TEST REPORT

Test Report No. : UL-RPT-RP10895510JD04G V2.0

Manufacturer	:	Bang & Olufsen a/s
Model No.	:	WUS-AC08V
FCC ID	:	TTUWUSAC08V
Technology	:	WLAN (802.11a/n/ac)
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

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

UL VS LTD

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Table of Contents

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) – Section 15.407
Specification Reference:	47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 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:	10 January 2017 to 21 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 *(Conducted sample)*
Hardware Version:	A1G
Software Version:	4.2.3.5
FCC ID:	TTUWUSAC08V

3.1.1 Host Product Details

Brand Name:	BeoVision Avant 85 NG
Model Name or Number:	BeoVision Avant 85 NG
Test Sample Serial Number:	92997 *(Radiated sample)*
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 85“ 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:**	20 January 2017
Test Sample Serial Number:	92997		

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:

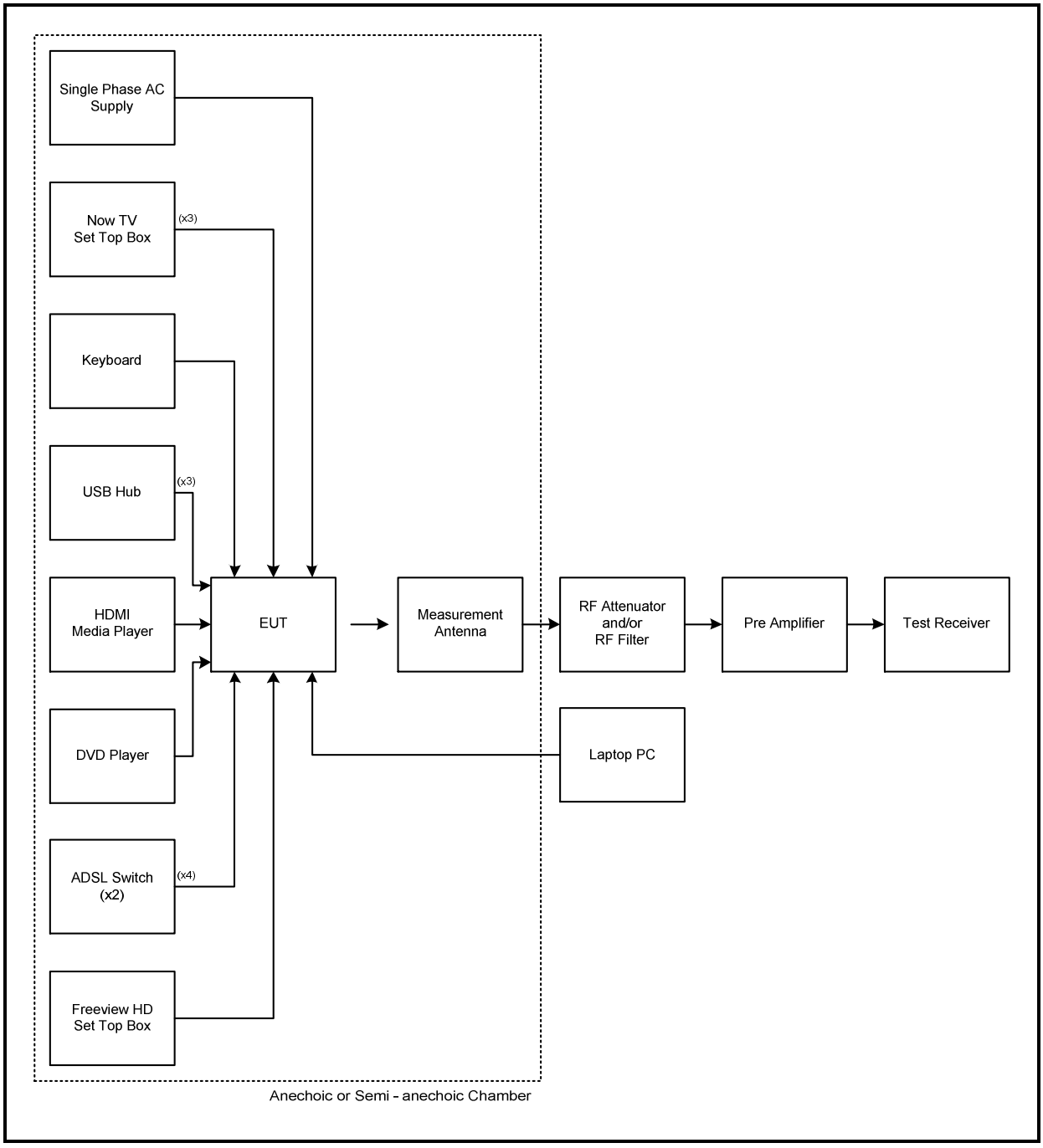
Temperature (°C):	22
Relative Humidity (%):	26

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 band 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:

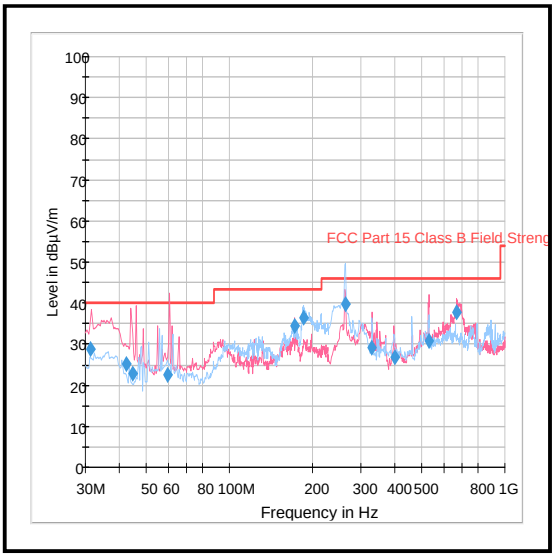


Note: The number in brackets relates to the quantity of cables which were connected between the TV and the support equipment.

