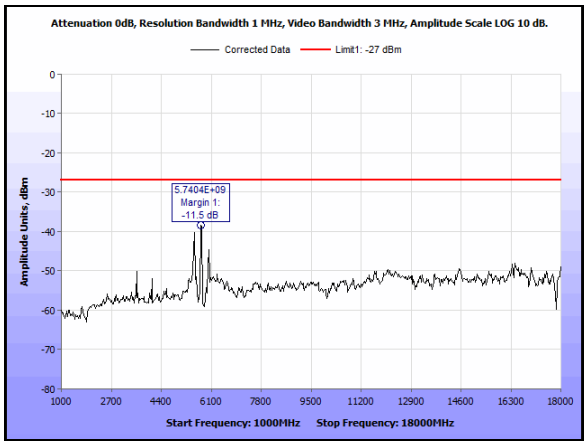
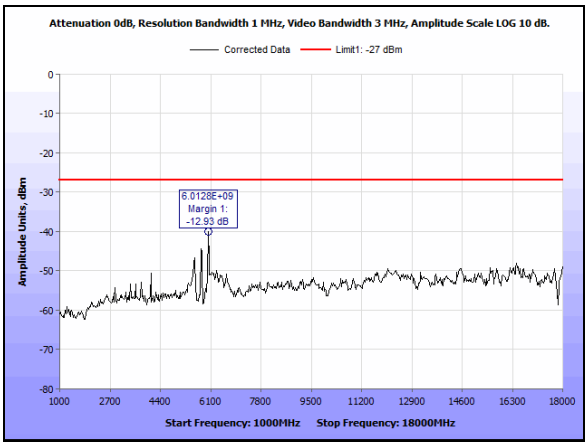
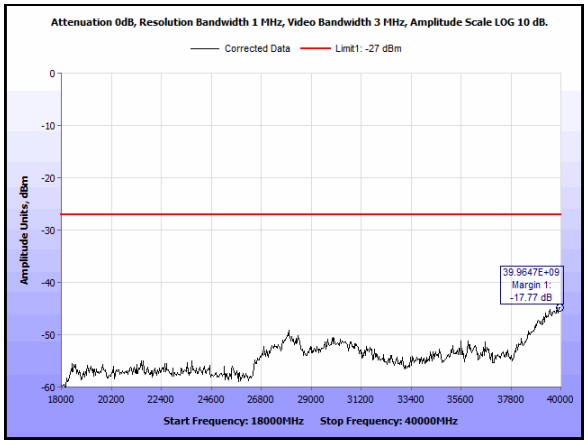


Plot 14. Undesirable Emissions, 802.11ac 40, Spurious Emissions, 5755, 1-18GHz



Plot 15. Undesirable Emissions, 802.11ac 40, Spurious Emissions, 5795, 1-18GHz



Plot 16. Undesirable Emissions, 802.11ac 80, Spurious Emissions, 18-40GHz

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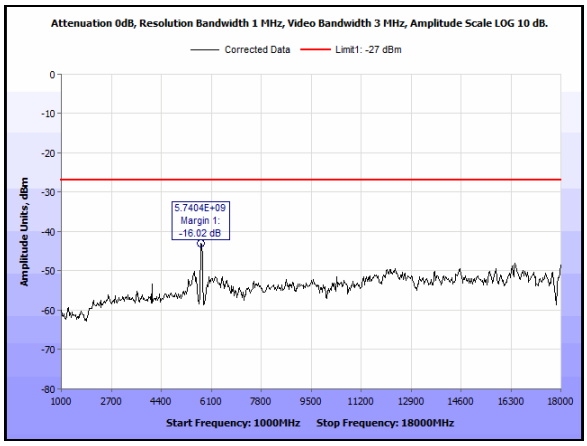
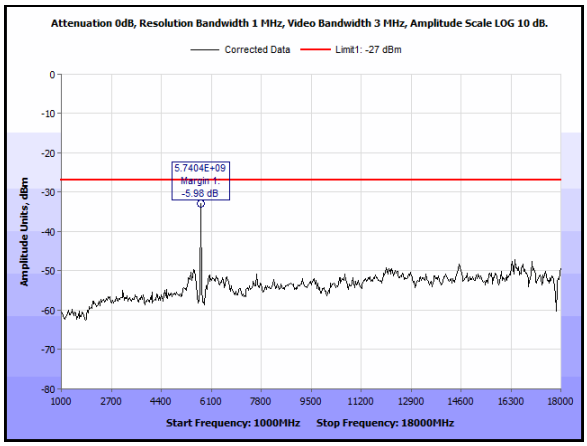
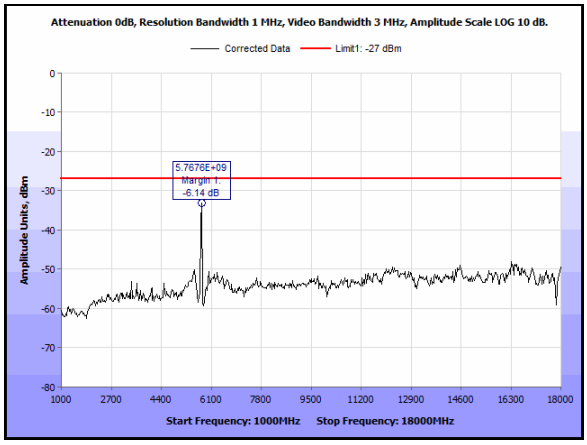


