




TEST REPORT


Test Report No. : UL-RPT-RP10895473JD04G V2.0

Manufacturer : Bang & Olufsen a/s
Model No. : WUS-AC08V
FCC ID : TTUWUSAC08V
Technology : WLAN
Test Standard(s) : FCC Parts 15.209(a) & 15.407(b)

1. This test report shall not be reproduced in full or partial, without the written approval of UL VS LTD.
2. The results in this report apply only to the sample(s) tested.
3. The sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 2.0 supersedes all previous versions.

Date of Issue: 25 January 2017

Checked by: 
Sarah Williams
Senior Engineer, Radio Laboratory

Company Signatory: 
Ian Watch
Senior Engineer, Radio Laboratory
UL VS LTD



This laboratory is accredited by UKAS. The tests reported herein have been performed in accordance with its terms of accreditation.

UL VS LTD

Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire, RG23 8BG, UK
Telephone: +44 (0)1256 312000
Facsimile: +44 (0)1256 312001

This page has been left intentionally blank.

Table of Contents

1. Customer Information.....	4
2. Summary of Testing.....	5
2.1. General Information	5
2.2. Summary of Test Results	5
2.3. Methods and Procedures	5
2.4. Deviations from the Test Specification	5
3. Equipment Under Test (EUT)	6
3.1. Identification of Equipment Under Test (EUT)	6
3.1.1 Host Product Details	6
3.2. Description of EUT	6
3.3. Modifications Incorporated in the EUT	6
3.4. Additional Information Related to Testing	7
3.5. Support Equipment	9
4. Operation and Monitoring of the EUT during Testing	12
4.1. Operating Modes	12
4.2. Configuration and Peripherals	12
4.3. Power Settings Used During Testing	13
5. Measurements, Examinations and Derived Results.....	14
5.1. General Comments	14
5.2. Test Results	15
5.2.1. Transmitter Out of Band Radiated Emissions	15
5.2.2. Transmitter Band Edge Radiated Emissions	31
6. Measurement Uncertainty	60
7. Report Revision History	61

1. Customer Information





Company Name:	Bang & Olufsen A/S
Address:	Peter Bangs Vej 15 7600 Struer Denmark

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.407
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart E (Unlicensed National Information Infrastructure Devices) – Sections 15.407
Specification Reference:	47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.209
Site Registration:	209735
Location of Testing:	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	23 January 2017 to 25 January 2017

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.407(b)/15.209(a)	Transmitter Out of Band Radiated Emissions	
Part 15.407(b)/15.209(a)	Transmitter Band Edge Radiated Emissions	
Key to Results		
 = Complied  = Did not comply		

2.3. Methods and Procedures

Reference:	ANSI C63.10-2013
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
Reference:	KDB 789033 D02 General UNII Test Procedures New Rules v01r03 August 22, 2016
Title:	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E

2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specifications identified above.

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	WUS-AC08V
Model Name or Number:	WUS-AC08V
Test Sample MAC address:	542AA22F8F19 (<i>Conducted sample</i>)
Hardware Version:	A1G
Software Version:	4.2.3.5
FCC ID:	TTUWUSAC08V

3.1.1 Host Product Details

Brand Name:	BeoVision Avant 75 NG
Model Name or Number:	BeoVision Avant 75 NG
Test Sample Serial Number:	93010 (<i>Radiated sample</i>)
Hardware Version:	8009004
Software Version:	1.0.66

Description:	AC power cable
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

3.2. Description of EUT

The equipment under test was a *Bluetooth* Basic Rate + EDR, *Bluetooth* Low Energy, IEEE 802.11a,b,g,n,ac WLAN module operating in the 2.4 GHz and 5 GHz bands, which was incorporated into a 75" Television. The EUT has two external antenna ports with two transmit chains and MIMO is supported. For 802.11a/g/n/ac operation the device uses two by two MIMO transmitters. Depending on the 802.11 data rate, the device transmits 1 or 2 spatial stream. The device uses spatial multiplexing and from an RF point of view the streams are correlated.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Technology Tested:	WLAN (IEEE 802.11a,n,ac) / U-NII		
Type of Unit:	Transceiver		
Modulation:	BPSK, QPSK, 16QAM, 64QAM & 256QAM		
Data rates:	802.11a	6, 9, 12, 18, 24, 36, 48 & 54 Mbps	
	802.11n HT20 (SISO)	MCS0 to MCS7	
	802.11n HT20 (MIMO)	MCS0 to MCS15 (CDD MCS0 to MCS7)	
	802.11n HT40 (SISO)	MCS0 to MCS7	
	802.11n HT40 (MIMO)	MCS0 to MCS15 (CDD MCS0 to MCS7)	
	802.11ac VHT20	MCS0 to MCS8	
	802.11ac VHT40	MCS0 to MCS9	
	802.11ac VHT80	MCS0 to MCS9	
Transmit Frequency Band:	5150 MHz to 5250 MHz		
Channel Spacing:	20 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	36	5180
	Middle	40	5200
	Top	48	5240
Channel Spacing:	40 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	38	5190
	Top	46	5230
Channel Spacing:	80 MHz		
Transmit Channel Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Single	42	5210

Additional Information Related to Testing (continued)

Transmit Frequency Band:	5725 MHz to 5850 MHz		
Channel Spacing:	20 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	149	5745
	Middle	157	5785
	Top	165	5825
Channel Spacing:	40 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	151	5755
	Top	159	5795
Channel Spacing:	80 MHz		
Transmit Channel Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Single	155	5775

3.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

Description:	Laptop PC
Brand Name:	Lenovo
Model Name or Number:	T61
Serial Number:	L3E7586

Description:	USB Keyboard
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	HDMI cable. Quantity 3. Length 2m
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	HDMI cable. Quantity 2. Length 3m
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	Now TV set top box
Brand Name:	Sky
Model Name or Number:	2400SK
Serial Number:	1MM4DE006281

Description:	Now TV set top box
Brand Name:	Sky
Model Name or Number:	2400SK
Serial Number:	1MM552038807

Description:	Freeview HD Set Top Box
Brand Name:	Technika
Model Name or Number:	STBHDIS2010
Serial Number:	GRTB58073912047

Support Equipment (continued)

Description:	HDMI media player
Brand Name:	SUMVISION
Model Name or Number:	Cyclone Micro
Serial Number:	SUM091104017

Description:	Ethernet cable. Quantity 3. Length 2m
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	Ethernet cable. Quantity 3. Length 3m
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	Ethernet cable. Quantity 1. Length 5m
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	Ethernet cable. Quantity 1. Length 10m
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	ADSL2+ Modem Router
Brand Name:	Netgear
Model Name or Number:	DG834 v4
Serial Number:	1PL596BD001A4

Description:	ADSL Modem Router
Brand Name:	Linksys
Model Name or Number:	WAG54G
Serial Number:	CF610E100799

Support Equipment (continued)

Description:	USB cable type A male to type A male. Quantity 3. Length 3m
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	Audio cable 3.5mm male to 3.5mm male. Quantity 1. Length 3m
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	Aerial cable. Quantity 1. Length 2m
Brand Name:	Belkin
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	Freeview Set Top Box
Brand Name:	Sagem
Model Name or Number:	251657024
Serial Number:	441901036882

Description:	USB cable type A male to type B male. Quantity 1. Length 3m with 3 FAIR-RITE V0 ferrites and 1 unmarked or stated ferrite
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	Laptop Computer
Brand Name:	Lenovo
Model Name or Number:	E555
Serial Number:	PF03XEND

Description:	USB Hub
Brand Name:	Belkin
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):

- Continuously transmitting with a modulated carrier at maximum power on the bottom, middle and top channels as required using the supported data rates/modulation types.

4.2. Configuration and Peripherals

The EUT was tested in the following configuration(s):

- Controlled using *MT7662U_QA_tool_V1.0.3.0* test application supplied by the customer on a UL laptop PC. The application was used to enable a continuous transmission mode and to select the test channels, data rates and modulation schemes as required.
- All supported modes and channel widths were initially investigated on one channel. The modes that produced the highest power for all bands were:
 - Highest power
 - 802.11a SISO – BPSK / 6 Mbps
 - 802.11a CDD – BPSK / 6 Mbps
 - 802.11n HT20 SISO – 16QAM / 26 Mbps / MCS3
 - 802.11n HT40 SISO – 16QAM / 54 Mbps / MCS3
 - 802.11n HT20 MIMO – QPSK / 13 Mbps / MCS1
 - 802.11n HT40 MIMO – 16QAM / 54 Mbps / MCS3
 - 802.11ac VHT80 SISO – QPSK / 87.8 Mbps / MCS2
 - 802.11ac VHT80 MIMO – 16QAM / 117 Mbps / MCS3
 - Widest bandwidth
 - 802.11a SISO– BPSK / 6 Mbps
 - 802.11a CDD – BPSK / 6 Mbps
 - 802.11n HT20 SISO – BPSK / 6.5 Mbps / MCS0
 - 802.11n HT40 SISO – BPSK / 13.5 Mbps / MCS0
 - 802.11n HT20 MIMO – BPSK / 6.5 Mbps / MCS0
 - 802.11n HT40 MIMO – BPSK / 13.5 Mbps / MCS0
 - 802.11ac VHT80 SISO – QPSK / 87.8 Mbps / MCS2
 - 802.11ac VHT80 MIMO – BPSK / 29.3 Mbps / MCS0
- For 802.11n HT modes, *HT MixMode* & *HT GreenField* data formats were selectable. Both formats were initially compared on a range of modulation types and bandwidths, and found to give identical results. For all tests requiring HT modes, *HT MixMode* was therefore selected.
- For all radiated measurements the EUT, being the TV, was connected to 120 VAC 60 Hz. The customer had fitted a USB cable to the module that was inside the TV. This was used to place the TV into test mode as required.
- The customer declared the power settings which are stated in section 4.3 of this test report.

Configuration and Peripherals (continued)

- Radiated spurious emissions tests were performed with the EUT transmitting with a data rate of 802.11a / 6 Mbps on Antenna 1 as it produced the worst conducted output power and highest spectral density level and was therefore deemed worst case.
- For all radiated tests the support equipment was used to terminate all active ports.

4.3. Power Settings Used During Testing

The manufacturer's declared power settings stated in the table below were used for both SISO and MIMO measurements:

Mode	Power Setting					
	Frequency Band 5.15 to 5.25 GHz			Frequency Band 5.725 to 5.85 GHz		
	Bottom Channel	Middle Channel	Top Channel	Bottom Channel	Middle Channel	Top Channel
802.11a SISO / 6 Mbps	16	16	16	16	16	16
802.11a CDD / 6 Mbps	10	10	10	10	10	10
802.11n HT20 / SISO / MCS0	18	18	18	18	18	18
802.11n HT20 / SISO / MCS3	18	18	18	18	18	18
802.11n HT40 / SISO / MCS0	18	N/A	18	18	N/A	18
802.11n HT40 / SISO / MCS3	18	N/A	18	18	N/A	18
802.11n HT20 / MIMO / MCS0	12	12	12	12	12	12
802.11n HT20 / MIMO / MCS1	12	12	12	12	12	12
802.11n HT40 / MIMO / MCS0	12	N/A	12	12	N/A	12
802.11n HT40 / MIMO / MCS3	12	N/A	12	12	N/A	12
802.11ac VHT80 / SISO / MCS2	N/A	1A	N/A	N/A	1A	N/A
802.11ac VHT80 / MIMO / MCS0	N/A	14	N/A	N/A	14	N/A
802.11ac VHT80 / MIMO / MCS3	N/A	14	N/A	N/A	14	N/A

5. Measurements, Examinations and Derived Results

5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to *Section 6 Measurement Uncertainty* for details.

In accordance with UKAS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

5.2. Test Results

5.2.1. Transmitter Out of Band Radiated Emissions

Test Summary:

Test Engineer:	Georgios Vrezas	Test Date:	25 January 2017
Test Sample Serial Number:	93010		

FCC Reference:	Parts 15.407(b)(1),(6),(7) & 15.209(a)
Test Method Used:	KDB 789033 II.G. & ANSI C63.10 Sections 6.3 and 6.5
Frequency Range:	30 MHz to 1000 MHz

Environmental Conditions:

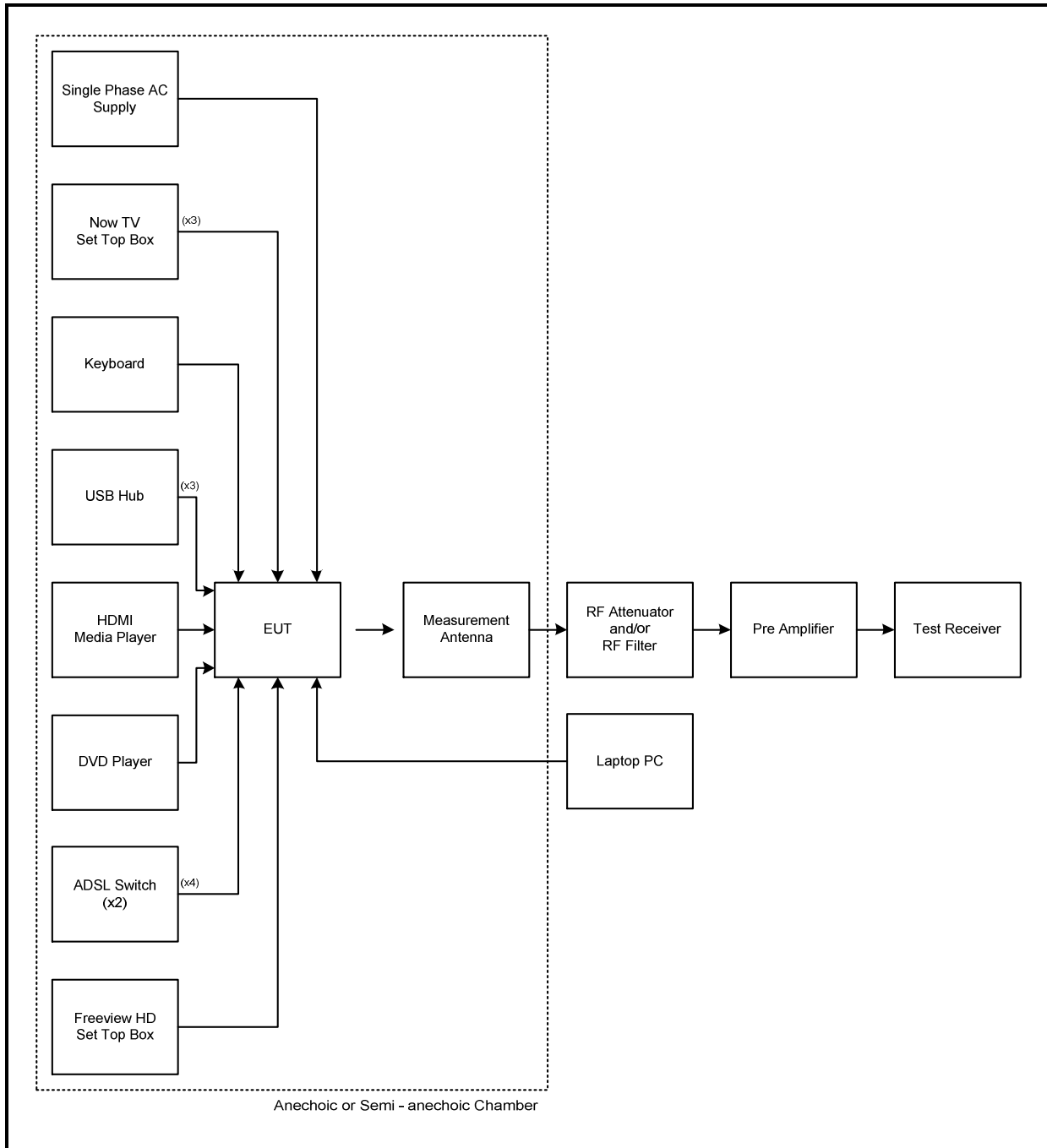
Temperature (°C):	22
Relative Humidity (%):	30