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

Results: Middle Channel / Field Strength

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
31.425	Vertical	28.7	40.0	11.3	Complied
172.028	Vertical	34.5	43.5	9.0	Complied
186.413	Horizontal	36.4	43.5	7.1	Complied
264.983	Horizontal	39.6	46.0	6.4	Complied
328.862	Vertical	29.0	46.0	17.0	Complied
669.119	Vertical	37.9	46.0	8.1	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 Engineer:	Georgios Vrezas	**Test Dates:**	10 January 2017 to 21 January 2017
Test Sample Serial Number:	92997		

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):	21 to 25
Relative Humidity (%):	28 to 41

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.1.c) if the peak measurement is below the average limit, it is not necessary to perform a separate average measurement.
6. In accordance with KDB 789033 Section II.G.6.c) Method AD (vi), the average measurements were performed using an increased number of sweeps.
7. 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:
    - 1 to 4 GHz – 6001 sweep points
    - 4 to 8 GHz – 8001 sweep points
    - 4.5 to 5.15 GHz – 1301 sweep points
    - 5.35 to 5.46 GHz – 301 sweep points
    - 8 to 12.75 GHz – 9501 sweep points
    - 12.75 to 18 GHz – 10501 sweep points
    - 18 to 26.5 GHz – 17001 sweep points
    - 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.
8. 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.
9. 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.
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.
11. The 4 to 8 GHz plot illustrates an incorrect job number.

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
See note 9					

Results: Bottom Channel / Field Strength

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
1048.571	Horizontal	43.8	54.0*	10.2	Complied
1050.000	Vertical	42.4	54.0*	11.6	Complied
1317.857	Horizontal	40.1	54.0*	13.9	Complied
1324.229	Vertical	36.4	54.0*	17.6	Complied
2696.779	Vertical	53.7	54.0*	0.3	Complied
2699.714	Horizontal	50.1	54.0*	3.9	Complied

Results: Middle Channel / EIRP

Frequency (MHz)	Antenna Polarity	Level (dBm)	Limit (dBm)	Margin (dB)	Result
See note 9					

Results: Middle Channel / Field Strength

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
1048.571	Horizontal	43.8	54.0*	10.2	Complied
1050.000	Vertical	42.4	54.0*	11.6	Complied
1317.857	Horizontal	40.1	54.0*	13.9	Complied
1324.229	Vertical	36.4	54.0*	17.6	Complied
2696.779	Vertical	53.7	54.0*	0.3	Complied
2699.714	Horizontal	50.1	54.0*	3.9	Complied

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

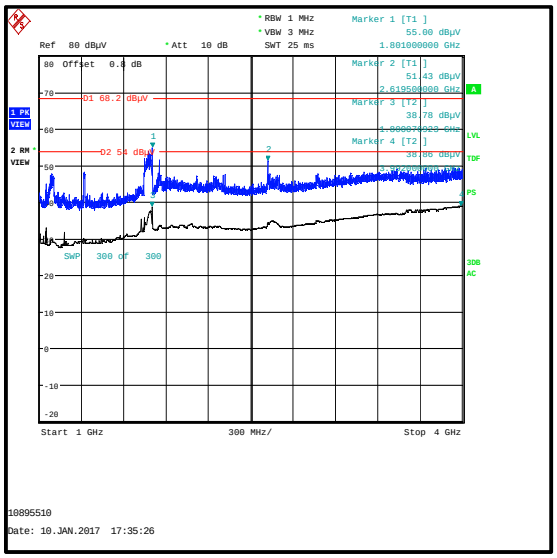
Results: Top Channel / EIRP

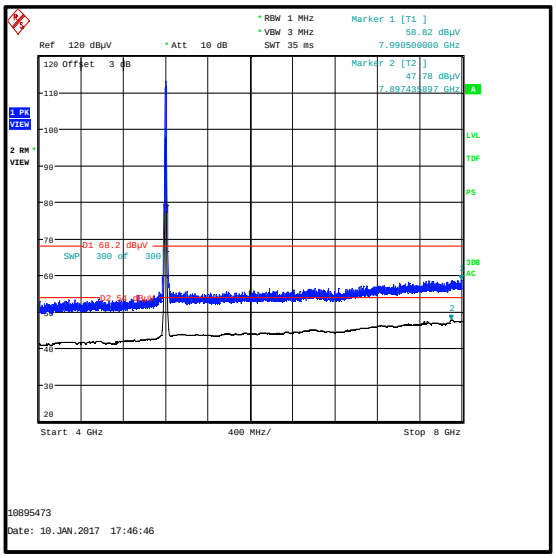
Frequency (MHz)	Antenna Polarity	Level (dBm)	Limit (dBm)	Margin (dB)	Result
See note 9					

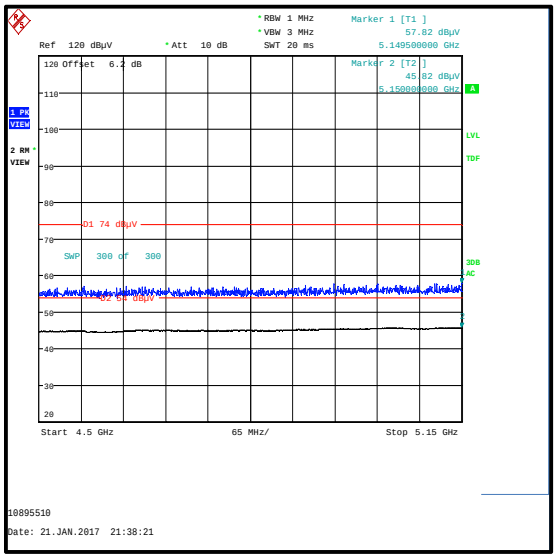
Results: Top Channel / Field Strength

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
1048.571	Horizontal	43.8	54.0*	10.2	Complied
1050.000	Vertical	42.4	54.0*	11.6	Complied
1317.857	Horizontal	40.1	54.0*	13.9	Complied
1324.229	Vertical	36.4	54.0*	17.6	Complied
2696.779	Vertical	53.7	54.0*	0.3	Complied
2699.714	Horizontal	50.1	54.0*	3.9	Complied