Plot 17. Undesirable Emissions, 802.11ac 80, Spurious Emissions, 5775, 1-18GHz



Plot 18. Undesirable Emissions, 802.11n 20, Spurious Emissions, 5745, 1-18GHz



Plot 19. Undesirable Emissions, 802.11n 20, Spurious Emissions, 5765, 1-18GHz

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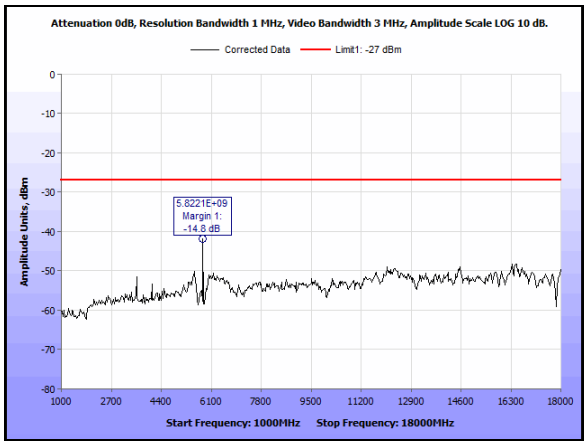
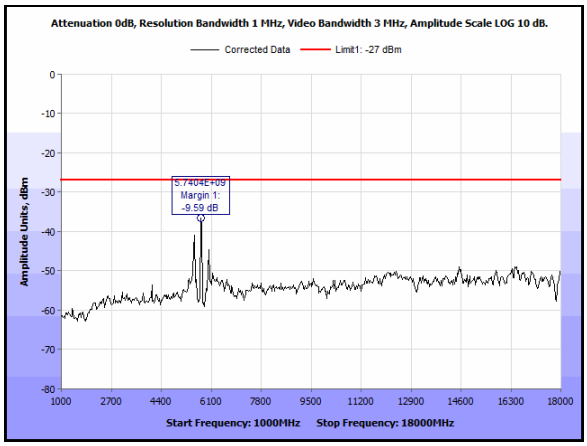
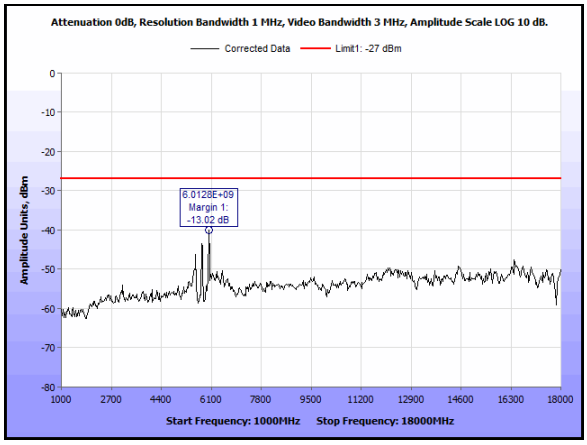


Plot 20. Undesirable Emissions, 802.11n 20, Spurious Emissions, 5825, 1-18GHz



Plot 21. Undesirable Emissions, 802.11n 40, Spurious Emissions, 5755, 1-18GHz



Plot 22. Undesirable Emissions, 802.11n 40, Spurious Emissions, 5795, 1-18GHz

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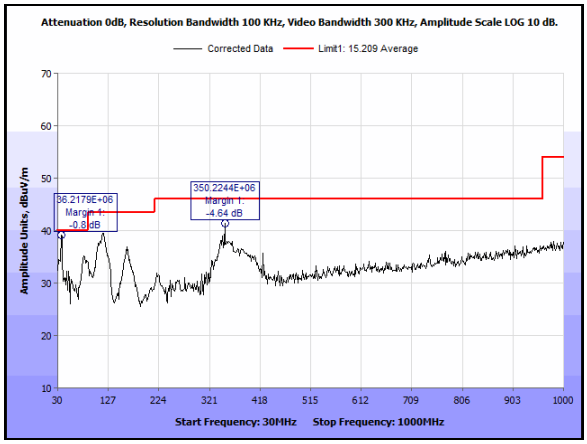
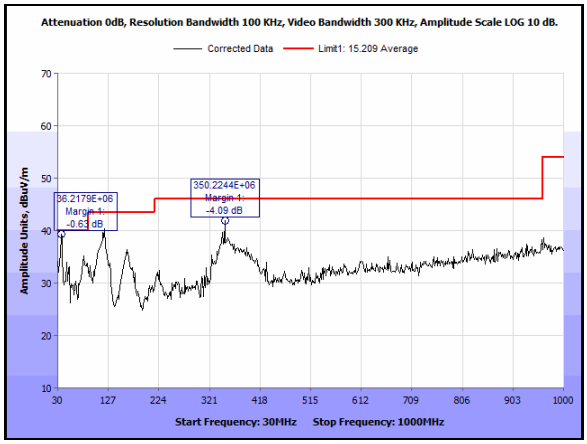
Below 1 GHz

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



Plot 23. Undesirable Emissions, 802.11a, Spurious Emissions, 30-1000MHz



Plot 24. Undesirable Emissions, 802.11ac 40, Spurious Emissions, 30-1000MHz

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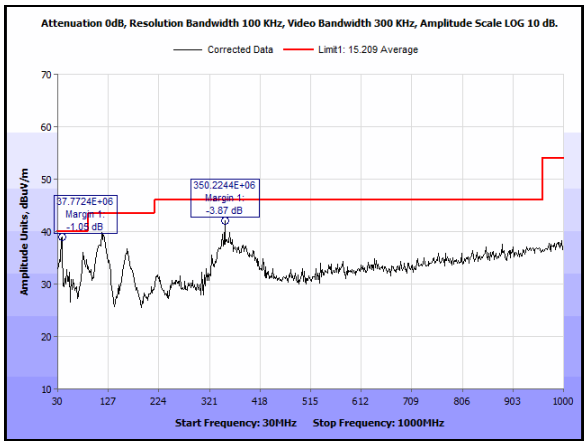
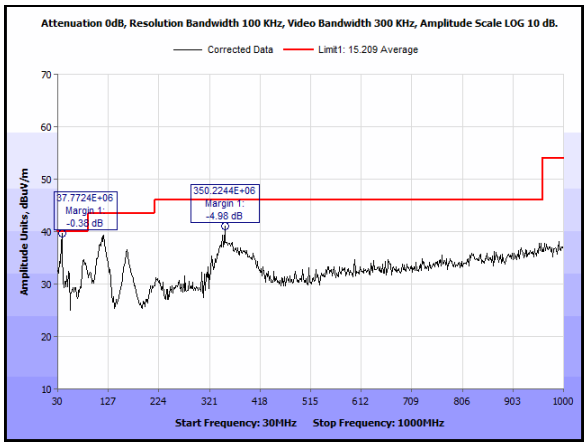
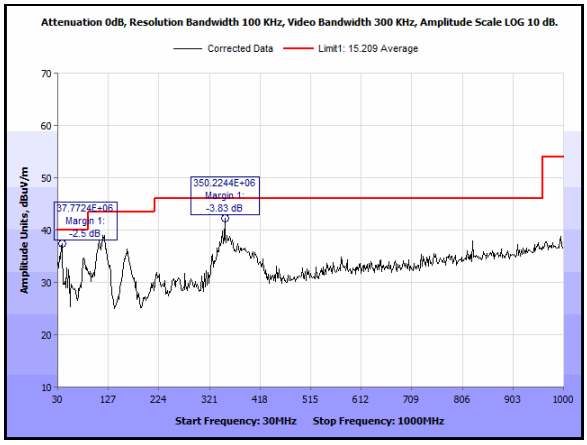


Plot 25. Undesirable Emissions, 802.11ac 20, Spurious Emissions, 30-1000MHz



Plot 26. Undesirable Emissions, 802.11ac 80, Spurious Emissions, 30-1000MHz



Plot 27. Undesirable Emissions, 802.11n 40, Spurious Emissions, 30-1000MHz

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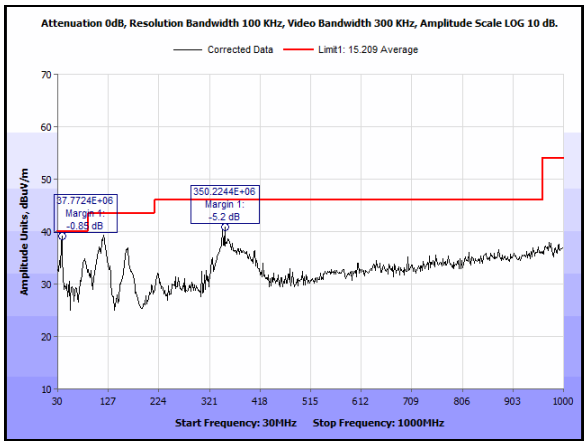