Note(s):

1. Measurements below 1 GHz were limited to the 5.15-5.25 GHz band, the EUT was transmitting with a data rate of 6 Mbps (802.11a) as it produced the highest EIRP and was therefore deemed worst case
2. Pre-scans with the EUT transmitting on the middle channel were measured according to FCC Part 15.407(b)(1) which states for transmitters operating in the band 5.15 to 5.25 GHz: all emissions outside of the band 5.15-5.35 GHz shall not exceed -27 dBm/MHz. Part(b)(6) states unwanted emissions below 1 GHz must comply with the general field strength limits set forth in 15.209. Part(b)(7) states the provisions of 15.205 apply, e.g. restricted bands of operation.
3. The final measured value, for the given emission in the field strength result tables, incorporates the calibrated antenna factor and cable loss.
4. The preliminary scans showed similar emission levels below 1 GHz, for each channel of operation. Therefore final radiated emissions measurements were performed with the EUT set to the middle channel only.
5. In accordance with ANSI C63.10 Section 6.5.4, the frequency and amplitude of the six highest spurious emissions relative to the limit were recorded in the table below.
6. Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed 0.5 metres above the reference ground-plane (in agreement with the FCC via lab KDB correspondence), in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

Transmitter Out of Band Radiated Emissions (continued)

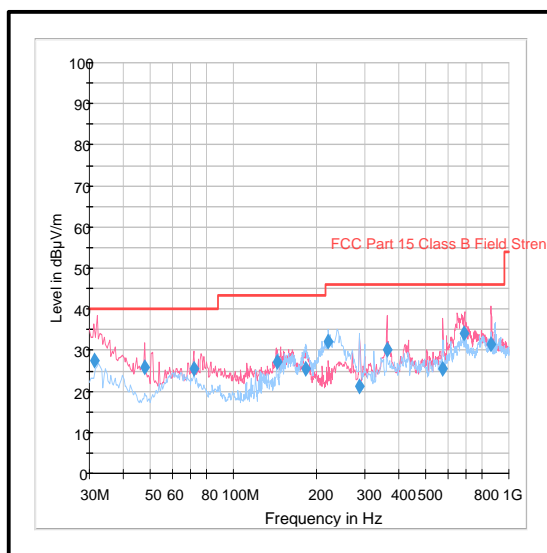
Test setup for radiated measurements:



Note: The number in brackets relates to the quantity of cables which were connected between the TV and the support equipment.

Transmitter Out of Band Radiated Emissions (5.15-5.25 GHz band operation) (continued)**Results: Middle Channel / Field Strength**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
31.459	Vertical	27.5	40.0	12.5	Complied
47.588	Vertical	25.7	40.0	14.3	Complied
71.932	Vertical	25.6	40.0	14.4	Complied
221.168	Horizontal	32.2	46.0	13.8	Complied
689.720	Vertical	34.0	46.0	12.0	Complied
862.828	Vertical	31.3	46.0	14.7	Complied



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2014	Thermohygrometer	Testo	608-H1	45046246	10 Jun 2017	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	07 Dec 2017	12
G0543	Amplifier	Sonoma	310N	230801	09 Jun 2017	6
M1124	Test Receiver	Rohde & Schwarz	ESIB26	100046	31 May 2017	12
A2959	Antenna	Schwarzbeck	VULB 9163	9163-967	08 Sep 2017	12
A1834	Attenuator	Hewlett Packard	8491B	10444	30 Mar 2017	12

Transmitter Out of Band Radiated Emissions (5.15-5.25 GHz band operation) (continued)**Test Summary:**

Test Engineers:	Georgios Vrezas & David Doyle	Test Dates:	24 January 2017 & 25 January 2017
Test Sample Serial Number:	93010		

FCC Reference:	Part 15.407(b)(1),(7) & 15.209(a)
Test Method Used:	KDB 789033 II.G. & ANSI C63.10 Sections 6.3 and 6.6
Frequency Range:	1 GHz to 40 GHz

Environmental Conditions:

Temperature (°C):	22 to 23
Relative Humidity (%):	28 to 30

Transmitter Out of Band Radiated Emissions (5.15-5.25 GHz band operation) (continued)**Note(s):**

1. FCC Part 15.407(b)(1) states for transmitters operating in the band 5.15 to 5.25 GHz: all emissions outside of the 5.15 to 5.35 GHz band will not exceed -27 dBm/MHz. Part(b)(7) states the provisions of 15.205 apply e.g. restricted bands of operation.
2. Pre-scans were performed with the EUT transmitting on middle channel in the 5.15 to 5.25 GHz band. An inquiry was made to the FCC and the response was pre-scans could be performed in the band with the highest EIRP and all final measurements should be performed on any emissions seen in each band.
3. The final measured value, for the given emission in the result tables, incorporates the calibrated antenna factor and cable loss.
4. Appropriate RF filters and attenuators were used during pre-scans and final measurements. Insertion losses were entered on the spectrum analyser as RF levels offsets.
5. In accordance with KDB 789033 Section II.G.6.c) Method AD (vi), the average measurements were performed using an increased number of sweeps. The number of sweeps used was greater than 116.
6. In accordance with KDB 789033 Section II.G.6.c) Method AD (iii), pre-scan plots from 1 to 26.5 GHz were performed using an increased number of sweep points as calculated below:
 - o 1 to 4 GHz – 6001 sweep points
 - o 4 to 6 GHz – 4001 sweep points
 - o 4.5 to 5.15 GHz – 1301 sweep points
 - o 5.35 to 5.46 GHz – 301 sweep points
 - o 6 to 8 GHz – 4001 sweep points
 - o 8 to 12.75 GHz – 9501 sweep points
 - o 12.75 to 18 GHz – 10501 sweep points
 - o 18 to 26.5 GHz – 17001 sweep points
 - o 26.5 GHz to 40 GHz– 27001 sweep points

All other measurements were performed with the Test Receiver's default setting of 625 sweep points.

7. In accordance with KDB 789033 Section II.G.6.c) Method AD (vii), for average measurements on data rates where the EUT was transmitting <98% duty cycle, the duty cycle correction factor was added to the measured result. Refer to UL test report UL-RPT-RP10895558JD02G Section 5.2.4 for duty cycle correction factor calculations.
8. All other emissions shown on the pre-scan plots were investigated and found to be ambient or >20 dB below the applicable limit or below the measurement system noise floor.
9. In accordance with ANSI C63.10 Section 6.6.4.3, the frequency and amplitude of the six highest spurious emissions relative to the limit were recorded in the tables below.
10. Measurements above 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed 0.5 metres above the reference ground-plane (in agreement with the FCC via lab KDB correspondence), in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

Transmitter Out of Band Radiated Emissions (5.15-5.25 GHz band operation) (continued)**Results: Bottom Channel / EIRP**

Frequency (MHz)	Antenna Polarity	Level (dBm)	Limit (dBm)	Margin (dB)	Result
1746.211	Horizontal	-39.3	-27.0	12.3	Complied
1800.149	Horizontal	-38.1	-27.0	11.1	Complied
2009.401	Vertical	-38.7	-27.0	11.7	Complied
2020.584	Vertical	-38.2	-27.0	11.2	Complied
2025.167	Vertical	-37.8	-27.0	10.8	Complied
2618.783	Vertical	-40.8	-27.0	13.8	Complied

Results: Bottom Channel / Field Strength / Peak

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)	Result
1437.263	Vertical	53.1	74.0	20.9	Complied
2700.763	Horizontal	54.3	74.0	19.7	Complied
2850.205	Vertical	55.7	74.0	18.3	Complied
2863.000	Vertical	54.0	74.0	20.0	Complied
2876.846	Vertical	53.8	74.0	20.2	Complied

Results: Bottom Channel / Field Strength / Average

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Duty Cycle correction (dB)	Corrected Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
1437.263	Vertical	37.9	0.6	38.5	54.0	15.5	Complied
2700.763	Horizontal	36.9	0.6	37.5	54.0	16.5	Complied
2850.205	Vertical	34.4	0.6	35.0	54.0	19.0	Complied
2863.000	Vertical	36.5	0.6	37.1	54.0	16.9	Complied
2876.846	Vertical	39.7	0.6	40.3	54.0	13.7	Complied

Transmitter Out of Band Radiated Emissions (5.15-5.25 GHz band operation) (continued)**Results: Middle Channel / EIRP**

Frequency (MHz)	Antenna Polarity	Level (dBm)	Limit (dBm)	Margin (dB)	Result
1746.211	Horizontal	-39.3	-27.0	12.3	Complied
1800.149	Horizontal	-38.1	-27.0	11.1	Complied
2009.401	Vertical	-38.7	-27.0	11.7	Complied
2020.584	Vertical	-38.2	-27.0	11.2	Complied
2025.167	Vertical	-37.8	-27.0	10.8	Complied
2618.783	Vertical	-40.8	-27.0	13.8	Complied

Results: Middle Channel / Field Strength / Peak

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)	Result
1437.263	Vertical	53.1	74.0	20.9	Complied
2700.763	Horizontal	54.3	74.0	19.7	Complied
2850.205	Vertical	55.7	74.0	18.3	Complied
2863.000	Vertical	54.0	74.0	20.0	Complied
2876.846	Vertical	53.8	74.0	20.2	Complied

Results: Middle Channel / Field Strength / Average

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Duty Cycle correction (dB)	Corrected Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
1437.263	Vertical	37.9	0.6	38.5	54.0	15.5	Complied
2700.763	Horizontal	36.9	0.6	37.5	54.0	16.5	Complied
2850.205	Vertical	34.4	0.6	35.0	54.0	19.0	Complied
2863.000	Vertical	36.5	0.6	37.1	54.0	16.9	Complied
2876.846	Vertical	39.7	0.6	40.3	54.0	13.7	Complied

Transmitter Out of Band Radiated Emissions (5.15-5.25 GHz band operation) (continued)**Results: Top Channel / EIRP**

Frequency (MHz)	Antenna Polarity	Level (dBm)	Limit (dBm)	Margin (dB)	Result
1746.211	Horizontal	-39.3	-27.0	12.3	Complied
1800.149	Horizontal	-38.1	-27.0	11.1	Complied
2009.401	Vertical	-38.7	-27.0	11.7	Complied
2020.584	Vertical	-38.2	-27.0	11.2	Complied
2025.167	Vertical	-37.8	-27.0	10.8	Complied
2618.783	Vertical	-40.8	-27.0	13.8	Complied

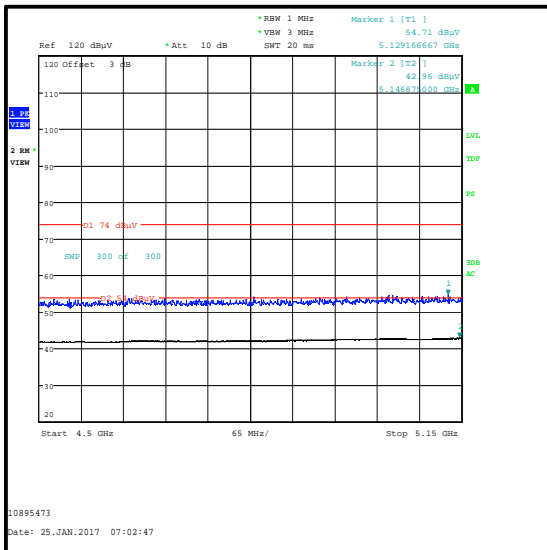
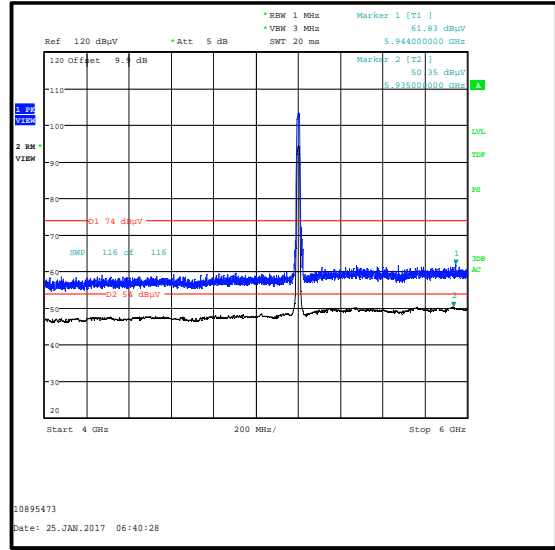
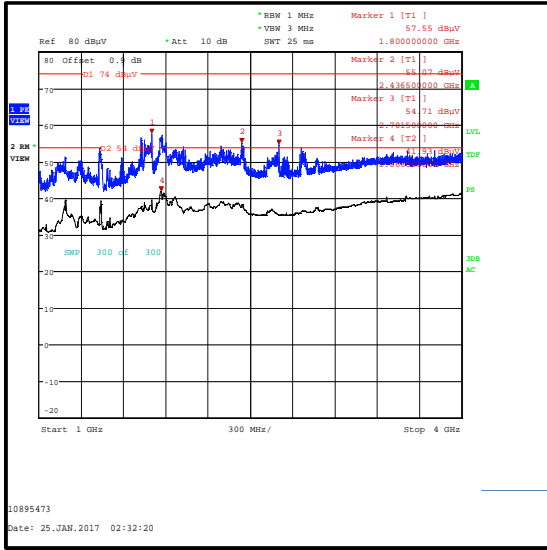
Results: Top Channel / Field Strength / Peak