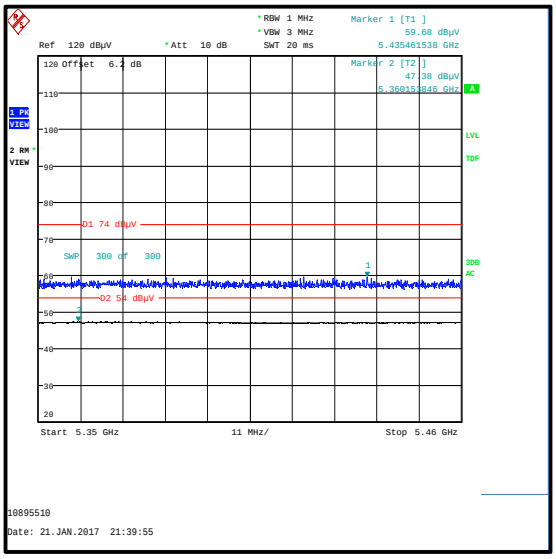
Transmitter Out of Band Radiated Emissions (5.15-5.25 GHz band operation) (continued)





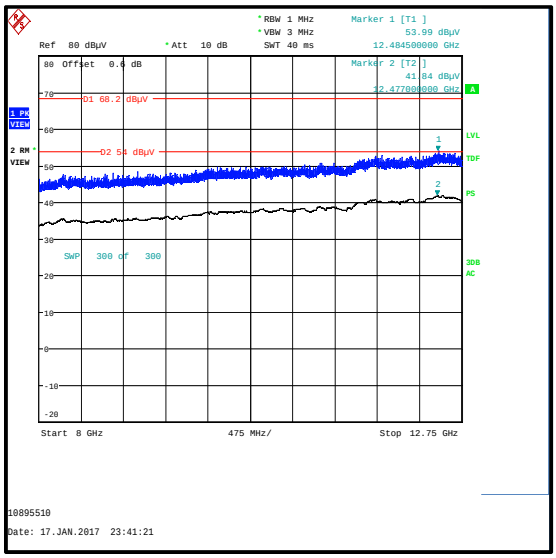


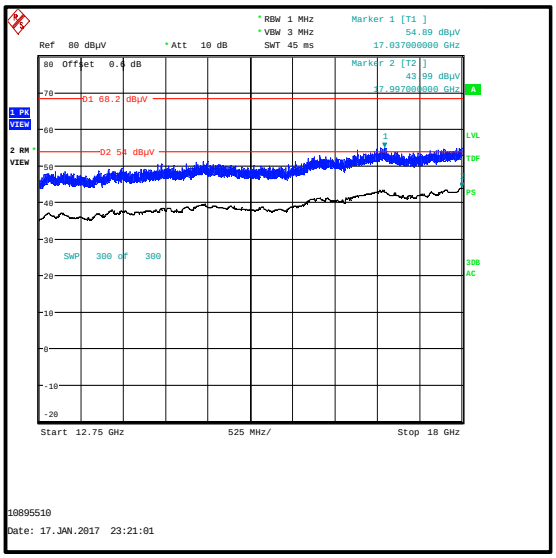
Restricted Band 4.5 GHz to 5.15 GHz

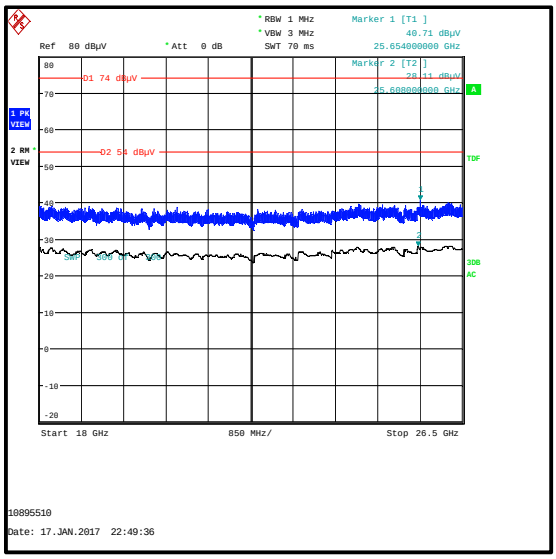


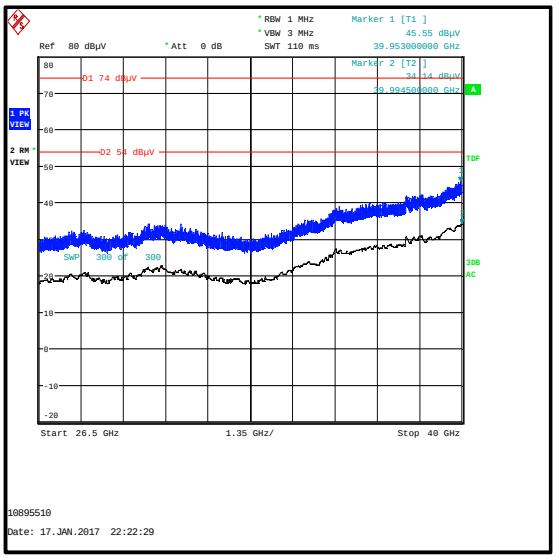
Restricted Band 5.35 GHz to 5.46 GHz

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









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 Engineer:	Georgios Vrezas	**Test Dates:**	10 January 2017 to 21 January 2017
Test Sample Serial Number:	92997		

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):	21 to 25
Relative Humidity (%):	28 to 41

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.1.c) if the peak measurement is below the average limit, it is not necessary to perform a separate average measurement.
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.
7. 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.
8. The third harmonic emission was observed on the 12.75 to 18 GHz pre-scan plot when the EUT is transmitting on middle channel in the 5.15 to 5.25 GHz band. This harmonic was investigated in the 5.725 to 5.85 GHz band and emission levels were found to be below the measurement system noise floor on bottom, middle and top channels.
9. 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
See note 9					

Results: Bottom Channel / Field Strength

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
1048.571	Horizontal	43.8	54.0*	10.2	Complied
1050.000	Vertical	42.4	54.0*	11.6	Complied
1317.857	Horizontal	40.1	54.0*	13.9	Complied
1324.229	Vertical	36.4	54.0*	17.6	Complied
2696.779	Vertical	53.7	54.0*	0.3	Complied
2699.714	Horizontal	50.1	54.0*	3.9	Complied