Plot 28. Undesirable Emissions, 802.11n 20, Spurious Emissions, 30-1000MHz

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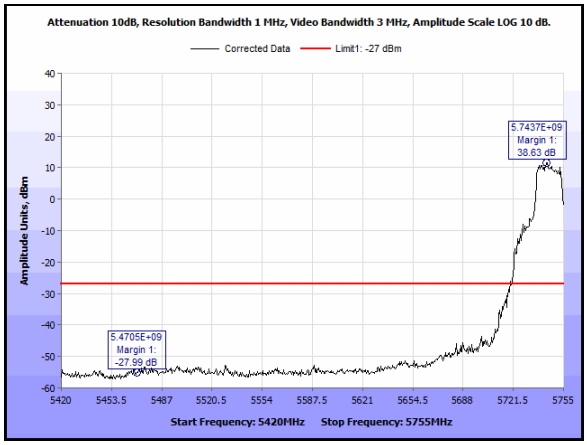
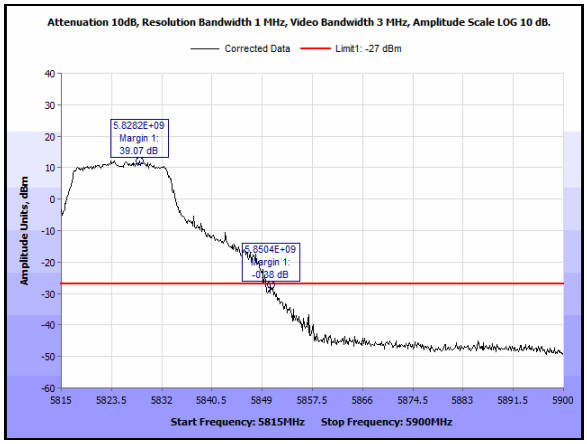
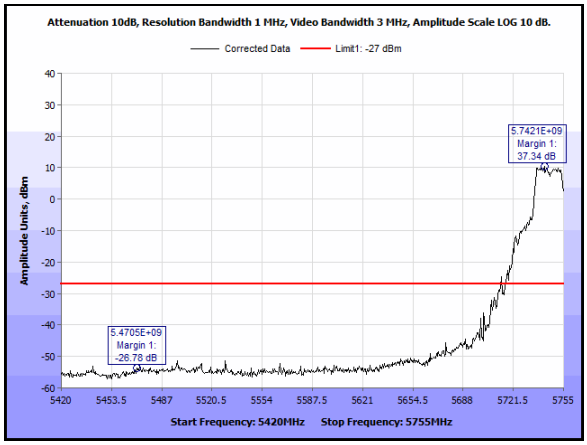
Bandedge



Plot 29. Undesirable Emissions, 802.11a, Spurious Emissions, 5745, Bandedge



Plot 30. Undesirable Emissions, 802.11a, Spurious Emissions, 5825, Bandedge



Plot 31. Undesirable Emissions, 802.11ac 20, Spurious Emissions, 5745, Bandedge

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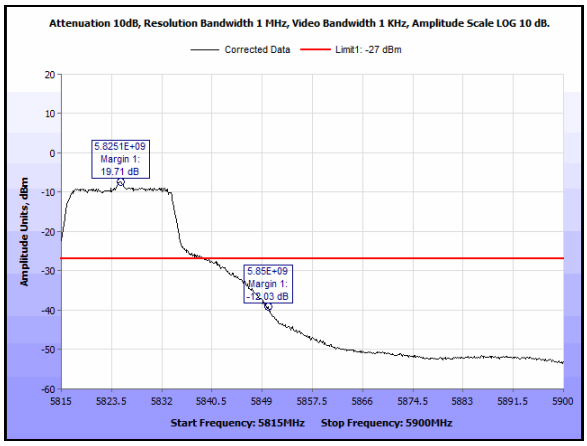
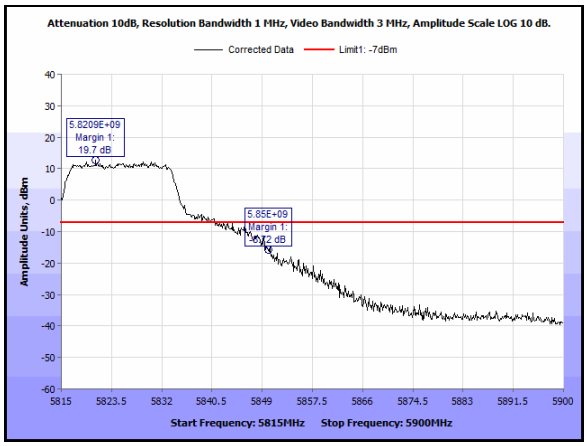
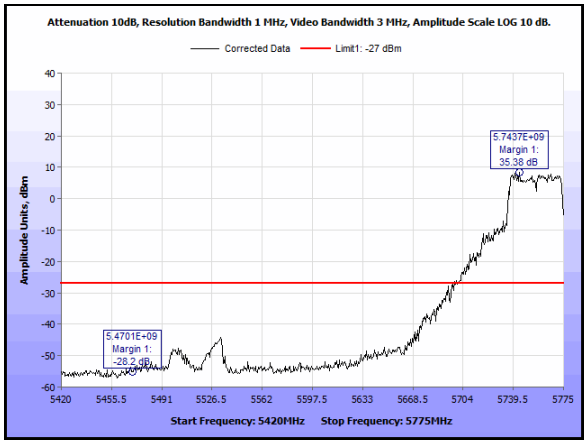


Plot 32. Undesirable Emissions, 802.11ac 20, Spurious Emissions, 5825, Bandedge, Average



Plot 33. Undesirable Emissions, 802.11ac 20, Spurious Emissions, 5825, Bandedge, Peak