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)	Result
1437.263	Vertical	53.1	74.0	20.9	Complied
2700.763	Horizontal	54.3	74.0	19.7	Complied
2850.205	Vertical	55.7	74.0	18.3	Complied
2863.000	Vertical	54.0	74.0	20.0	Complied
2876.846	Vertical	53.8	74.0	20.2	Complied

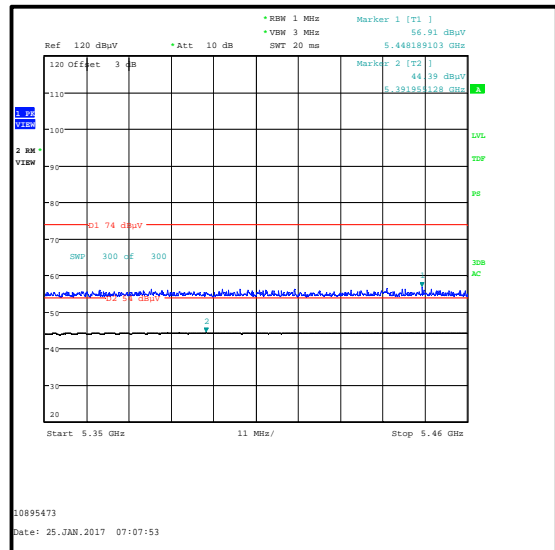
Results: Top Channel / Field Strength / Average

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Duty Cycle correction (dB)	Corrected Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
1437.263	Vertical	37.9	0.6	38.5	54.0	15.5	Complied
2700.763	Horizontal	36.9	0.6	37.5	54.0	16.5	Complied
2850.205	Vertical	34.4	0.6	35.0	54.0	19.0	Complied
2863.000	Vertical	36.5	0.6	37.1	54.0	16.9	Complied
2876.846	Vertical	39.7	0.6	40.3	54.0	13.7	Complied

Transmitter Out of Band Radiated Emissions (5.15-5.25 GHz band operation) (continued)

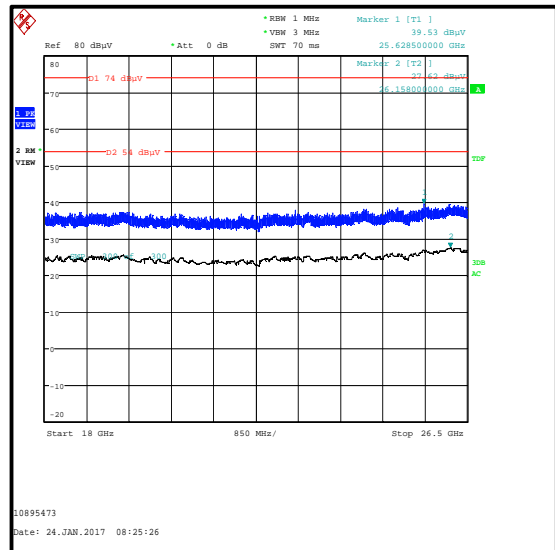
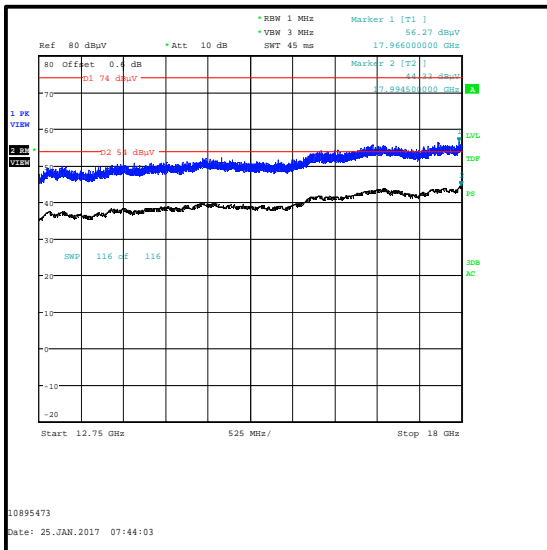
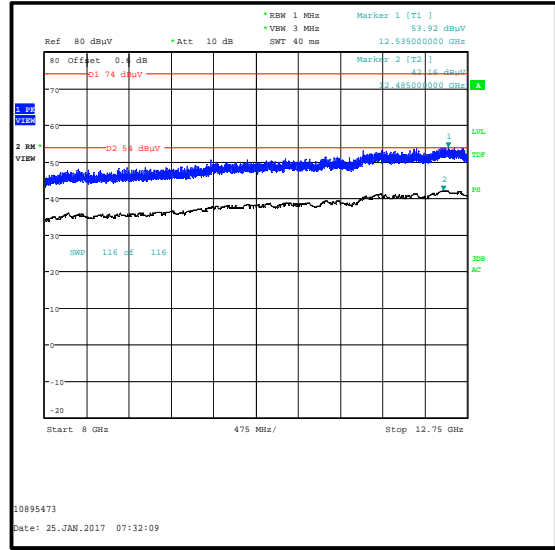
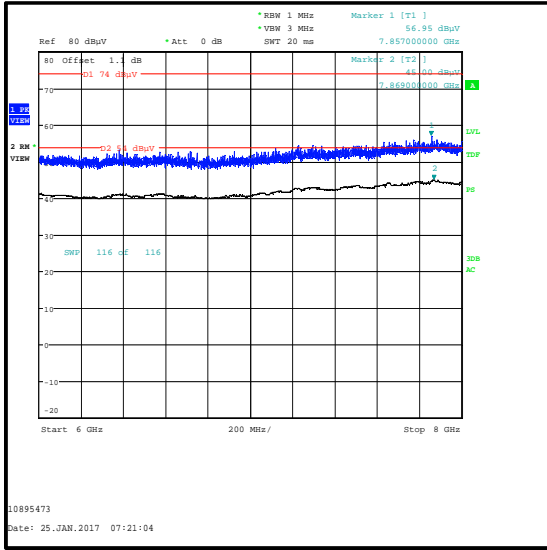


Restricted Band 4.5 GHz to 5.15 GHz

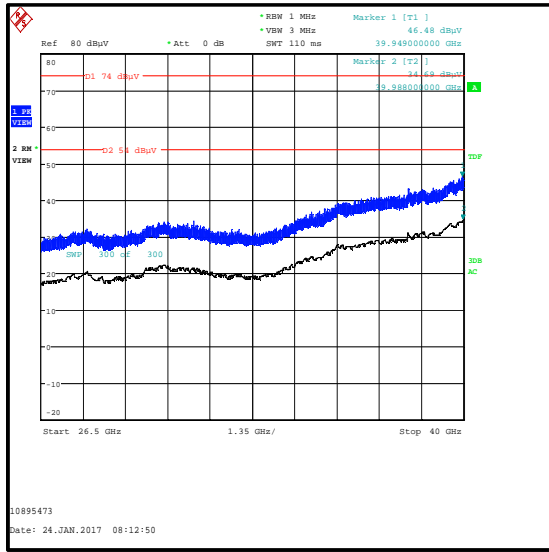


Restricted Band 5.35 GHz to 5.46 GHz

Transmitter Out of Band Radiated Emissions (5.15-5.25 GHz band operation) (continued)



Transmitter Out of Band Radiated Emissions (5.15-5.25 GHz band operation) (continued)



Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Transmitter Out of Band Radiated Emissions (5.725-5.85 GHz band operation) (continued)**Test Summary:**

Test Engineers:	Georgios Vrezas & David Doyle	Test Dates:	24 January 2017 & 25 January 2017
Test Sample Serial Number:	93010		

FCC Reference:	Part 15.407(b)(4)(i),(7) & 15.209(a)
Test Method Used:	KDB 789033 II.G. & ANSI C63.10 Sections 6.3 and 6.6
Frequency Range:	1 GHz to 40 GHz

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	30

Note(s):

1. FCC Part 15.407(b)(4)(i) states for transmitters operating in the band 5.725 to 5.85 GHz: all emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge. Part(b)(7) states the provisions of 15.205 apply e.g. restricted bands of operation
2. Pre-scans were performed with the EUT transmitting on middle channel in 5.15 to 5.25 GHz band. An inquiry was made to the FCC and the response was pre-scans could be performed in the band with the highest conducted output power and all final measurements should be performed on any emissions seen in each band.
3. The final measured value, for the given emission in the result tables, incorporates the calibrated antenna factor and cable loss.
4. Appropriate RF filters and attenuators were used during pre-scans and final measurements. Insertion losses were entered on the spectrum analyser as RF levels offsets.
5. In accordance with KDB 789033 Section II.G.6.c) Method AD (vii), for average measurements on data rates where the EUT was transmitting <98% duty cycle, the duty cycle correction factor was added to the measured result. Refer to UL test report UL-RPT-RP10895558JD02G Section 5.2.4 for duty cycle correction factor calculations.
6. All other emissions shown on the pre-scan plot were investigated and found to be ambient or >20 dB below the applicable limit or below the measurement system noise floor.
7. In accordance with ANSI C63.10 Section 6.6.4.3, the frequency and amplitude of the six highest spurious emissions relative to the limit were recorded in the tables below.
8. Measurements above 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed 0.5 metres above the reference ground-plane (in agreement with the FCC via lab KDB correspondence), in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

Transmitter Out of Band Radiated Emissions (5.725-5.85 GHz band operation) (continued)**Results: Bottom Channel / EIRP**

Frequency (MHz)	Antenna Polarity	Level (dBm)	Limit (dBm)	Margin (dB)	Result
1746.211	Horizontal	-39.3	-27.0	12.3	Complied
1800.149	Horizontal	-38.1	-27.0	11.1	Complied
2009.401	Vertical	-38.7	-27.0	11.7	Complied
2020.584	Vertical	-38.2	-27.0	11.2	Complied
2025.167	Vertical	-37.8	-27.0	10.8	Complied
2618.783	Vertical	-40.8	-27.0	13.8	Complied

Results: Bottom Channel / Field Strength / Peak

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)	Result
1437.263	Vertical	53.1	74.0	20.9	Complied
2700.763	Horizontal	54.3	74.0	19.7	Complied
2850.205	Vertical	55.7	74.0	18.3	Complied
2863.000	Vertical	54.0	74.0	20.0	Complied
2876.846	Vertical	53.8	74.0	20.2	Complied

Results: Bottom Channel / Field Strength / Average

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Duty Cycle correction (dB)	Corrected Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
1437.263	Vertical	37.9	0.6	38.5	54.0	15.5	Complied
2700.763	Horizontal	36.9	0.6	37.5	54.0	16.5	Complied
2850.205	Vertical	34.4	0.6	35.0	54.0	19.0	Complied
2863.000	Vertical	36.5	0.6	37.1	54.0	16.9	Complied
2876.846	Vertical	39.7	0.6	40.3	54.0	13.7	Complied

Transmitter Out of Band Radiated Emissions (5.725-5.85 GHz band operation) (continued)**Results: Middle Channel / EIRP**

Frequency (MHz)	Antenna Polarity	Level (dBm)	Limit (dBm)	Margin (dB)	Result
1746.211	Horizontal	-39.3	-27.0	12.3	Complied
1800.149	Horizontal	-38.1	-27.0	11.1	Complied
2009.401	Vertical	-38.7	-27.0	11.7	Complied
2020.584	Vertical	-38.2	-27.0	11.2	Complied
2025.167	Vertical	-37.8	-27.0	10.8	Complied
2618.783	Vertical	-40.8	-27.0	13.8	Complied

Results: Middle Channel / Field Strength / Peak

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)	Result
1437.263	Vertical	53.1	74.0	20.9	Complied
2700.763	Horizontal	54.3	74.0	19.7	Complied
2850.205	Vertical	55.7	74.0	18.3	Complied
2863.000	Vertical	54.0	74.0	20.0	Complied
2876.846	Vertical	53.8	74.0	20.2	Complied

Results: Middle Channel / Field Strength / Average

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Duty Cycle correction (dB)	Corrected Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
1437.263	Vertical	37.9	0.6	38.5	54.0	15.5	Complied
2700.763	Horizontal	36.9	0.6	37.5	54.0	16.5	Complied
2850.205	Vertical	34.4	0.6	35.0	54.0	19.0	Complied
2863.000	Vertical	36.5	0.6	37.1	54.0	16.9	Complied
2876.846	Vertical	39.7	0.6	40.3	54.0	13.7	Complied

Transmitter Out of Band Radiated Emissions (5.725-5.85 GHz band operation) (continued)**Results: Top Channel / EIRP**

Frequency (MHz)	Antenna Polarity	Level (dBm)	Limit (dBm)	Margin (dB)	Result
1746.211	Horizontal	-39.3	-27.0	12.3	Complied
1800.149	Horizontal	-38.1	-27.0	11.1	Complied
2009.401	Vertical	-38.7	-27.0	11.7	Complied
2020.584	Vertical	-38.2	-27.0	11.2	Complied
2025.167	Vertical	-37.8	-27.0	10.8	Complied
2618.783	Vertical	-40.8	-27.0	13.8	Complied

Results: Top Channel / Field Strength / Peak

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)	Result
1437.263	Vertical	53.1	74.0	20.9	Complied
2700.763	Horizontal	54.3	74.0	19.7	Complied
2850.205	Vertical	55.7	74.0	18.3	Complied
2863.000	Vertical	54.0	74.0	20.0	Complied
2876.846	Vertical	53.8	74.0	20.2	Complied

Results: Top Channel / Field Strength / Average

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Duty Cycle correction (dB)	Corrected Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
1437.263	Vertical	37.9	0.6	38.5	54.0	15.5	Complied
2700.763	Horizontal	36.9	0.6	37.5	54.0	16.5	Complied
2850.205	Vertical	34.4	0.6	35.0	54.0	19.0	Complied
2863.000	Vertical	36.5	0.6	37.1	54.0	16.9	Complied
2876.846	Vertical	39.7	0.6	40.3	54.0	13.7	Complied

Transmitter Out of Band Radiated Emissions (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2014	Thermohygrometer	Testo	608-H1	45046246	10 Jun 2017	12
K0001	3m RSE Chamber	Rainford EMC	N/A	N/A	07 Dec 2017	12
M1630	Test receiver	Rohde & Schwarz	ESU40	100233	17 Feb 2017	12
A1227	Pre-Amplifier	Agilent	8449B	3008A01566	09 Jun 2017	6
A2893	Pre-Amplifier	Schwarzbeck	BBV 9721	9721-021	07 Apr 2017	12
A1817	Antenna	EMCO	3115	00075694	14 Oct 2017	12
A2699	Antenna	EMCO	3115	6738	26 May 2017	12
A2898	Antenna	Schwarzbeck	HWRD 750	013	06 May 2017	12
A2899	Antenna	Schwarzbeck	BBHA 9120 B	BBHA 9120 B 652	06 May 2017	12
A2892	Antenna	Schwarzbeck	BBHA 9170	9170-727	07 Apr 2017	12
A1395	Attenuator	Huber & Suhner	6806.17.B	753459	04 Nov 2017	12
A2941	Attenuator	AtlanTecRF	AN18W5-03	208440#1	Calibrated before use	-
A2974	High Pass Filter	AtlanTecRF	AFH-06000	15032501232	04 Nov 2017	12
A2176	High Pass Filter	AtlanTecRF	AFH-07000	800980	26 Apr 2017	12
A2133	Low Pass Filter	AtlanTecRF	AFL-04000	JFB1006-002	26 Apr 2017	12
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	02 May 2017	12

5.2.2. Transmitter Band Edge Radiated Emissions**Test Summary:**

Test Engineer:	Georgios Vrezas	Test Dates:	23 January 2017 & 24 January 2017
Test Sample Serial Number:	93010		

FCC Reference:	Parts 15.407(b)(1),(7), 15.205 & 15.209(a)
Test Method Used:	ANSI C63.10 Section 6.10 & KDB 789033 II.G.