Results: Middle Channel / EIRP

Frequency (MHz)	Antenna Polarity	Level (dBm)	Limit (dBm)	Margin (dB)	Result
See note 9					

Results: Middle Channel / Field Strength

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
1048.571	Horizontal	43.8	54.0*	10.2	Complied
1050.000	Vertical	42.4	54.0*	11.6	Complied
1317.857	Horizontal	40.1	54.0*	13.9	Complied
1324.229	Vertical	36.4	54.0*	17.6	Complied
2696.779	Vertical	53.7	54.0*	0.3	Complied
2699.714	Horizontal	50.1	54.0*	3.9	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
See note 9					

Results: Top Channel / Field Strength

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
1048.571	Horizontal	43.8	54.0*	10.2	Complied
1050.000	Vertical	42.4	54.0*	11.6	Complied
1317.857	Horizontal	40.1	54.0*	13.9	Complied
1324.229	Vertical	36.4	54.0*	17.6	Complied
2696.779	Vertical	53.7	54.0*	0.3	Complied
2699.714	Horizontal	50.1	54.0*	3.9	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
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	-
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 Date:**	21 January 2017
Test Sample Serial Number:	92997		

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 (%):	28

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.

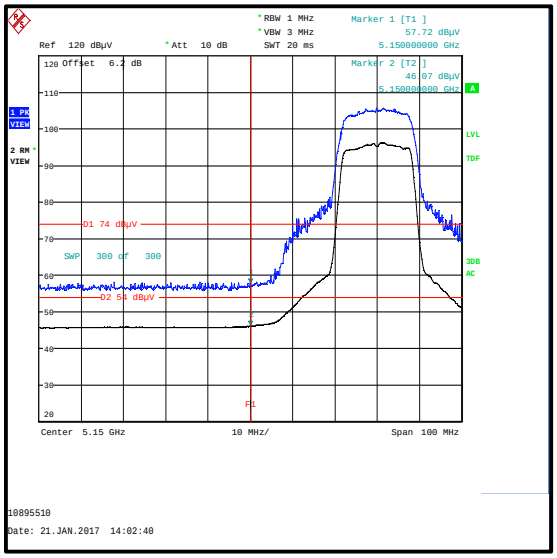
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

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

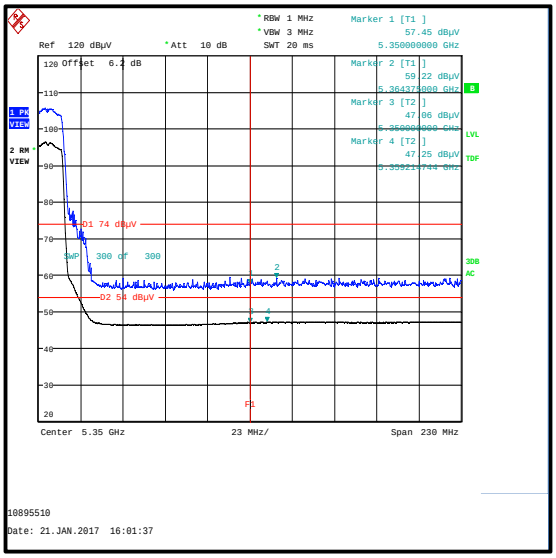
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5150	57.7	74.0	16.3	Complied
5350	57.5	74.0	16.5	Complied
5364.375	59.2	74.0	14.8	Complied

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	46.1	0.6	46.7	54.0	7.3	Complied
5350	47.1	0.6	47.7	54.0	6.3	Complied
5359.215	47.3	0.6	47.9	54.0	6.1	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

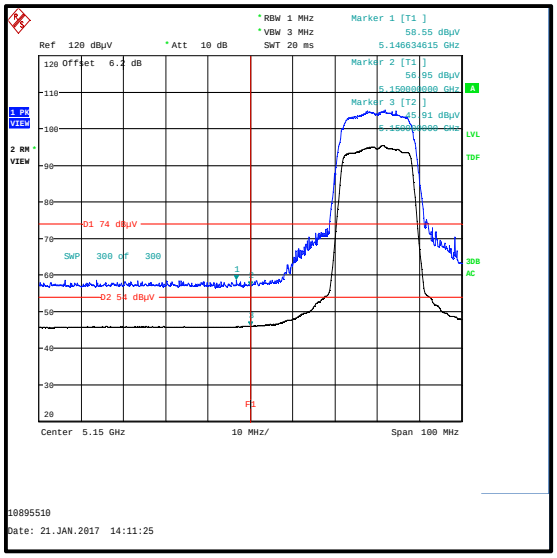
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

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

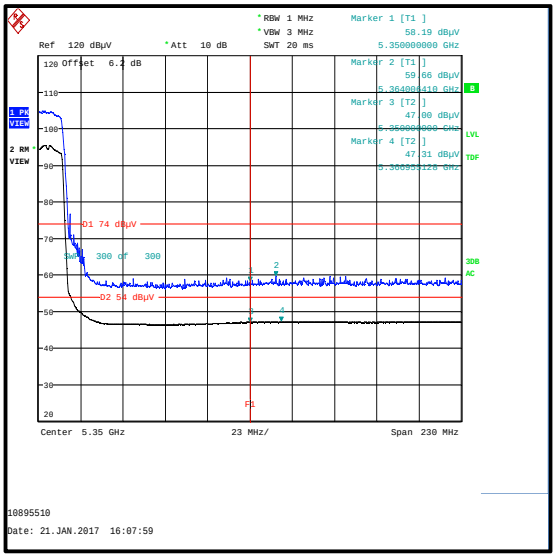
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5146.635	58.6	74.0	15.4	Complied
5150	57.0	74.0	17.0	Complied
5350	58.2	74.0	15.8	Complied
5364.006	59.7	74.0	14.3	Complied