Plot 34. Undesirable Emissions, 802.11ac 40, Spurious Emissions, 5755, Bandedge

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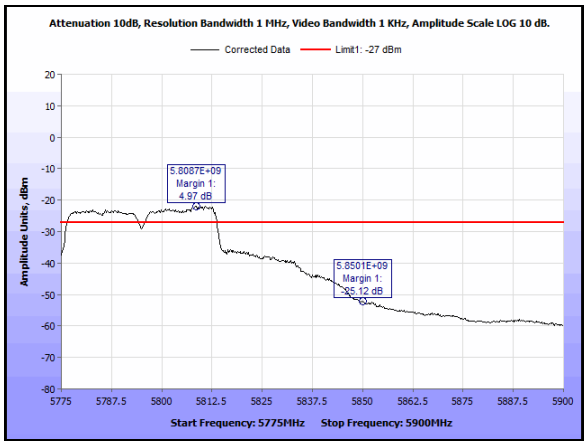
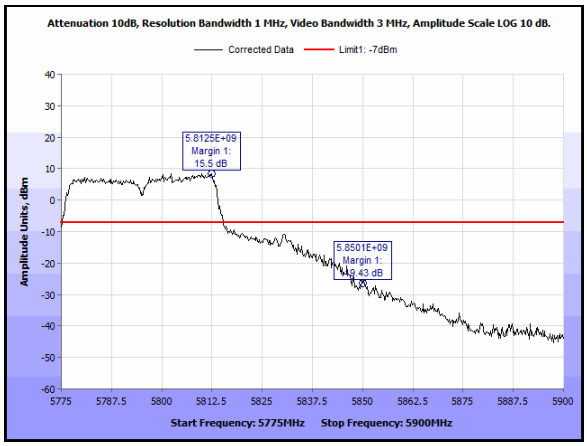
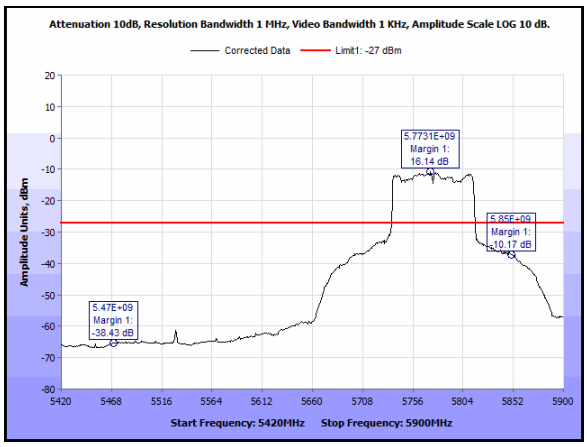


Plot 35. Undesirable Emissions, 802.11ac 40, Spurious Emissions, 5795, Bandedge, Average



Plot 36. Undesirable Emissions, 802.11ac 40, Spurious Emissions, 5795, Bandedge, Peak



Plot 37. Undesirable Emissions, 802.11ac 80, Spurious Emissions, 5775, Bandedge, Average

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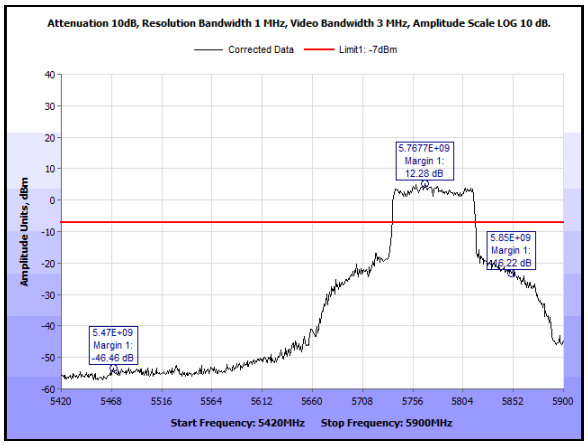
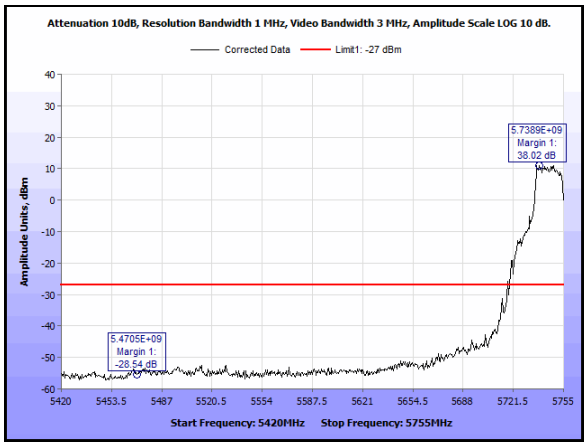
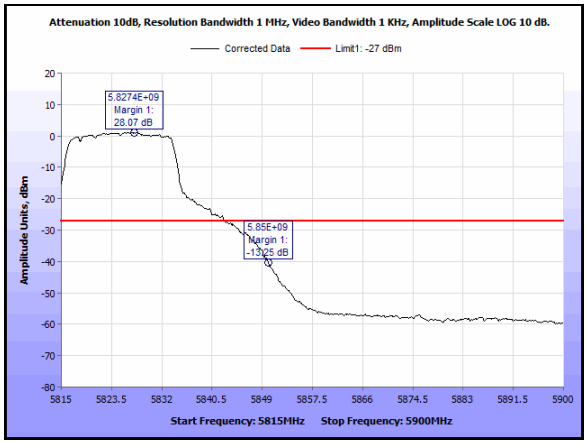


Plot 38. Undesirable Emissions, 802.11ac 80, Spurious Emissions, 5775, Bandedge, Peak



Plot 39. Undesirable Emissions, 802.11n 20, Spurious Emissions, 5745, Bandedge



Plot 40. Undesirable Emissions, 802.11n 20, Spurious Emissions, 5825, Bandedge, Average

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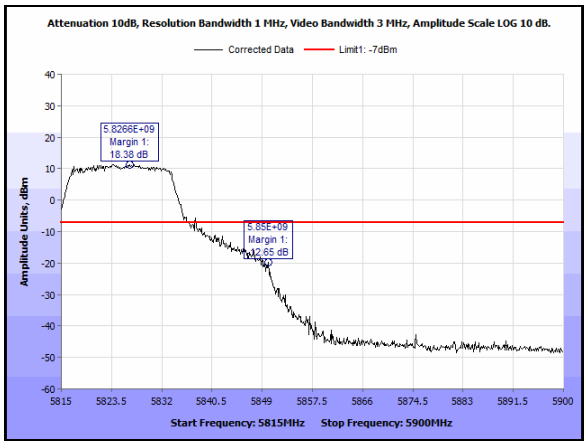
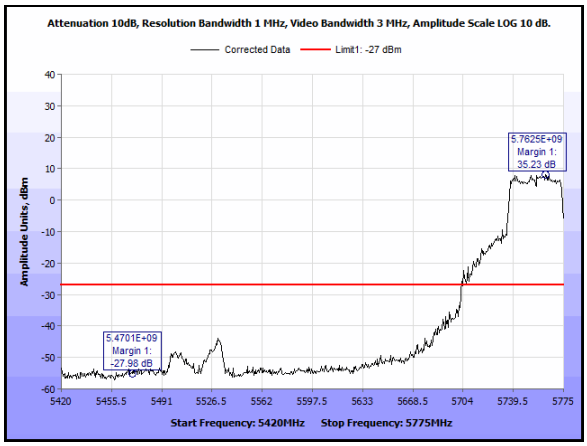
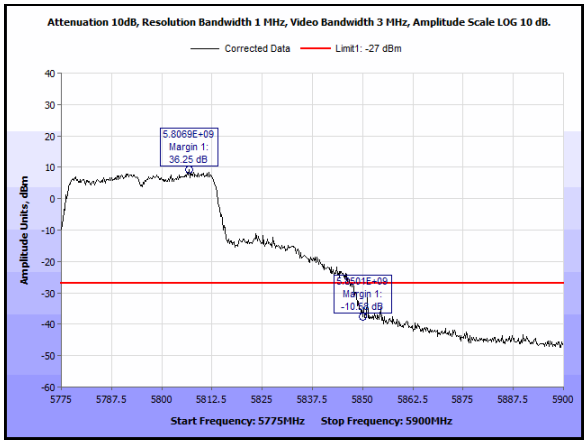