Environmental Conditions:

Temperature (°C):	21
Relative Humidity (%):	30

Note(s):

1. Band edge measurements were performed in the EUT modes that produce the highest power and the widest bandwidths. The modes were:
 - 802.11a - BPSK / 6 Mbps
 - 802.11a CDD - BPSK / 6 Mbps
 - 802.11n HT20 SISO - BPSK / MCS0 & 16QAM / MCS3
 - 802.11n HT40 SISO - BPSK / MCS0 & 16QAM / MCS3
 - 802.11n HT20 MIMO - BPSK / MCS0 & QPSK / MCS1
 - 802.11n HT40 MIMO - BPSK / MCS0 & 16QAM / MCS3
 - 802.11ac VHT80 SISO - QPSK / MCS2
 - 802.11ac VHT80 MIMO - BPSK / MCS0 & 16QAM / MCS3
2. Lower band edge measurements were performed with the EUT transmitting on the bottom or single channel. Upper band edge measurements were performed with the EUT transmitting on the top or single channel.
3. For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. However, there are restricted bands of operation below the lower band edge at 4.5-5.15 GHz and also above the upper band edge at 5.35-5.46 GHz therefore the provisions of FCC Part 15.205 apply.
4. Field strength measurements using peak and average detectors were performed in the restricted bands below 5.15 GHz and above 5.35 GHz. Field strength and EIRP results were found to be compliant with the restricted band limits and Part 15.407 out-of-band limits.

Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)**Note(s):**

5. In accordance with KDB 789033 Section II.G.6.c) Method AD (vi), the average measurements were performed using a number of sweeps greater than the number of sweeps calculated below:
 - 802.11a - BPSK / 6 Mbps – 116 sweeps
 - 802.11a CDD - BPSK / 6 Mbps – 115 sweeps
 - 802.11n HT20 SISO - BPSK / MCS0 – 117 sweeps
 - 802.11n HT20 SISO – 16QAM / MCS3 – 165 sweeps
 - 802.11n HT40 SISO - BPSK / MCS0 – 134 sweeps
 - 802.11n HT40 SISO – 16QAM / MCS3 – 206 sweeps
 - 802.11n HT20 MIMO - BPSK / MCS0 – 133 sweeps
 - 802.11n HT20 MIMO - QPSK / MCS1 – 164 sweeps
 - 802.11n HT40 MIMO - BPSK / MCS0 – 158 sweeps
 - 802.11n HT40 MIMO – 16QAM / MCS3 – 272 sweeps
 - 802.11ac VHT80 SISO - QPSK / MCS2 – 247 sweeps
 - 802.11ac VHT80 MIMO - BPSK / MCS0 – 161 sweeps
 - 802.11ac VHT80 MIMO – 16QAM / MCS3 – 323 sweeps
6. In accordance with KDB 789033 Section II.G.6.c) Method AD (vii), for average measurements on data rates where the EUT was transmitting <98% duty cycle, the duty cycle correction factor was added to the measured result. Refer to UL test report UL-RPT-RP10895558JD02G Section 5.2.4 for duty cycle correction factor calculations.

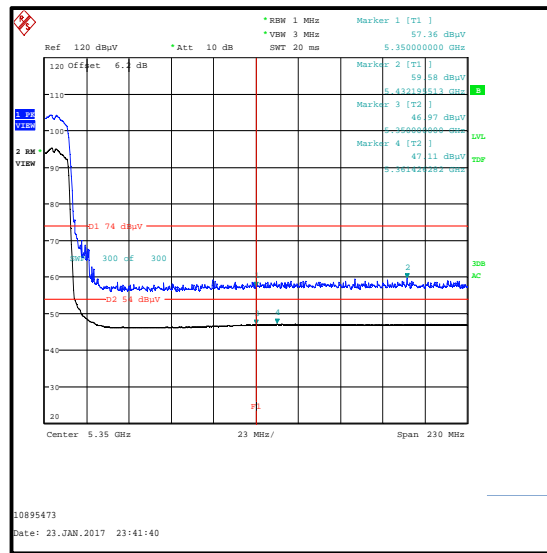
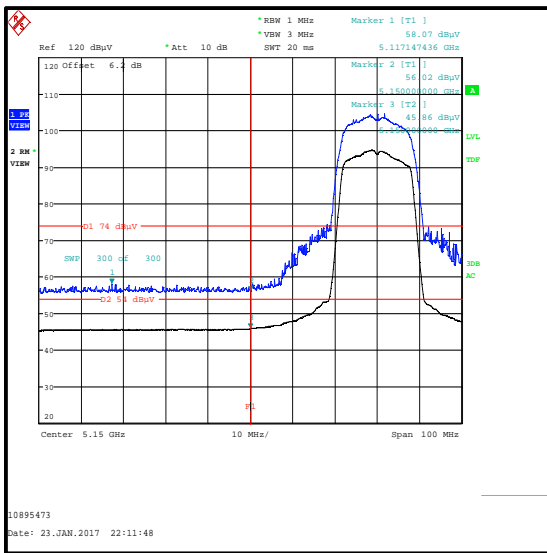
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

Results: 802.11a / 20 MHz / BPSK / 6 Mbps / Peak

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5117.147	58.1	74.0	15.9	Complied
5150	56.0	74.0	18.0	Complied
5350	57.4	74.0	16.6	Complied
5432.196	59.6	74.0	14.4	Complied

Results: 802.11a / 20 MHz / BPSK / 6 Mbps / Average

Frequency (MHz)	Level (dBμV/m)	Duty Cycle correction (dB)	Corrected Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5150	45.9	0.6	46.5	54.0	7.5	Complied
5350	47.0	0.6	47.6	54.0	6.4	Complied
5361.426	47.1	0.6	47.7	54.0	6.3	Complied



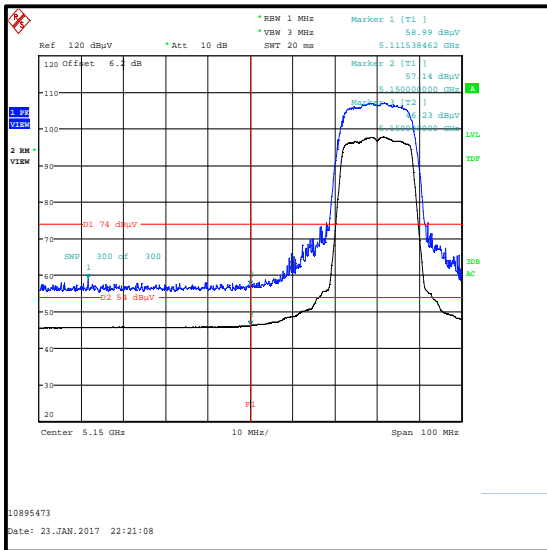
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

Results: 802.11a / 20 MHz / CDD / BPSK / 6 Mbps / Peak

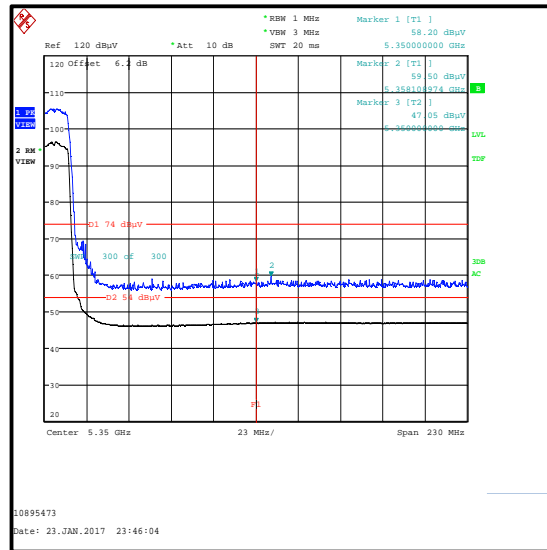
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5111.538	59.0	74.0	15.0	Complied
5150	57.1	74.0	16.9	Complied
5350	58.2	74.0	15.8	Complied
5358.109	59.5	74.0	14.5	Complied

Results: 802.11a / 20 MHz / CDD / BPSK / 6 Mbps / Average

Frequency (MHz)	Level (dBμV/m)	Duty Cycle correction (dB)	Corrected Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5150	46.2	0.6	46.8	54.0	7.2	Complied
5350	47.1	0.6	47.7	54.0	6.3	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

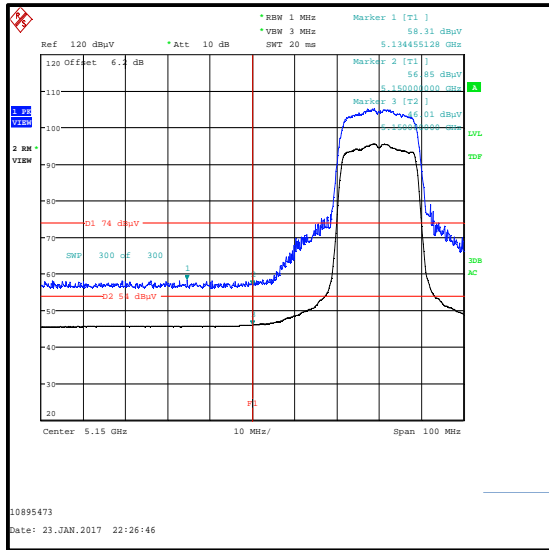
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Peak

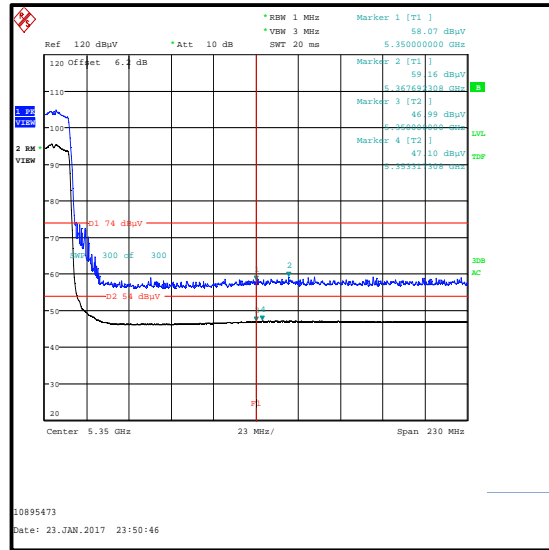
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5134.455	58.3	74.0	15.7	Complied
5150	56.9	74.0	17.1	Complied
5350	58.1	74.0	15.9	Complied
5367.692	59.2	74.0	14.8	Complied

Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Average

Frequency (MHz)	Level (dBμV/m)	Duty Cycle correction (dB)	Corrected Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5150	46.0	0.6	46.6	54.0	7.4	Complied
5350	47.0	0.6	47.6	54.0	6.4	Complied
5353.317	47.1	0.6	47.7	54.0	6.3	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

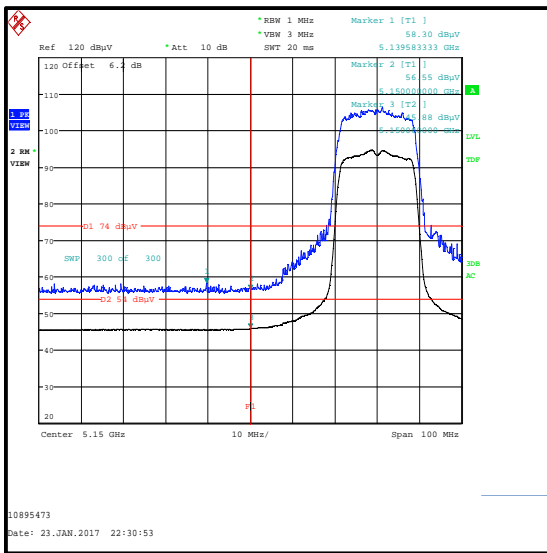
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

Results: 802.11n / 20 MHz / SISO / 16QAM / MCS3 / Peak

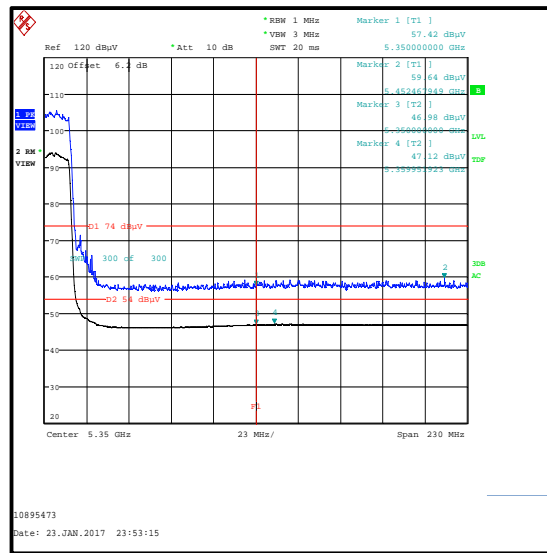
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5139.583	58.3	74.0	15.7	Complied
5150	56.6	74.0	17.4	Complied
5350	57.4	74.0	16.6	Complied
5452.468	59.6	74.0	14.4	Complied

Results: 802.11n / 20 MHz / SISO / 16QAM / MCS3 / Average

Frequency (MHz)	Level (dBμV/m)	Duty Cycle correction (dB)	Corrected Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5150	45.9	2.0	47.9	54.0	6.1	Complied
5350	47.0	2.0	49.0	54.0	5.0	Complied
5359.952	47.1	2.0	49.1	54.0	4.9	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