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	45.9	0.6	46.5	54.0	7.5	Complied
5350	47.0	0.6	47.6	54.0	6.4	Complied
5366.955	47.3	0.6	47.9	54.0	6.1	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

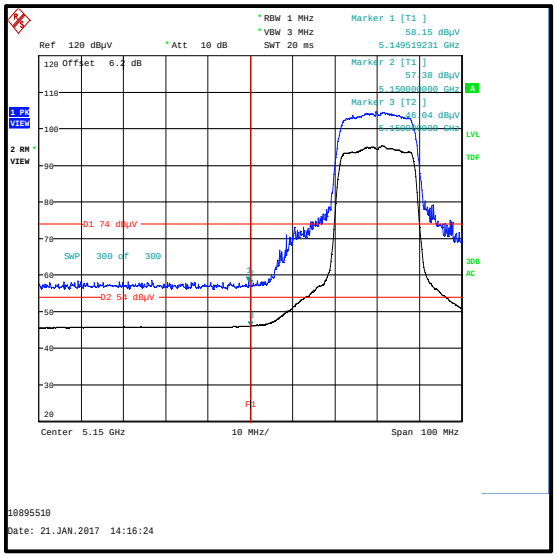
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

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

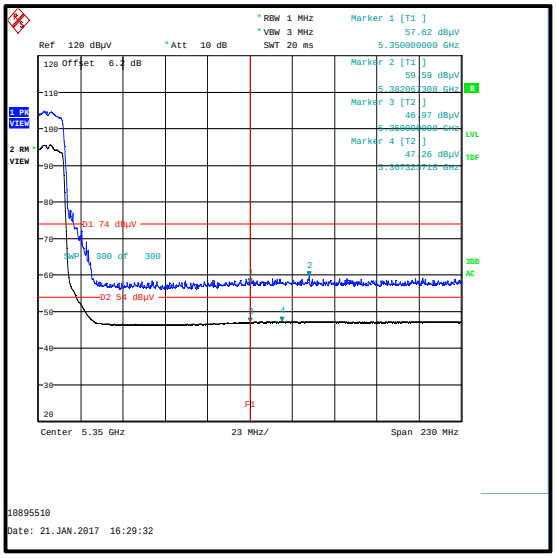
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5149.519	58.2	74.0	15.8	Complied
5150	57.4	74.0	16.6	Complied
5350	57.6	74.0	16.4	Complied
5382.067	59.6	74.0	14.4	Complied

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
5367.324	47.3	0.6	47.9	54.0	6.1	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

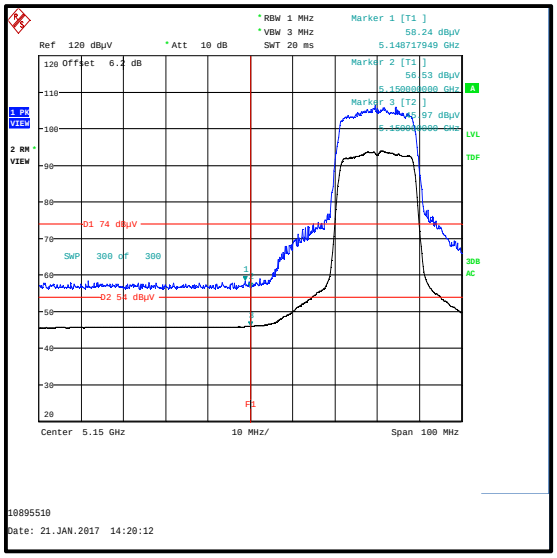
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

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

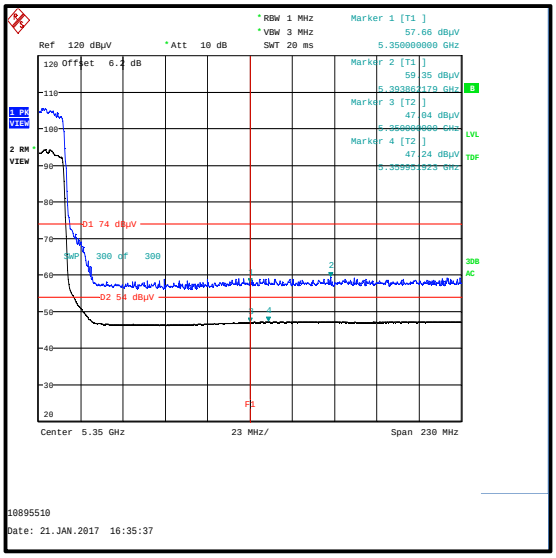
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5148.718	58.2	74.0	15.8	Complied
5150	56.5	74.0	17.5	Complied
5350	57.7	74.0	16.3	Complied
5393.862	59.4	74.0	14.6	Complied

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	46.0	2.0	48.0	54.0	6.0	Complied
5350	47.0	2.0	49.0	54.0	5.0	Complied
5359.952	47.2	2.0	49.2	54.0	4.8	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

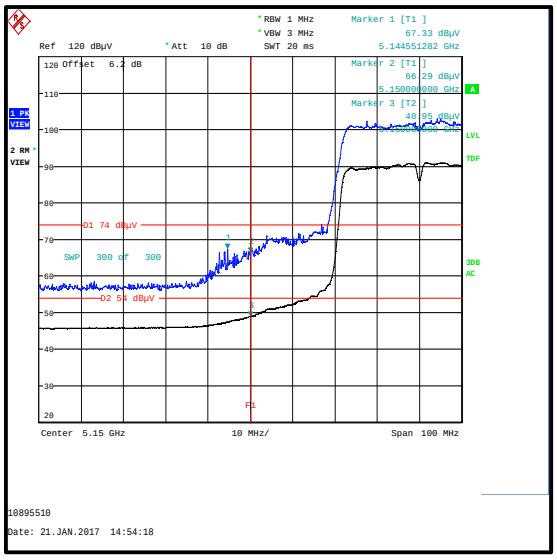
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