Plot 41. Undesirable Emissions, 802.11n 20, Spurious Emissions, 5825, Bandedge, Peak



Plot 42. Undesirable Emissions, 802.11n 40, Spurious Emissions, 5755, Bandedge



Plot 43. Undesirable Emissions, 802.11n 40, Spurious Emissions, 5795, Bandedge

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

Test Procedure: The EUT was placed on a non-metallic table above a ground plane. 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

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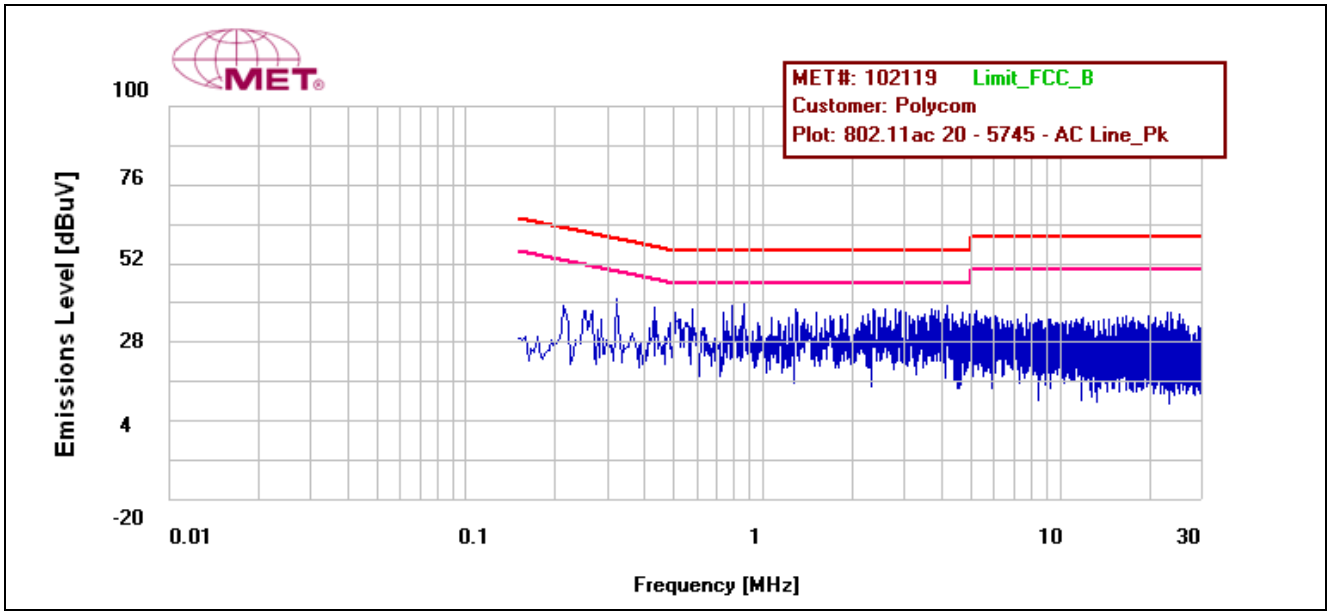
Line	Freq (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
802.11ac 20 - 5745 - AC Line	0.322	40.7	59.672	-18.972	Pass	34.3	49.672	-15.372	Pass
802.11ac 20 - 5745 - AC Line	0.866	40.2	56	-15.8	Pass	32.6	46	-13.4	Pass
802.11ac 20 - 5745 - AC Line	0.214	41.7	63.057	-21.357	Pass	33.8	53.057	-19.257	Pass
802.11ac 20 - 5745 - AC Line	4.198	36.4	56	-19.6	Pass	29.9	46	-16.1	Pass
802.11ac 20 - 5745 - AC Line	0.790	36.7	56	-19.3	Pass	23.5	46	-22.5	Pass
802.11ac 20 - 5745 - AC Line	0.430	39.9	57.277	-17.377	Pass	33.5	47.277	-13.777	Pass
802.11ac 40 - 5755 - AC Line	0.302	39.5	60.204	-20.704	Pass	24.8	50.204	-25.404	Pass
802.11ac 40 - 5755 - AC Line	0.434	40	57.2	-17.2	Pass	33.9	47.2	-13.3	Pass
802.11ac 40 - 5755 - AC Line	0.218	41.3	62.903	-21.603	Pass	33.9	52.903	-19.003	Pass
802.11ac 40 - 5755 - AC Line	0.278	37.1	60.889	-23.789	Pass	25.5	50.889	-25.389	Pass
802.11ac 40 - 5755 - AC Line	1.298	36.6	56	-19.4	Pass	27.6	46	-18.4	Pass
802.11ac 40 - 5755 - AC Line	0.250	38.3	61.769	-23.469	Pass	37.4	51.769	-14.369	Pass
802.11ac 80 - 5775 - AC Line	0.862	39.8	56	-16.2	Pass	32.9	46	-13.1	Pass
802.11ac 80 - 5775 - AC Line	0.290	38.9	60.539	-21.639	Pass	25	50.539	-25.539	Pass
802.11ac 80 - 5775 - AC Line	4.206	35.6	56	-20.4	Pass	29.3	46	-16.7	Pass
802.11ac 80 - 5775 - AC Line	0.250	38.4	61.769	-23.369	Pass	37.4	51.769	-14.369	Pass
802.11ac 80 - 5775 - AC Line	0.538	38	56	-18	Pass	32.2	46	-13.8	Pass
802.11ac 80 - 5775 - AC Line	1.294	37	56	-19	Pass	28.9	46	-17.1	Pass