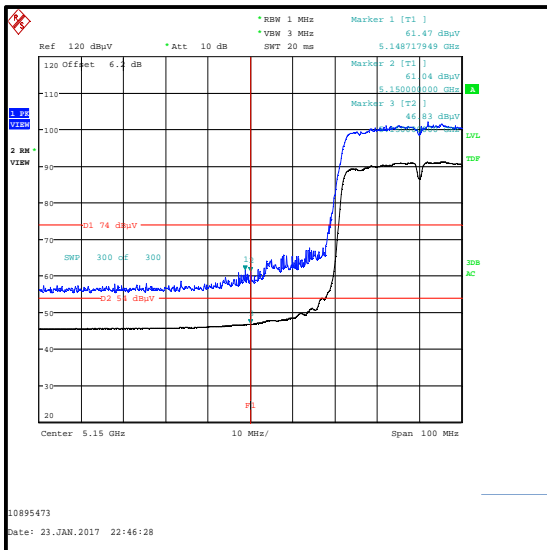
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Peak

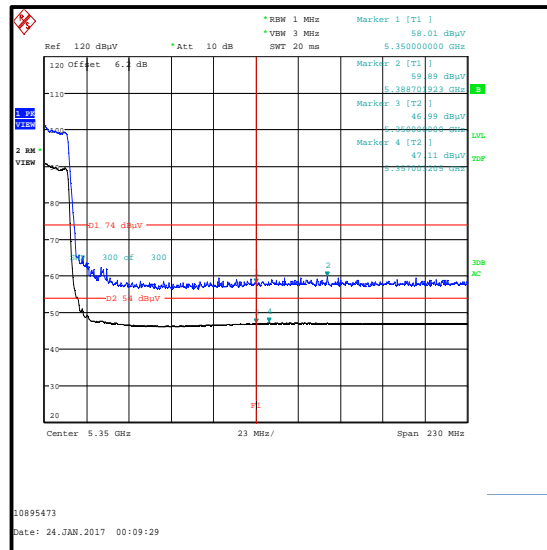
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5148.718	61.5	74.0	12.5	Complied
5150	61.0	74.0	13.0	Complied
5350	58.0	74.0	16.0	Complied
5388.702	59.9	74.0	14.1	Complied

Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Average

Frequency (MHz)	Level (dBμV/m)	Duty Cycle correction (dB)	Corrected Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5150	46.8	1.2	48.0	54.0	6.0	Complied
5350	47.0	1.2	48.2	54.0	5.8	Complied
5357.003	47.1	1.2	48.3	54.0	5.7	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

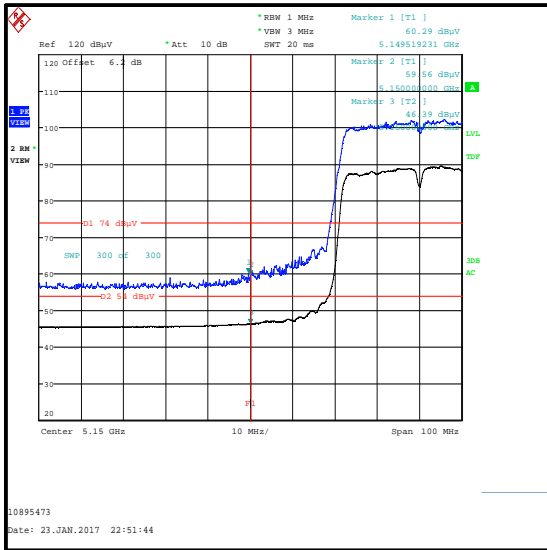
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

Results: 802.11n / 40 MHz / SISO / 16QAM / MCS3 / Peak

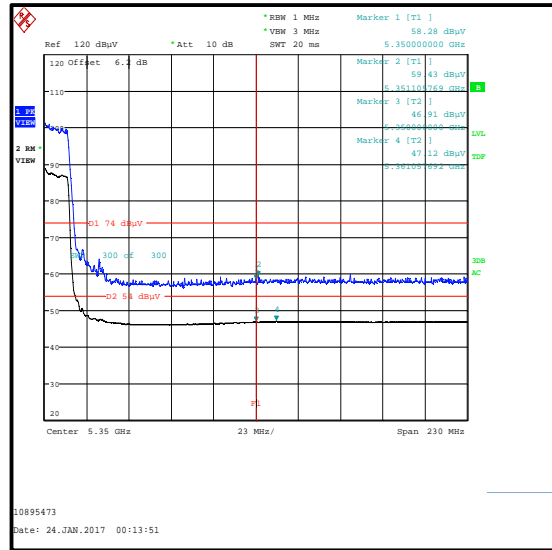
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5149.519	60.3	74.0	13.7	Complied
5150	59.6	74.0	14.4	Complied
5350	58.3	74.0	15.7	Complied
5351.106	59.4	74.0	14.6	Complied

Results: 802.11n / 40 MHz / SISO / 16QAM / MCS3 / Average

Frequency (MHz)	Level (dBμV/m)	Duty Cycle correction (dB)	Corrected Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5150	46.4	3.1	49.5	54.0	4.5	Complied
5350	46.9	3.1	50.0	54.0	4.0	Complied
5361.058	47.1	3.1	50.2	54.0	3.8	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

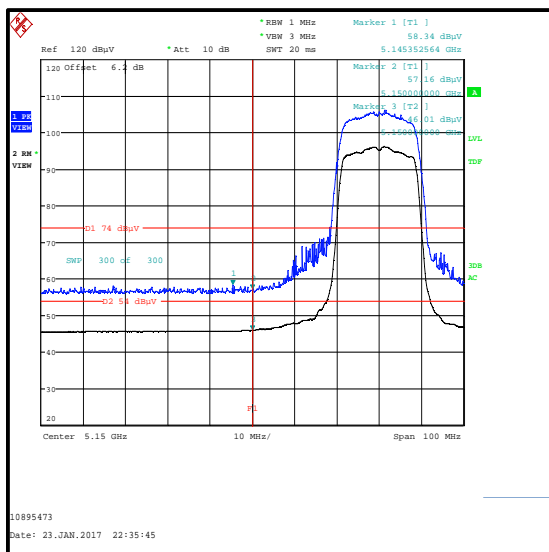
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

Results: 802.11n / 20 MHz / MIMO / BPSK / MCS0 / Peak

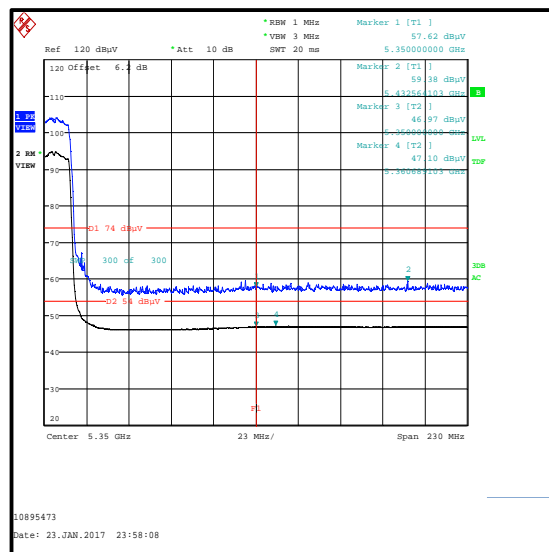
Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5145.353	58.3	74.0	15.7	Complied
5150	57.2	74.0	16.8	Complied
5350	57.6	74.0	16.4	Complied
5432.564	59.4	74.0	14.6	Complied

Results: 802.11n / 20 MHz / MIMO / BPSK / MCS0 / Average

Frequency (MHz)	Level (dB μ V/m)	Duty Cycle correction (dB)	Corrected Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5150	46.0	0.6	46.6	54.0	7.4	Complied
5350	47.0	0.6	47.6	54.0	6.4	Complied
5360.689	47.1	0.6	47.7	54.0	6.3	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

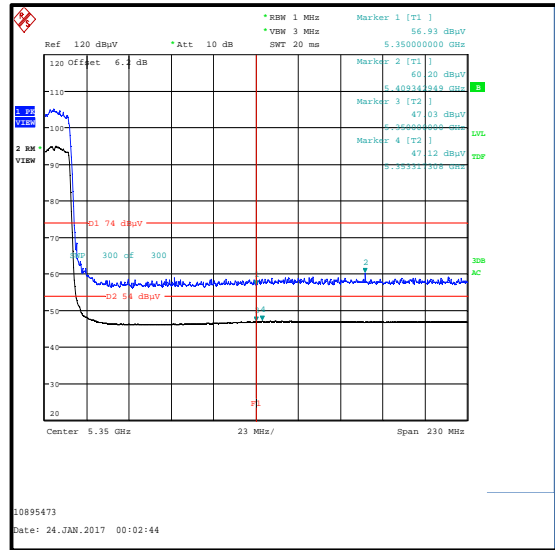
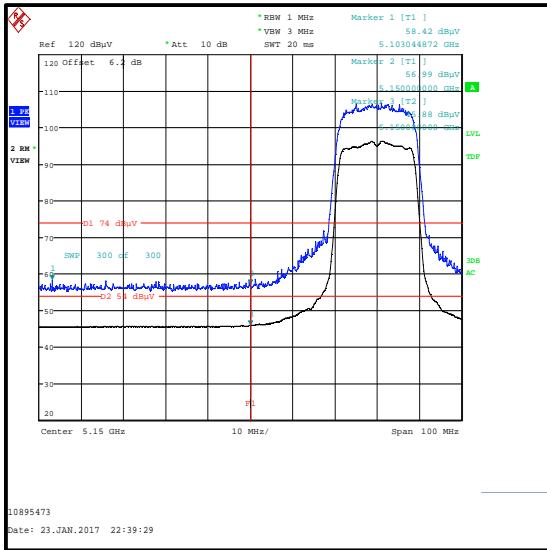
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

Results: 802.11n / 20 MHz / MIMO / QPSK / MCS1 / Peak

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5103.045	58.4	74.0	15.6	Complied
5150	57.0	74.0	17.0	Complied
5350	56.9	74.0	17.1	Complied
5409.343	60.2	74.0	13.8	Complied

Results: 802.11n / 20 MHz / MIMO / QPSK / MCS1 / Average

Frequency (MHz)	Level (dBμV/m)	Duty Cycle correction (dB)	Corrected Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5150	45.9	1.1	47.0	54.0	7.0	Complied
5350	47.0	1.1	48.1	54.0	5.9	Complied
5353.317	47.1	1.1	48.2	54.0	5.8	Complied



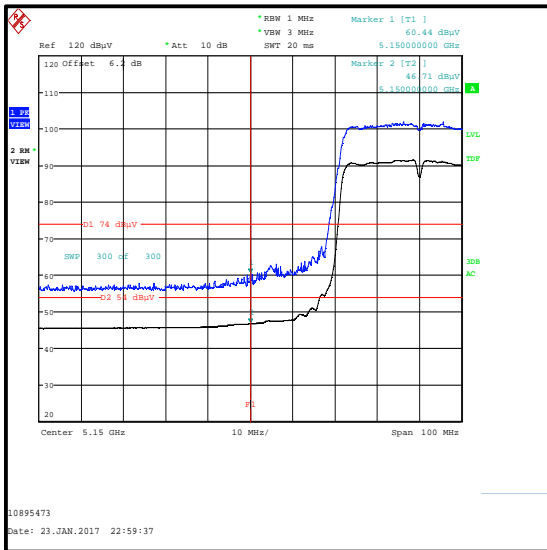
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

Results: 802.11n / 40 MHz / MIMO / BPSK / MCS0 / Peak

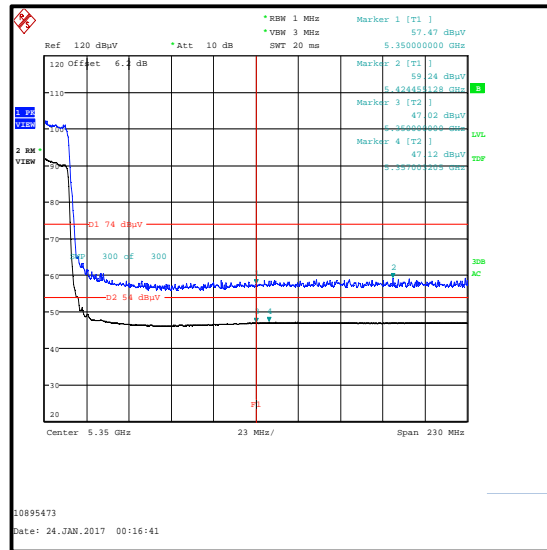
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5150	60.4	74.0	13.6	Complied
5350	57.5	74.0	16.5	Complied
5424.455	59.2	74.0	14.8	Complied

Results: 802.11n / 40 MHz / MIMO / BPSK / MCS0 / Average

Frequency (MHz)	Level (dBμV/m)	Duty Cycle correction (dB)	Corrected Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5150	46.7	1.2	47.9	54.0	6.1	Complied
5350	47.0	1.2	48.2	54.0	5.8	Complied
5357.003	47.1	1.2	48.3	54.0	5.7	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

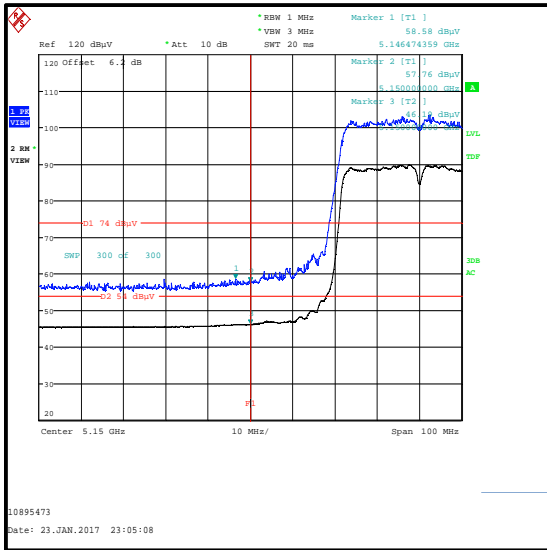
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

Results: 802.11n / 40 MHz / MIMO / 16QAM / MCS3 / Peak

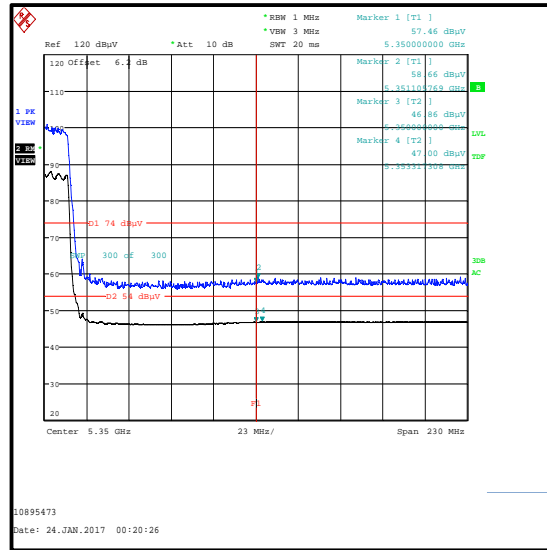
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5146.474	58.6	74.0	15.4	Complied
5150	57.8	74.0	16.2	Complied
5350	57.5	74.0	16.5	Complied
5351.106	58.7	74.0	15.3	Complied