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

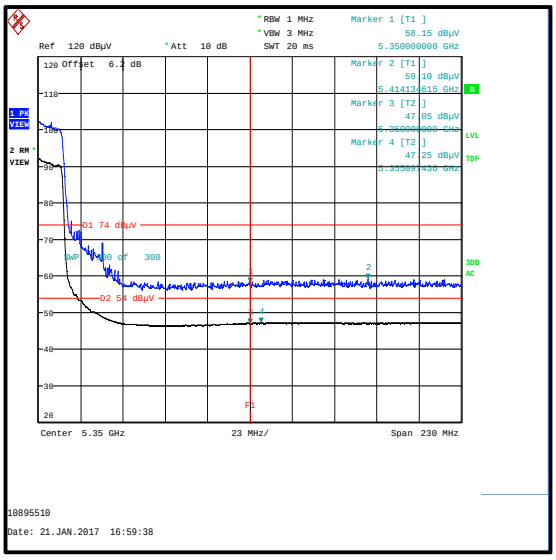
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5144.551	67.3	74.0	6.7	Complied
5150	66.3	74.0	7.7	Complied
5350	58.2	74.0	15.8	Complied
5414.135	59.1	74.0	14.9	Complied

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	49.0	1.2	50.2	54.0	3.8	Complied
5350	47.1	1.2	48.3	54.0	5.7	Complied
5355.897	47.3	1.2	48.5	54.0	5.5	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

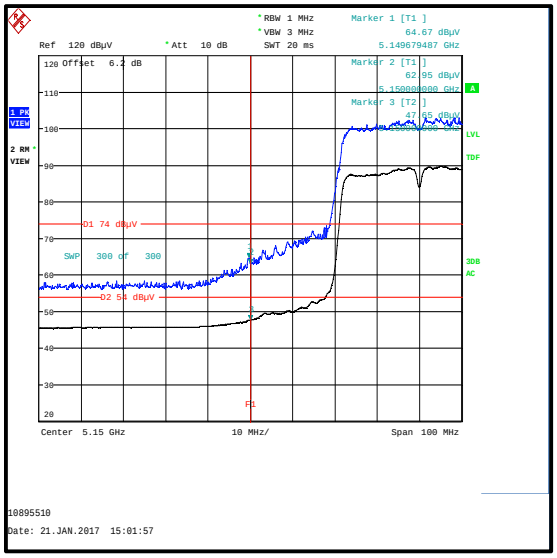
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

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

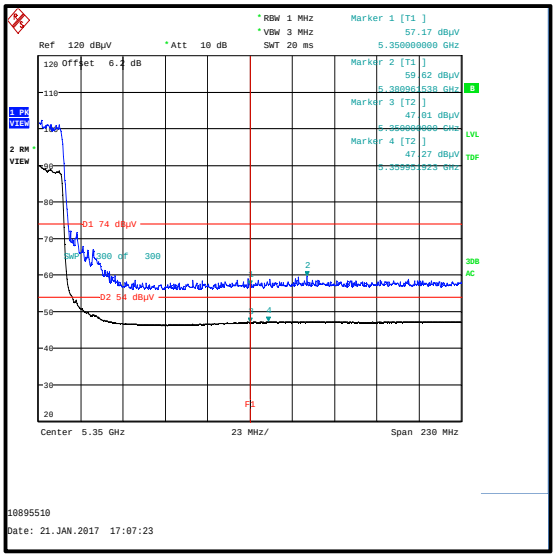
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5149.679	64.7	74.0	9.3	Complied
5150	63.0	74.0	11.0	Complied
5350	57.2	74.0	16.8	Complied
5380.962	59.6	74.0	14.4	Complied

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	47.7	3.1	50.8	54.0	3.2	Complied
5350	47.0	3.1	50.1	54.0	3.9	Complied
5359.952	47.3	3.1	50.4	54.0	3.6	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

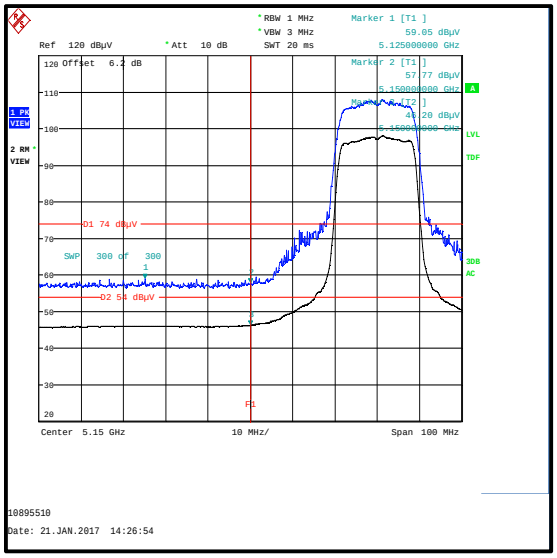
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

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

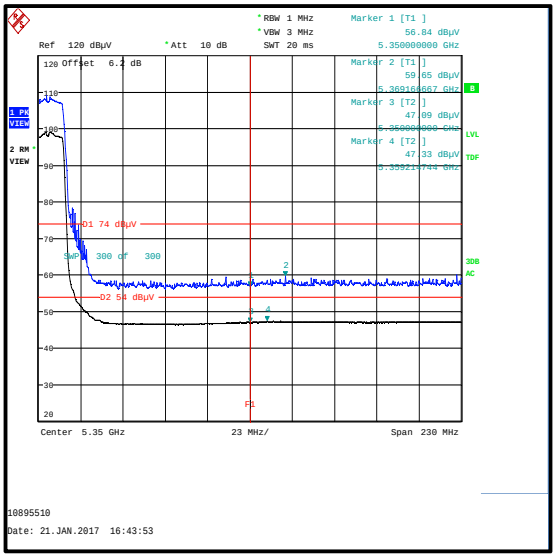
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5125.000	59.1	74.0	14.9	Complied
5150	57.8	74.0	16.2	Complied
5350	56.8	74.0	17.2	Complied
5369.167	59.7	74.0	14.3	Complied

Results: 802.11n / 20 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	46.2	0.6	46.8	54.0	7.2	Complied
5350	47.1	0.6	47.7	54.0	6.3	Complied
5359.215	47.3	0.6	47.9	54.0	6.1	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