Table 11. Conducted Emissions, Test Results, Phase Line



Plot 44. Conducted Emissions, Phase Line, 802.11ac 20 MHz, 5745 MHz

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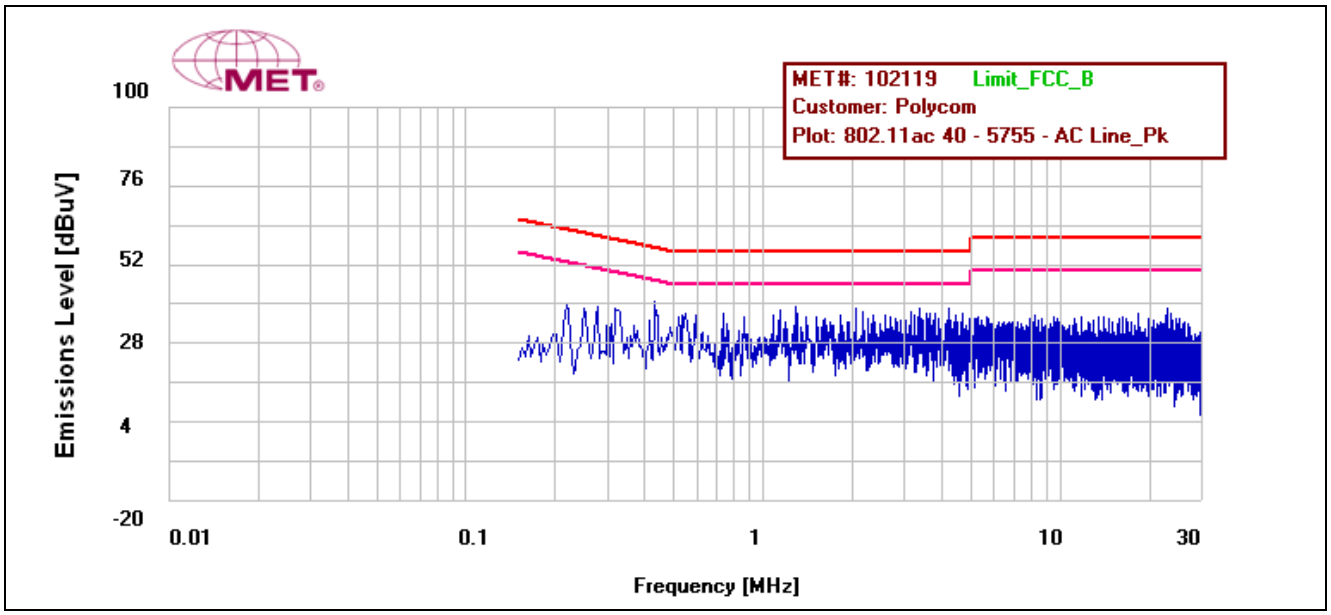
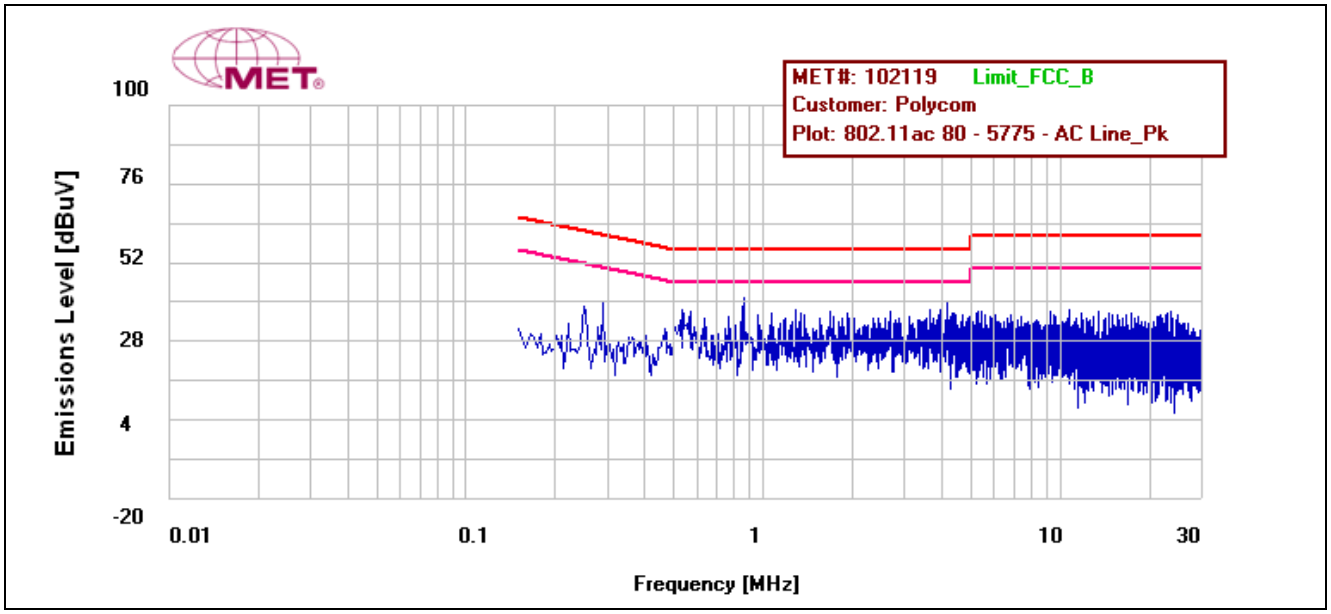