Results: 802.11n / 40 MHz / MIMO / 16QAM / MCS3 / Average

Frequency (MHz)	Level (dBμV/m)	Duty cycle correction (dB)	Corrected Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5150	46.2	3.1	49.3	54.0	4.7	Complied
5350	46.9	3.1	50.0	54.0	4.0	Complied
5353.317	47.0	3.1	50.1	54.0	3.9	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

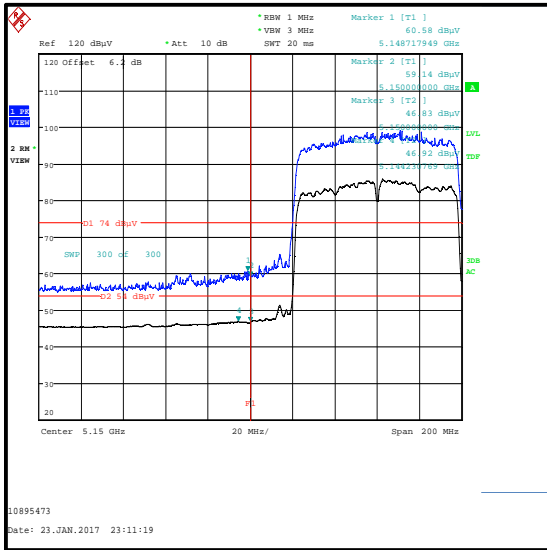
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

Results: 802.11ac / 80 MHz / SISO / QPSK / MCS2 / Peak

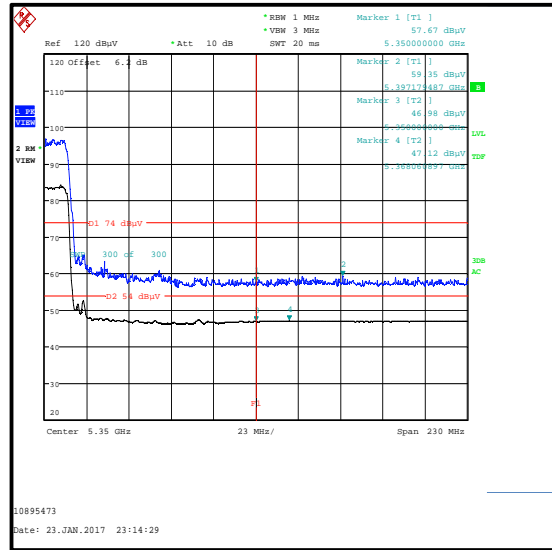
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5148.718	60.6	74.0	13.4	Complied
5150	59.1	74.0	14.9	Complied
5350	57.7	74.0	16.3	Complied
5397.179	59.4	74.0	14.6	Complied

Results: 802.11ac / 80 MHz / SISO / QPSK / MCS2 / Average

Frequency (MHz)	Level (dBμV/m)	Duty cycle correction (dB)	Corrected Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5144.231	46.9	3.9	50.8	54.0	3.2	Complied
5150	46.8	3.9	50.7	54.0	3.3	Complied
5350	47.0	3.9	50.9	54.0	3.1	Complied
5368.061	47.1	3.9	51.0	54.0	3.0	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

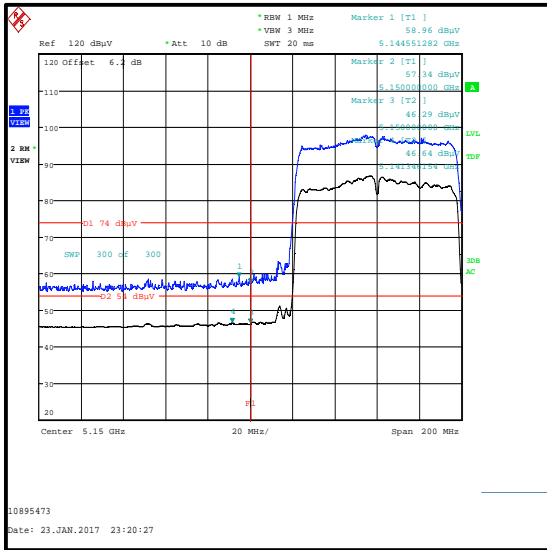
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

Results: 802.11ac / 80 MHz / MIMO / BPSK / MCS0 / Peak

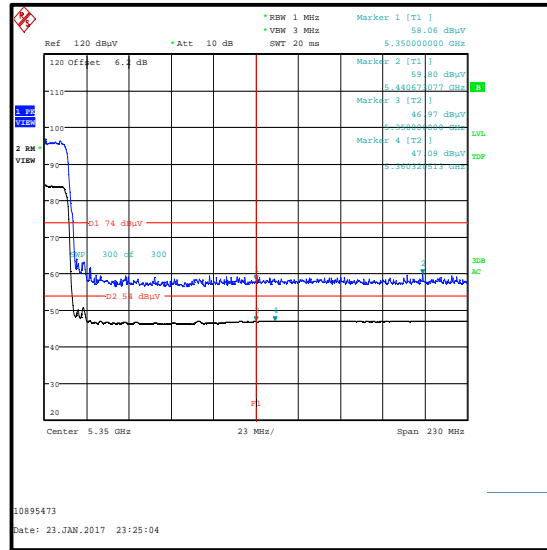
Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5144.551	59.0	74.0	15.0	Complied
5150	57.3	74.0	16.7	Complied
5350	58.1	74.0	15.9	Complied
5440.673	59.8	74.0	14.2	Complied

Results: 802.11ac / 80 MHz / MIMO / BPSK / MCS0 / Average

Frequency (MHz)	Level (dB μ V/m)	Duty Cycle correction (dB)	Corrected Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
5141.346	46.6	2.1	48.7	54.0	5.3	Complied
5150	46.3	2.1	48.4	54.0	5.6	Complied
5350	47.0	2.1	49.1	54.0	4.9	Complied
5360.321	47.1	2.1	49.2	54.0	4.8	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

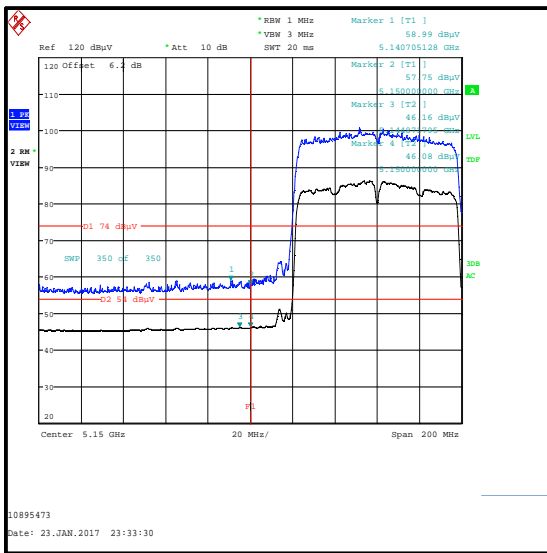
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

Results: 802.11ac / 80 MHz / MIMO / 16QAM / MCS3 / Peak

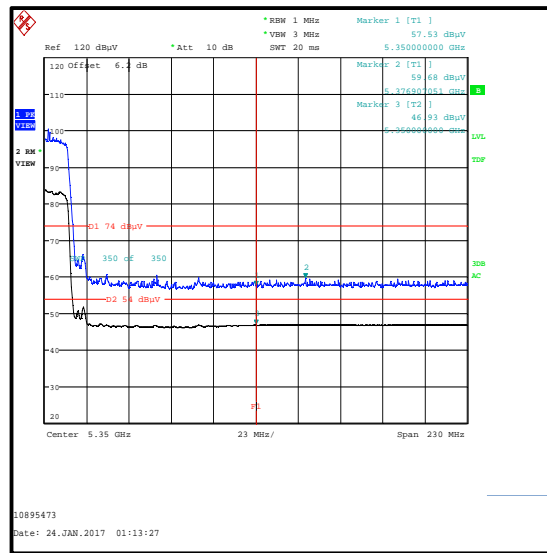
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5140.705	59.0	74.0	15.0	Complied
5150	57.8	74.0	16.2	Complied
5350	57.5	74.0	16.5	Complied
5376.907	59.7	74.0	14.3	Complied

Results: 802.11ac / 80 MHz / MIMO / 16QAM / MCS3 / Average

Frequency (MHz)	Level (dBμV/m)	Duty cycle correction (dB)	Corrected Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5144.872	46.2	4.5	50.7	54.0	3.3	Complied
5150	46.1	4.5	50.6	54.0	3.4	Complied
5350	46.9	4.5	51.4	54.0	2.6	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band)**Test Summary:**

Test Engineer:	Georgios Vrezas	Test Date:	24 January 2017
Test Sample Serial Number:	93010		

FCC Reference:	Parts 15.407(b)(4),(7), 15.205 & 15.209(a)
Test Method Used:	ANSI C63.10 Section 6.10.4 & KDB 789033 II.G.

Environmental Conditions:

Temperature (°C):	21
Relative Humidity (%):	30

Note(s):

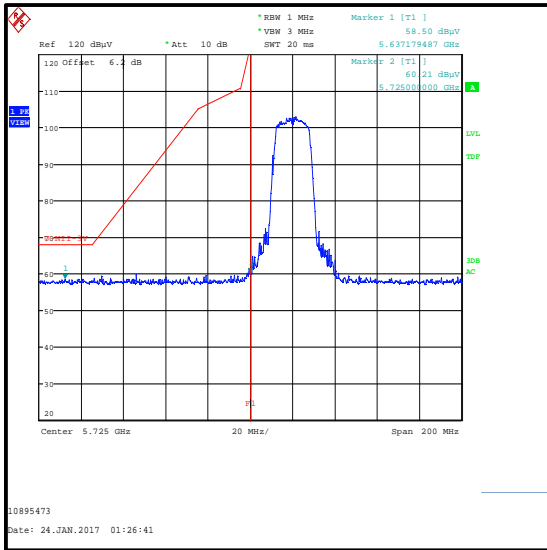
- Band edge measurements were performed in the EUT modes that produce the highest power and the widest bandwidths. The modes were:
 - 802.11a - BPSK / 6 Mbps
 - 802.11a CDD - BPSK / 6 Mbps
 - 802.11n HT20 SISO - BPSK / MCS0 & 16QAM / MCS3
 - 802.11n HT40 SISO - BPSK / MCS0 & 16QAM / MCS3
 - 802.11n HT20 MIMO - BPSK / MCS0 & QPSK / MCS1
 - 802.11n HT40 MIMO - BPSK / MCS0 & 16QAM / MCS3
 - 802.11ac VHT80 SISO - QPSK / MCS2
 - 802.11ac VHT80 MIMO - BPSK / MCS0 & 16QAM / MCS3
- Lower band edge measurements were performed with the EUT transmitting on the bottom or single channel. Upper band edge measurements were performed with the EUT transmitting on the top or single channel.
- For completeness, results are also shown as EIRP in dBm and also as field strength in dB μ V/m. Measured field strength was converted to EIRP in accordance with KDB 789033 G.2.d)(iii) using a conversion factor of 95.2.

Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)

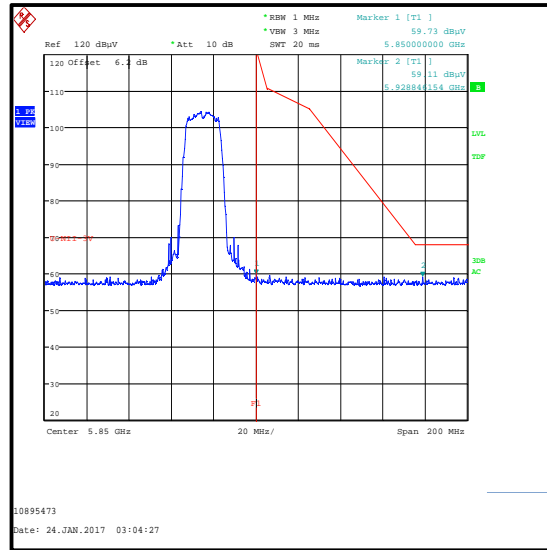
Results: 802.11a / 20 MHz / BPSK / 6 Mbps / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5637.179	-36.7	-27.0	9.7	Complied
5725	-35.0	27.0	62.0	Complied
5850	-35.5	27.0	62.5	Complied
5928.846	-36.1	-27.0	9.1	Complied

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5637.179	58.5	68.2	9.7	Complied
5725	60.2	122.2	62.0	Complied
5850	59.7	122.2	62.5	Complied
5928.846	59.1	68.2	9.1	Complied



Lower Band Edge Measurement



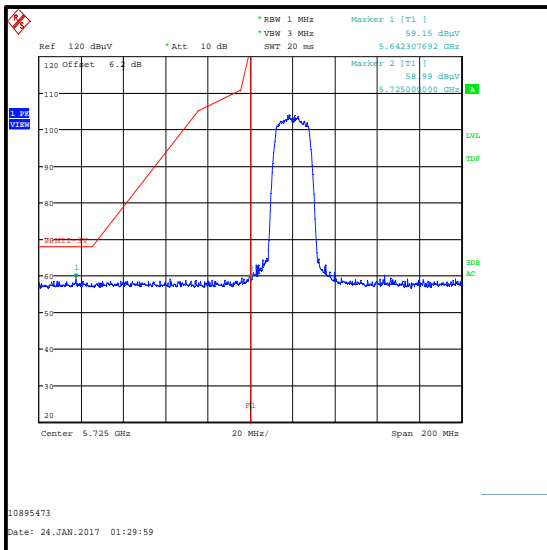
Upper Band Edge Measurement

Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)

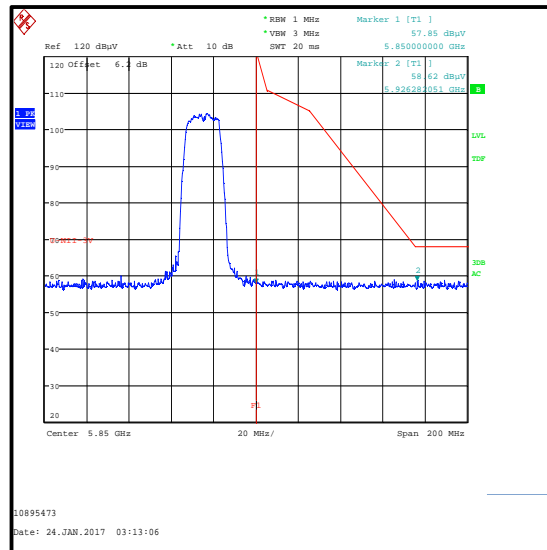
Results: 802.11a / 20 MHz / CDD / BPSK / 6 Mbps / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5642.308	-36.0	-27.0	9.0	Complied
5725	-36.2	27.0	63.2	Complied
5850	-37.3	27.0	64.3	Complied
5926.282	-36.6	-27.0	9.6	Complied