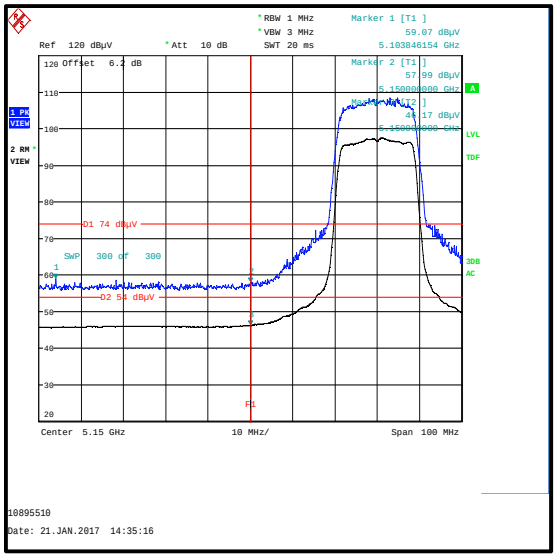
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

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

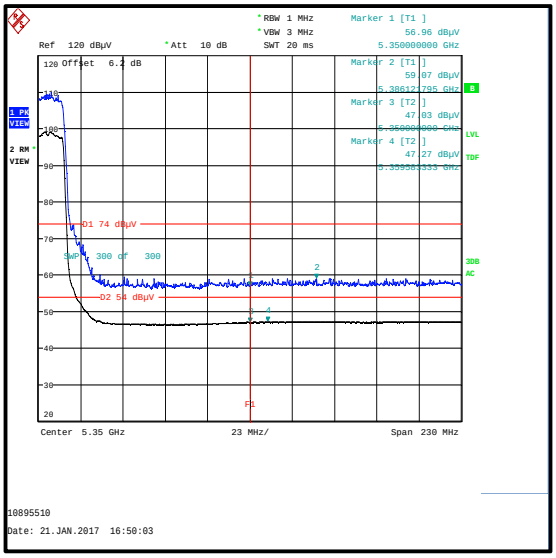
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5103.846	59.1	74.0	14.9	Complied
5150	58.0	74.0	16.0	Complied
5350	57.0	74.0	17.0	Complied
5386.122	59.1	74.0	14.9	Complied

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	46.2	1.1	47.3	54.0	6.7	Complied
5350	47.0	1.1	48.1	54.0	5.9	Complied
5359.583	47.3	1.1	48.4	54.0	5.6	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

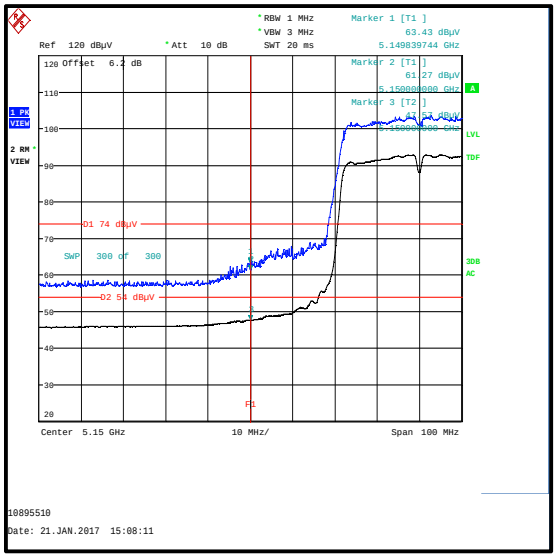
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

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

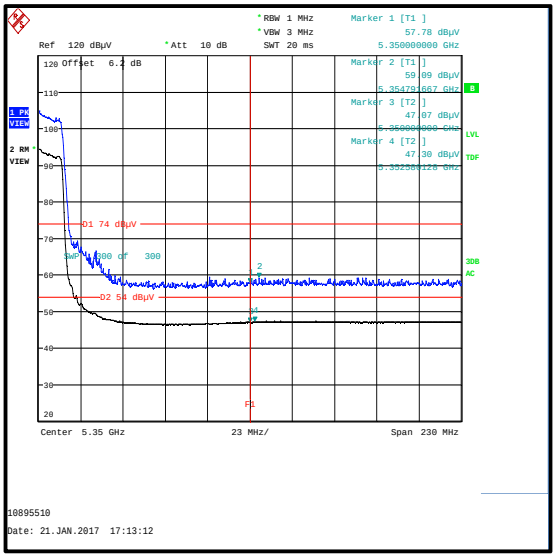
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5149.840	63.4	74.0	10.6	Complied
5150	61.3	74.0	12.7	Complied
5350	57.8	74.0	16.2	Complied
5354.792	59.1	74.0	14.9	Complied

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	47.6	1.2	48.8	54.0	5.2	Complied
5350	47.1	1.2	48.3	54.0	5.7	Complied
5352.580	47.3	1.2	48.5	54.0	5.5	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

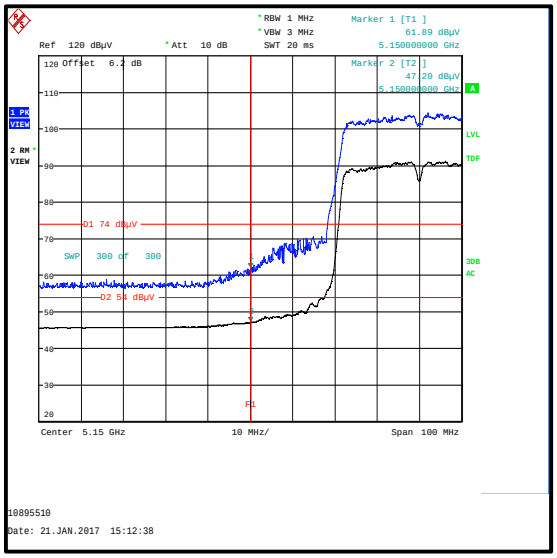
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