Plot 45. Conducted Emissions, Phase Line, 802.11ac 40 MHz, 5755 MHz



Plot 46. Conducted Emissions, Phase Line, 802.11ac 80 MHz, 5775 MHz

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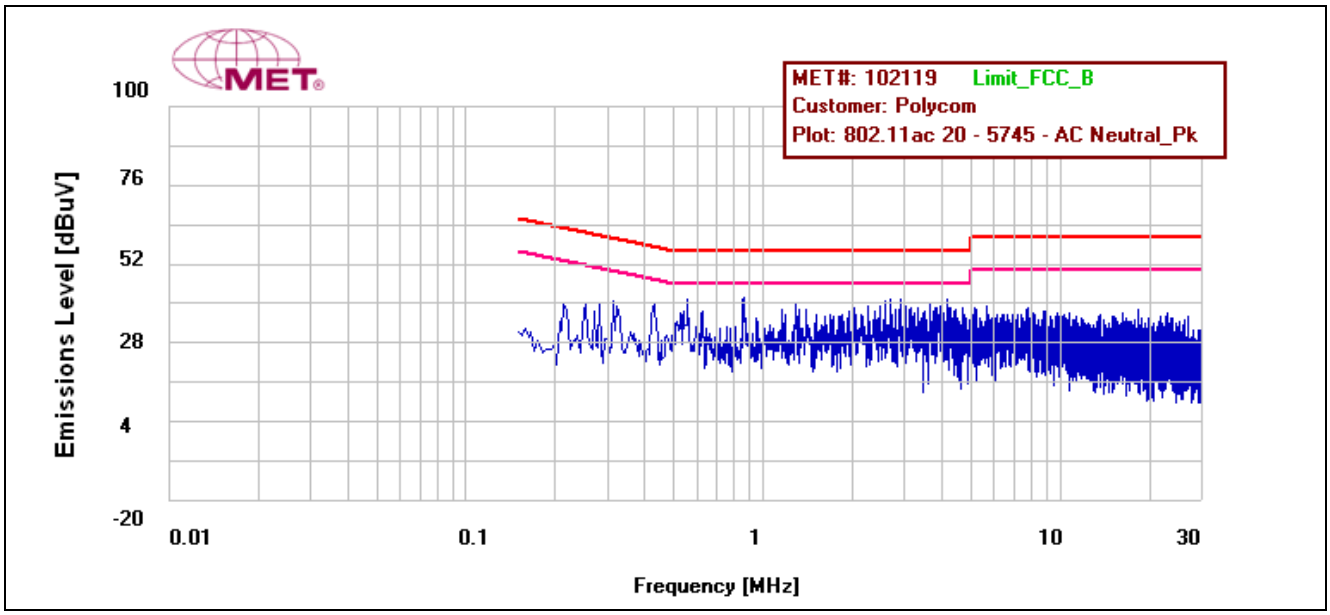
Line	Freq (MHz)	QP Amplitude	QP Limit	Delta	Pass	Average Amplitude	Average Limit	Delta	Pass
802.11ac 20 - 5745 - AC Neutral	0.862	41.3	56	-14.7	Pass	34.4	46	-11.6	Pass
802.11ac 20 - 5745 - AC Neutral	2.682	35.3	56	-20.7	Pass	28	46	-18	Pass
802.11ac 20 - 5745 - AC Neutral	0.558	35.5	56	-20.5	Pass	29.1	46	-16.9	Pass
802.11ac 20 - 5745 - AC Neutral	2.910	38.2	56	-17.8	Pass	31.4	46	-14.6	Pass
802.11ac 20 - 5745 - AC Neutral	4.190	38.8	56	-17.2	Pass	31.6	46	-14.4	Pass
802.11ac 20 - 5745 - AC Neutral	0.314	40.1	59.881	-19.781	Pass	25.8	49.881	-24.081	Pass
802.11ac 40 - 5755 - AC Neutral	0.218	41	62.903	-21.903	Pass	34.3	52.903	-18.603	Pass
802.11ac 40 - 5755 - AC Neutral	0.326	40.9	59.57	-18.67	Pass	34.7	49.57	-14.87	Pass
802.11ac 40 - 5755 - AC Neutral	0.302	39.1	60.204	-21.104	Pass	25.4	50.204	-24.804	Pass
802.11ac 40 - 5755 - AC Neutral	4.466	36.6	56	-19.4	Pass	30.3	46	-15.7	Pass
802.11ac 40 - 5755 - AC Neutral	0.594	37.6	56	-18.4	Pass	27.8	46	-18.2	Pass
802.11ac 40 - 5755 - AC Neutral	5.206	37.5	60	-22.5	Pass	30.7	50	-19.3	Pass
802.11ac 80 - 5775 - AC Neutral	0.862	41.4	56	-14.6	Pass	34.4	46	-11.6	Pass
802.11ac 80 - 5775 - AC Neutral	2.358	36.1	56	-19.9	Pass	28.2	46	-17.8	Pass
802.11ac 80 - 5775 - AC Neutral	3.566	35.9	56	-20.1	Pass	27	46	-19	Pass
802.11ac 80 - 5775 - AC Neutral	2.574	37.2	56	-18.8	Pass	27.5	46	-18.5	Pass
802.11ac 80 - 5775 - AC Neutral	2.898	37.4	56	-18.6	Pass	30	46	-16	Pass
802.11ac 80 - 5775 - AC Neutral	0.538	38.8	56	-17.2	Pass	33.1	46	-12.9	Pass

Table 12. Conducted Emissions, Test Results, Neutral Line



Plot 47. Conducted Emissions, Neutral Line, 802.11ac 20 MHz, 5745 MHz

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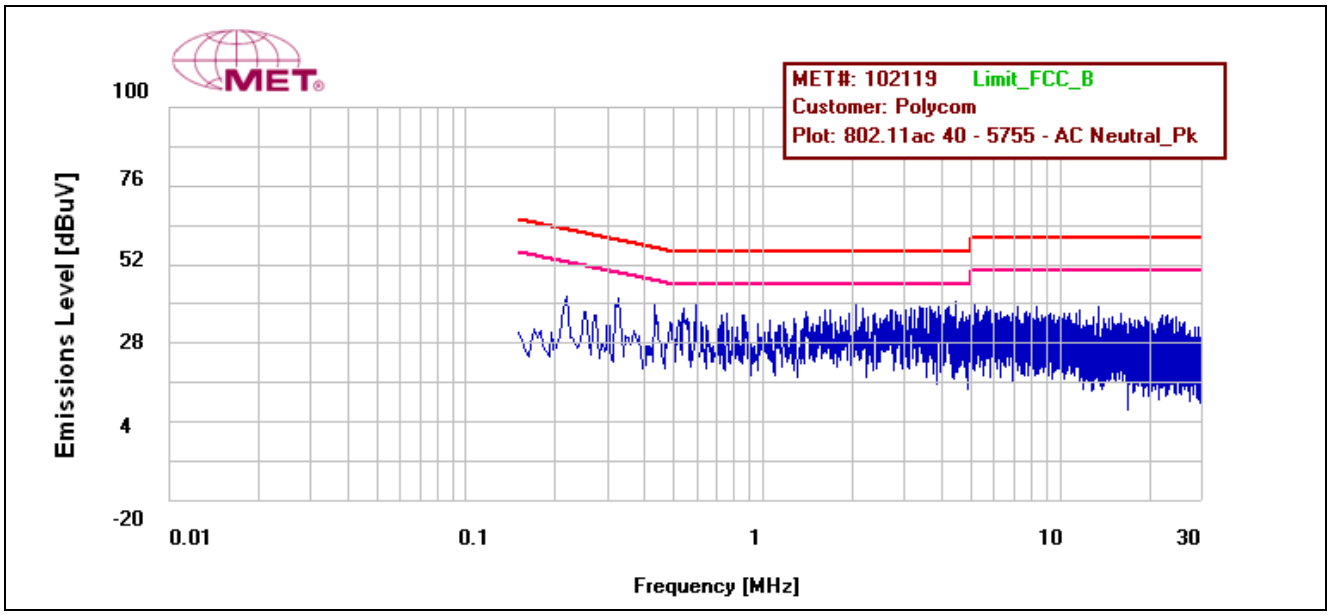
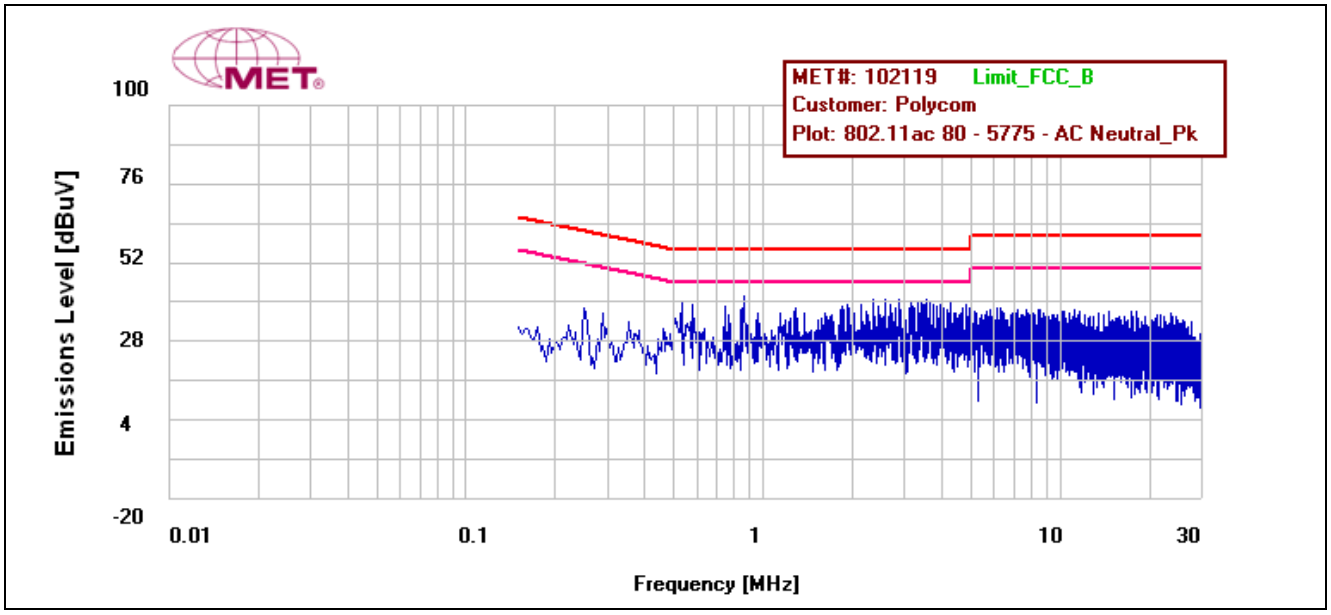