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5642.308	59.2	68.2	9.0	Complied
5725	59.0	122.2	63.2	Complied
5850	57.9	122.2	64.3	Complied
5926.282	58.6	68.2	9.6	Complied



Lower Band Edge Measurement



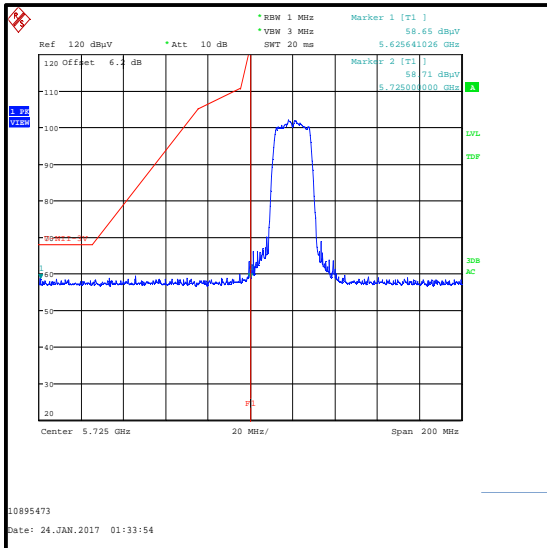
Upper Band Edge Measurement

Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)

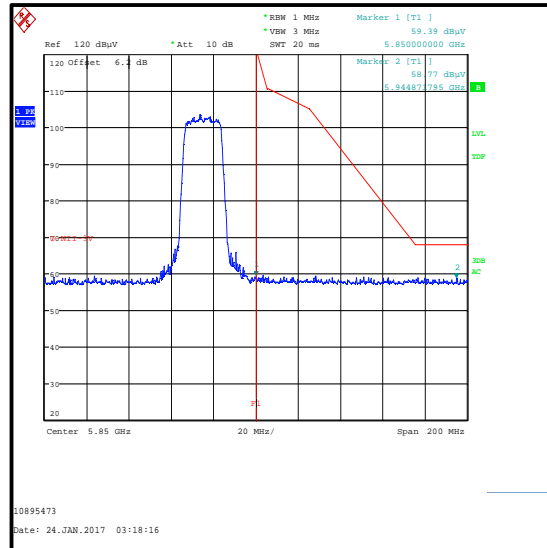
Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5625.641	-36.5	-27.0	9.5	Complied
5725	-36.5	27.0	63.5	Complied
5850	-35.8	27.0	62.8	Complied
5944.872	-36.4	-27.0	9.4	Complied

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5625.641	58.7	68.2	9.5	Complied
5725	58.7	122.2	63.5	Complied
5850	59.4	122.2	62.8	Complied
5944.872	58.8	68.2	9.4	Complied



Lower Band Edge Measurement



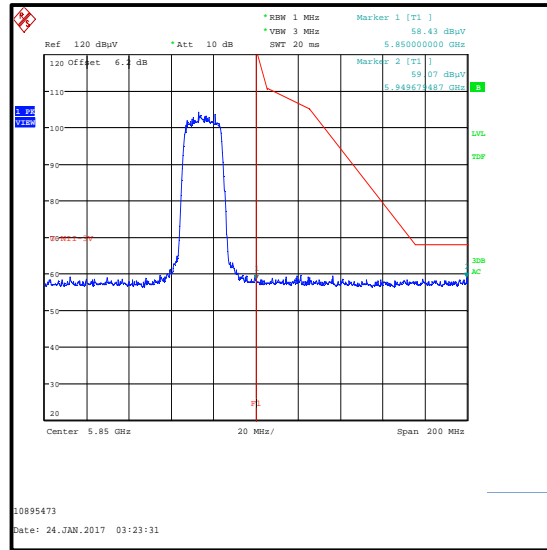
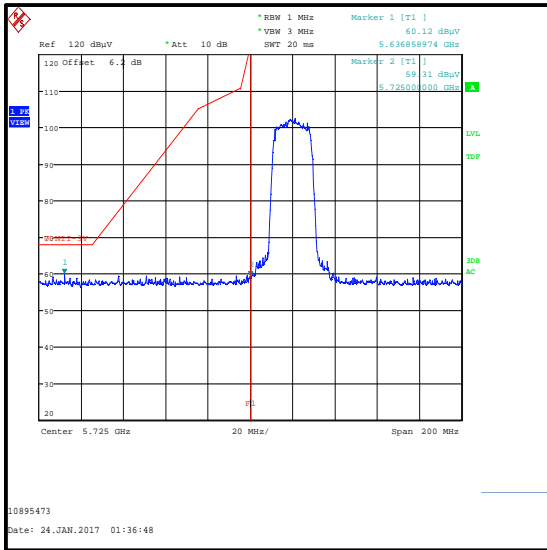
Upper Band Edge Measurement

Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)

Results: 802.11n / 20 MHz / SISO / 16QAM / MCS3 / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5636.859	-35.1	-27.0	8.1	Complied
5725	-35.9	27.0	62.9	Complied
5850	-36.8	27.0	63.8	Complied
5949.679	-36.1	-27.0	9.1	Complied

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5636.859	60.1	68.2	8.1	Complied
5725	59.3	122.2	62.9	Complied
5850	58.4	122.2	63.8	Complied
5949.679	59.1	68.2	9.1	Complied

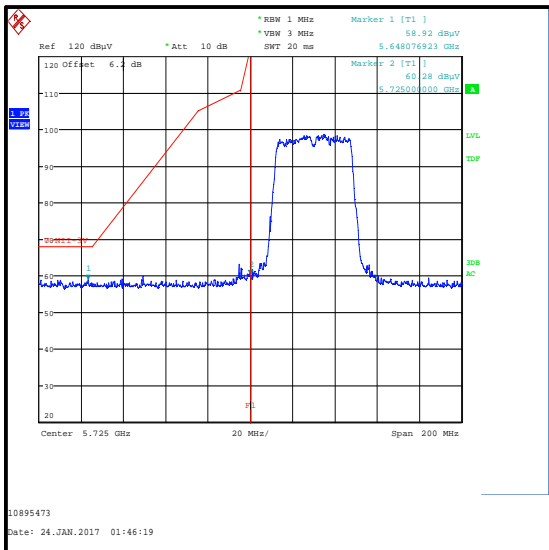


Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)

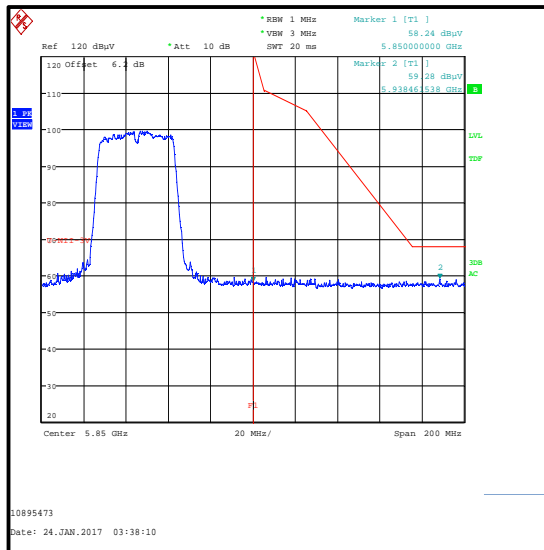
Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5648.077	-36.3	-27.0	9.3	Complied
5725	-34.9	27.0	61.9	Complied
5850	-37.0	27.0	64.0	Complied
5938.462	-35.9	-27.0	8.9	Complied

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5648.077	58.9	68.2	9.3	Complied
5725	60.3	122.2	61.9	Complied
5850	58.2	122.2	64.0	Complied
5938.462	59.3	68.2	8.9	Complied



Lower Band Edge Measurement



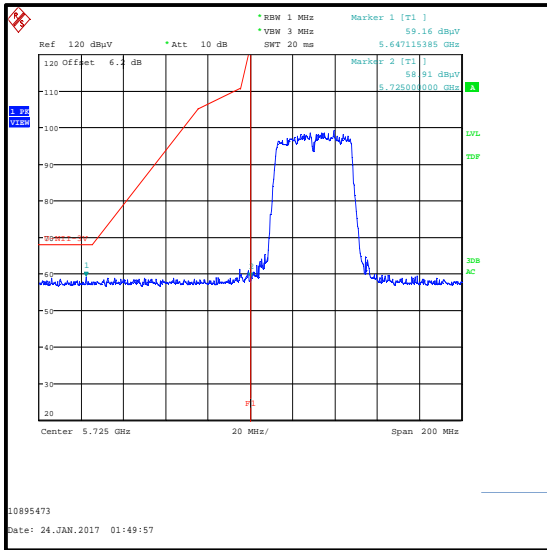
Upper Band Edge Measurement

Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)

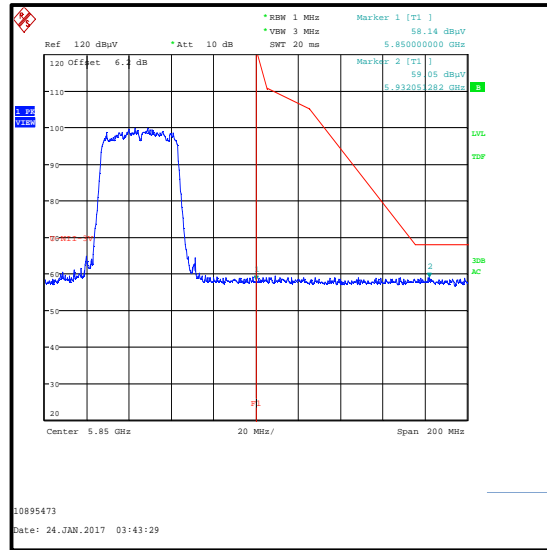
Results: 802.11n / 40 MHz / SISO / 16QAM / MCS3 / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5647.115	-36.0	-27.0	9.0	Complied
5725	-36.3	27.0	63.3	Complied
5850	-37.1	27.0	64.1	Complied
5932.051	-36.1	-27.0	9.1	Complied

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5647.115	59.2	68.2	9.0	Complied
5725	58.9	122.2	63.3	Complied
5850	58.1	122.2	64.1	Complied
5932.051	59.1	68.2	9.1	Complied



Lower Band Edge Measurement



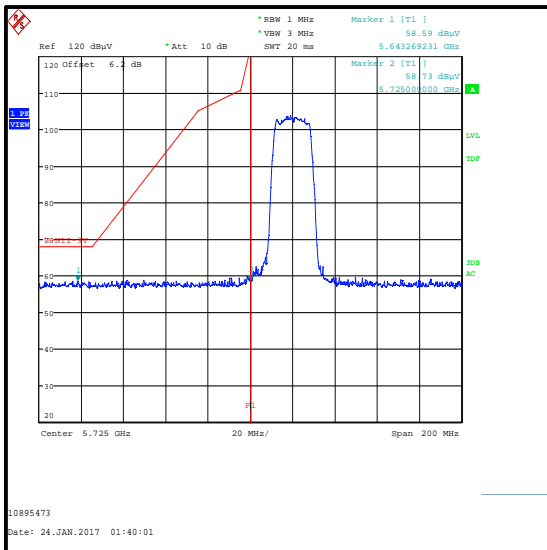
Upper Band Edge Measurement

Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)

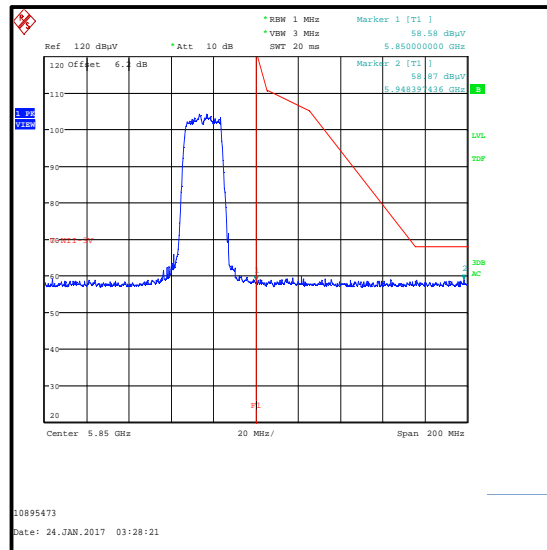
Results: 802.11n / 20 MHz / MIMO / BPSK / MCS0 / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5643.269	-36.6	-27.0	9.6	Complied
5725	-36.5	27.0	63.5	Complied
5850	-36.6	27.0	63.6	Complied
5948.397	-36.3	-27.0	9.3	Complied

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5643.269	58.6	68.2	9.6	Complied
5725	58.7	122.2	63.5	Complied
5850	58.6	122.2	63.6	Complied
5948.397	58.9	68.2	9.3	Complied



Lower Band Edge Measurement



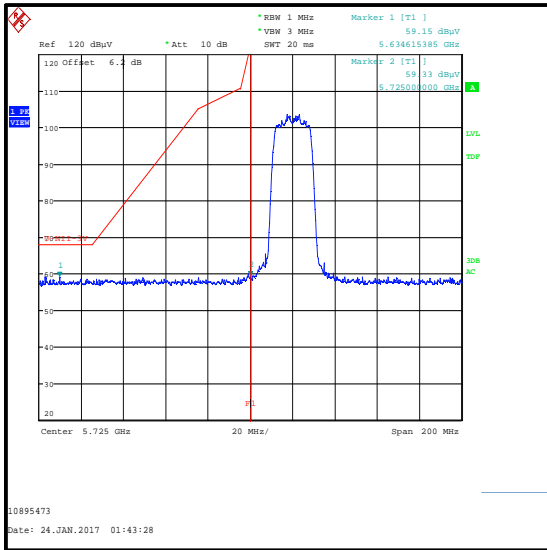
Upper Band Edge Measurement

Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)