Plot 48. Conducted Emissions, Neutral Line, 802.11ac 40 MHz, 5755 MHz



Plot 49. Conducted Emissions, Neutral Line, 802.11ac 80 MHz, 5775 MHz

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Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15. 407(e) 6 dB Bandwidth

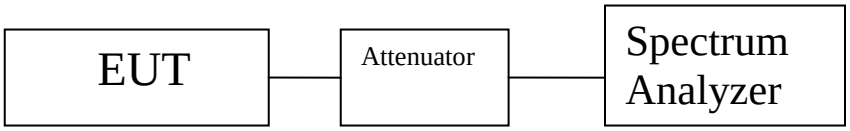
Test Requirements: **§ 15.407(e):** Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

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 6 dB Bandwidth was measured and recorded.

Test Results The 6 dB Bandwidth was compliant with the requirements of this section.

Test Engineer(s): Giuliano Messina

Test Date(s): February 14, 2019



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Mode	Freq (MHz)	-6dB Chain 1 (MHz)	99% Chain 1 (MHz)	-6dB Chain 2 (MHz)	99% Chain 2 (MHz)
802.11a	5745	15.969	16.51	16.418	16.49
802.11a	5785	15.655	16.49	16.022	16.5
802.11a	5825	15.702	16.5	16.201	16.51
802.11n 20	5745	16.931	17.68	16.937	17.65
802.11n 20	5785	17.174	17.68	17.744	17.71
802.11n 20	5825	15.342	17.7	15.924	17.66
802.11ac 20	5745	17.798	17.68	17.749	17.66
802.11ac 20	5785	17.794	17.67	17.787	17.71
802.11ac 20	5825	17.8	17.7	17.753	17.64
802.11n 40	5755	36.326	36.23	36.198	36.19
802.11n 40	5795	36.139	36.2	36.26	36.2
802.11ac 40	5755	36.496	36.43	36.431	36.46
802.11ac 40	5795	36.484	36.42	36.256	36.36
802.11ac 80	5775	76.371	75.99	76.153	75.71

Table 13. 6 dB Occupied Bandwidth, Test Results

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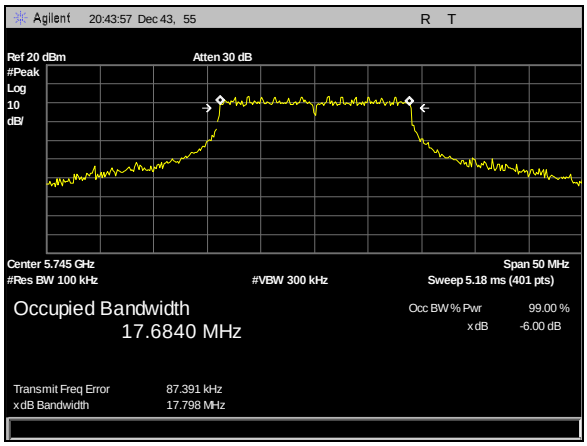
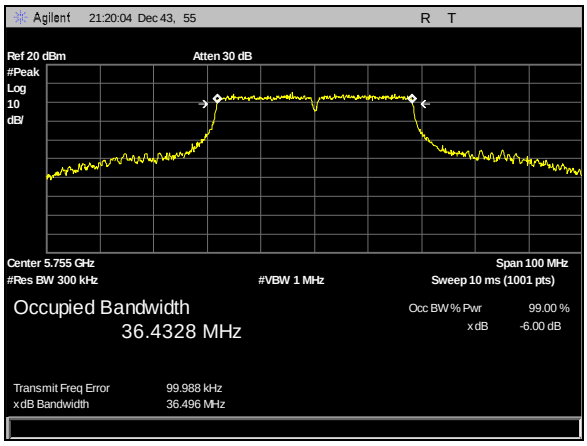
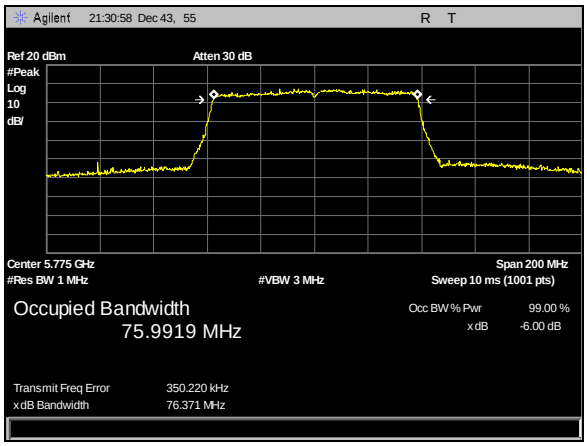


Plot 50. Occupied Bandwidth, 802.11ac 20, 5745, 6dB, 17.798MHz



Plot 51. Occupied Bandwidth, 802.11ac 40, 5755, 6dB, 36.496MHz



Plot 52. Occupied Bandwidth, 802.11ac 80, 5775, 6dB, 76.371MHz

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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 @ 5725 - 5850 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)

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**
5795	16.906	49.046	3	1.995	0.01947	1	0.98053	20	Pass

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

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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.

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IV. Test Equipment

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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 14. Test Equipment List

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

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V. Certification & User's Manual Information

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Certification & User's Manual Information

K. 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.

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(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.

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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.

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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.

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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.

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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.

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End of Report

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