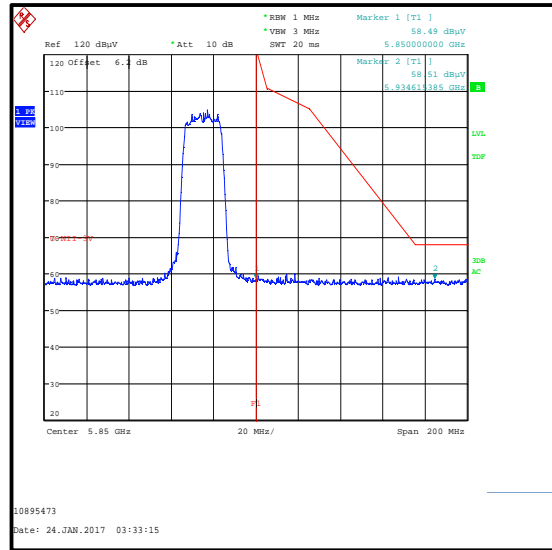
Results: 802.11n / 20 MHz / MIMO / QPSK / MCS1 / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5634.615	-36.0	-27.0	9.0	Complied
5725	-35.9	27.0	62.9	Complied
5850	-36.7	27.0	63.7	Complied
5934.615	-36.7	-27.0	9.7	Complied

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5634.615	59.2	68.2	9.0	Complied
5725	59.3	122.2	62.9	Complied
5850	58.5	122.2	63.7	Complied
5934.615	58.5	68.2	9.7	Complied



Lower Band Edge Measurement



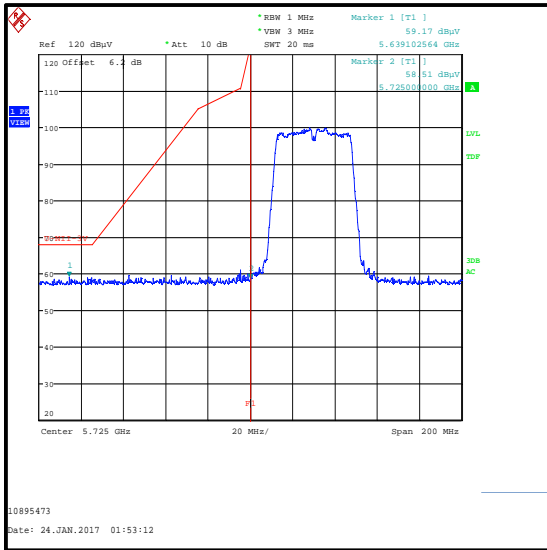
Upper Band Edge Measurement

Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)

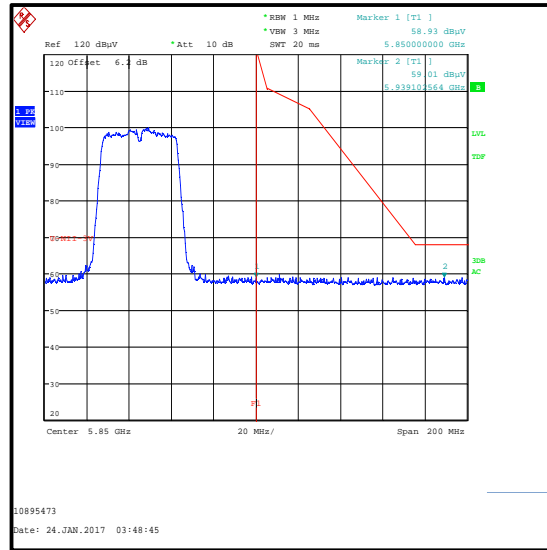
Results: 802.11n / 40 MHz / MIMO / BPSK / MCS0 / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5639.103	-36.0	-27.0	9.0	Complied
5725	-36.7	27.0	63.7	Complied
5850	-36.3	27.0	63.3	Complied
5939.103	-36.2	-27.0	9.2	Complied

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5639.103	59.2	68.2	9.0	Complied
5725	58.5	122.2	63.7	Complied
5850	58.9	122.2	63.3	Complied
5939.103	59.0	68.2	9.2	Complied



Lower Band Edge Measurement



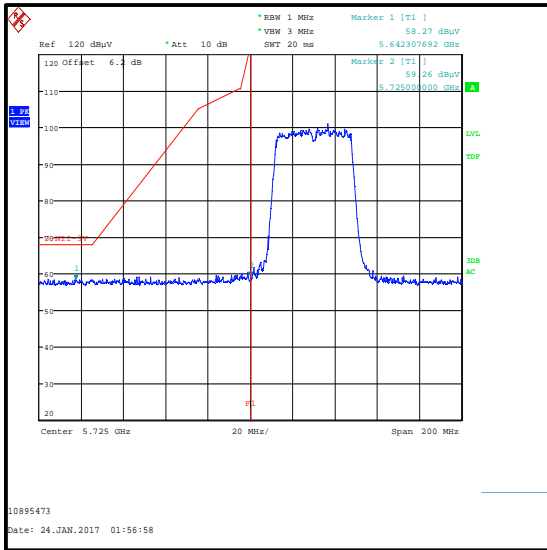
Upper Band Edge Measurement

Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)

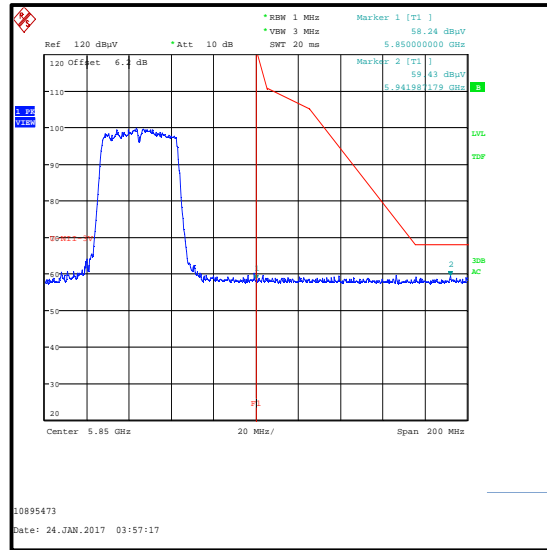
Results: 802.11n / 40 MHz / MIMO / 16QAM / MCS3 / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5642.308	-36.9	-27.0	9.9	Complied
5725	-35.9	27.0	62.9	Complied
5850	-37.0	27.0	64.0	Complied
5941.987	-35.8	-27.0	8.8	Complied

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5642.308	58.3	68.2	9.9	Complied
5725	59.3	122.2	62.9	Complied
5850	58.2	122.2	64.0	Complied
5941.987	59.4	68.2	8.8	Complied



Lower Band Edge Measurement



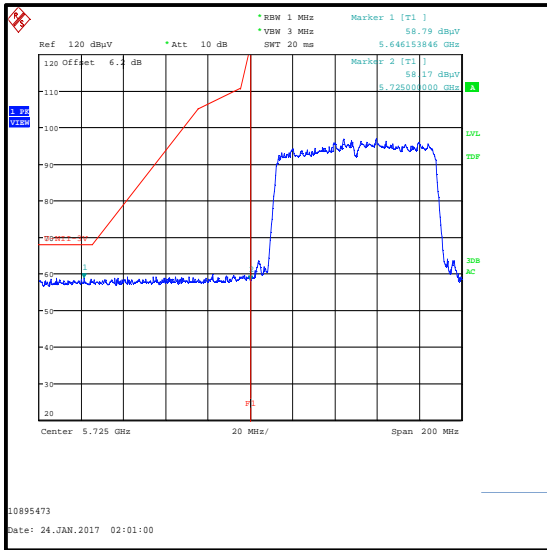
Upper Band Edge Measurement

Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)

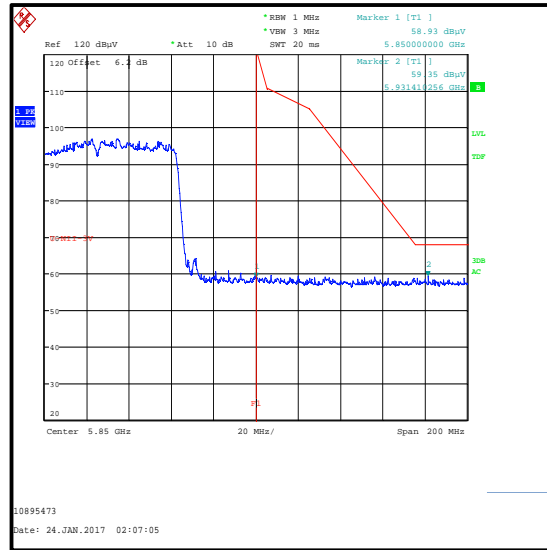
Results: 802.11ac / 80 MHz / SISO / QPSK / MCS2 / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5641.154	-36.4	-27.0	9.4	Complied
5725	-37.0	27.0	64.0	Complied
5850	-36.3	27.0	63.3	Complied
5931.410	-35.8	-27.0	8.8	Complied

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5641.154	58.8	68.2	9.4	Complied
5725	58.2	122.2	64.0	Complied
5850	58.9	122.2	63.3	Complied
5931.410	59.4	68.2	8.8	Complied



Lower Band Edge Measurement



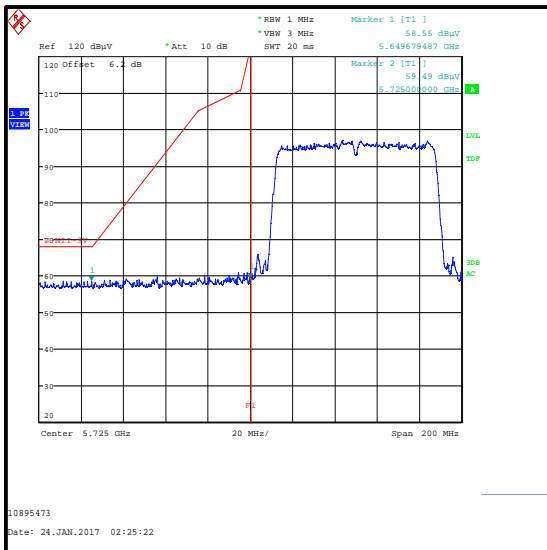
Upper Band Edge Measurement

Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)

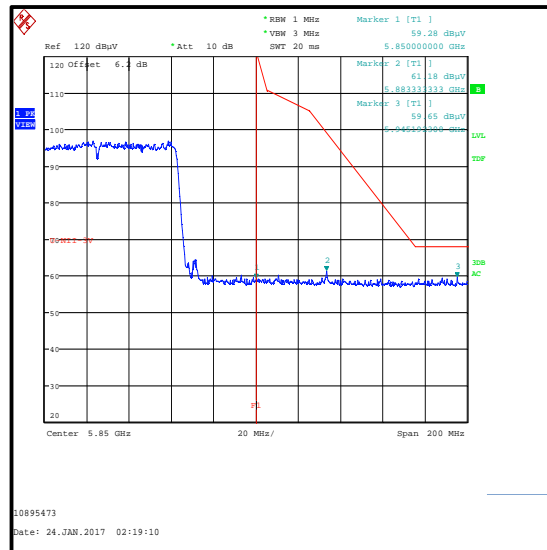
Results: 802.11ac / 80 MHz / MIMO / BPSK / MCS0 / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5649.679	-36.6	-27.0	9.6	Complied
5725	-35.7	27.0	62.7	Complied
5850	-35.9	27.0	62.9	Complied
5945.192	-35.5	-27.0	8.5	Complied

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5649.679	58.6	68.2	9.6	Complied
5725	59.5	122.2	62.7	Complied
5850	59.3	122.2	62.9	Complied
5945.192	59.7	68.2	8.5	Complied



Lower Band Edge Measurement



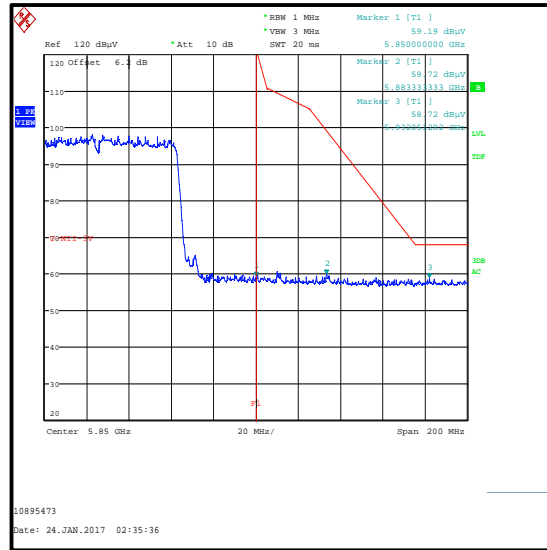
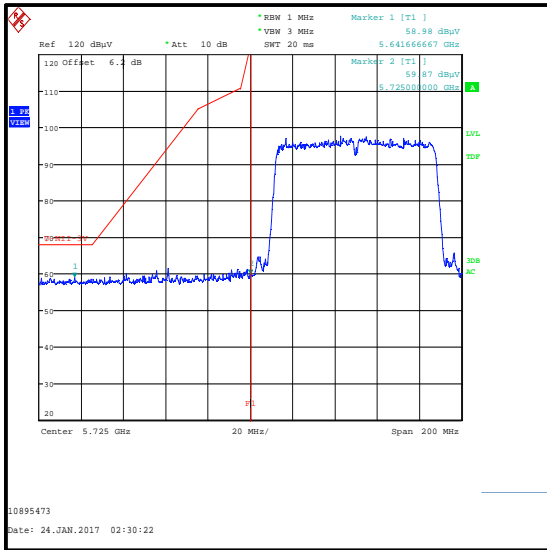
Upper Band Edge Measurement

Transmitter Band Edge Radiated Emissions (5.725-5.85 GHz band operation) (continued)

Results: 802.11ac / 80 MHz / MIMO / 16QAM / MCS3 / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5641.667	-36.2	-27.0	9.2	Complied
5725	-35.3	27.0	62.3	Complied
5850	-36.0	27.0	63.0	Complied
5932.051	-36.5	-27.0	9.5	Complied

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
5641.667	59.0	68.2	9.2	Complied
5725	59.9	122.2	62.3	Complied
5850	59.2	122.2	63.0	Complied
5932.051	58.7	68.2	9.5	Complied



Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2014	Thermohygrometer	Testo	608-H1	45046246	10 Jun 2017	12
K0001	3m RSE Chamber	Rainford EMC	N/A	N/A	07 Dec 2017	12
M1630	Test receiver	Rohde & Schwarz	ESU40	100233	17 Feb 2017	12
A1227	Pre-Amplifier	Agilent	8449B	3008A01566	09 Jun 2017	6
A2899	Antenna	Schwarzbeck	BBHA 9120 B	BBHA 9120 B 652	06 May 2017	12
A1395	Attenuator	Huber & Suhner	6806.17.B	753459	04 Nov 2017	12

6. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±5.65 dB
Radiated Spurious Emissions	1 GHz to 40 GHz	95%	±4.37 dB

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

7. Report Revision History

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	-	-	Initial Version
2.0	-	-	Tested in accordance with FCC KDB correspondence

--- END OF REPORT ---