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

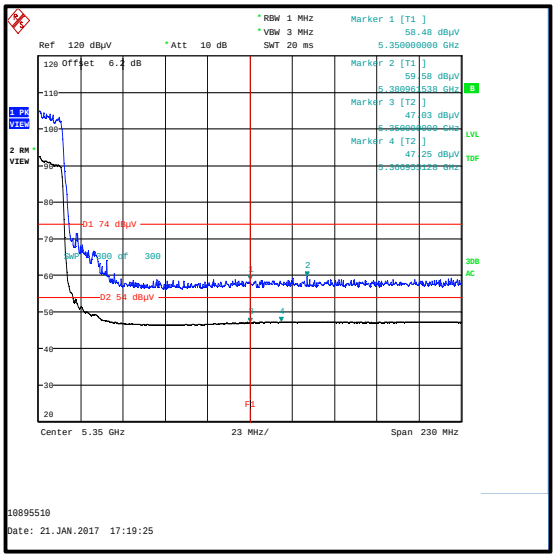
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5150	61.9	74.0	12.1	Complied
5350	58.5	74.0	15.5	Complied
5380.962	59.6	74.0	14.4	Complied

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	47.2	3.1	50.3	54.0	3.7	Complied
5350	47.0	3.1	50.1	54.0	3.9	Complied
5366.955	47.3	3.1	50.4	54.0	3.6	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

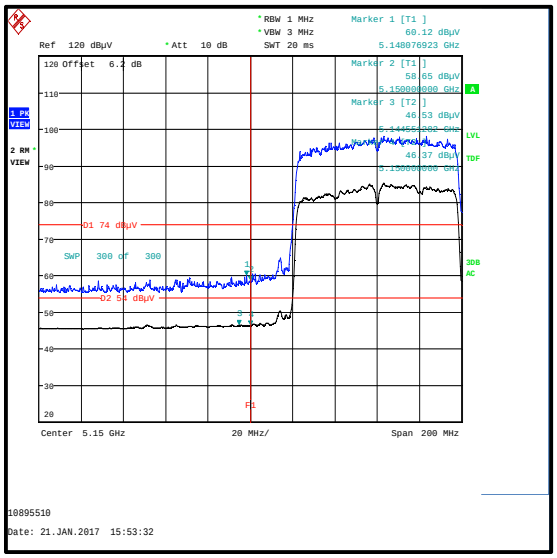
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

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

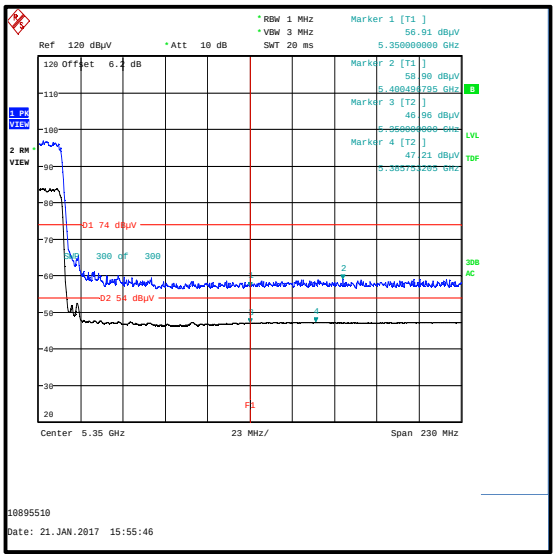
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5148.077	60.1	74.0	13.9	Complied
5150	58.7	74.0	15.3	Complied
5350	56.9	74.0	17.1	Complied
5400.497	58.9	74.0	15.1	Complied

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
5144.551	46.5	3.9	50.4	54.0	3.6	Complied
5150	46.4	3.9	50.3	54.0	3.7	Complied
5350	47.0	3.9	50.9	54.0	3.1	Complied
5385.753	47.2	3.9	51.1	54.0	2.9	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

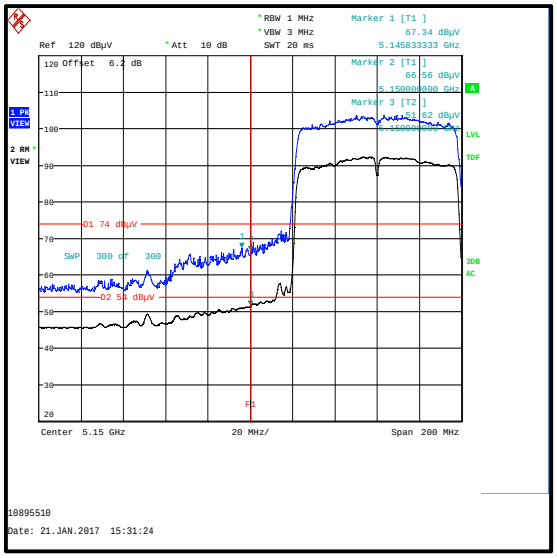
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

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

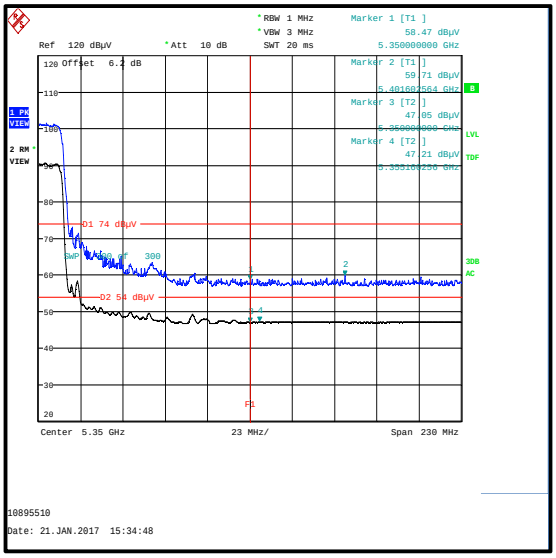
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5145.833	67.3	74.0	6.7	Complied
5150	66.6	74.0	7.4	Complied
5350	58.5	74.0	15.5	Complied
5401.603	59.7	74.0	14.3	Complied

Results: 802.11ac / 80 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	51.6	2.1	53.7	54.0	0.3	Complied
5350	47.1	2.1	49.2	54.0	4.8	Complied
5355.160	47.2	2.1	49.3	54.0	4.7	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

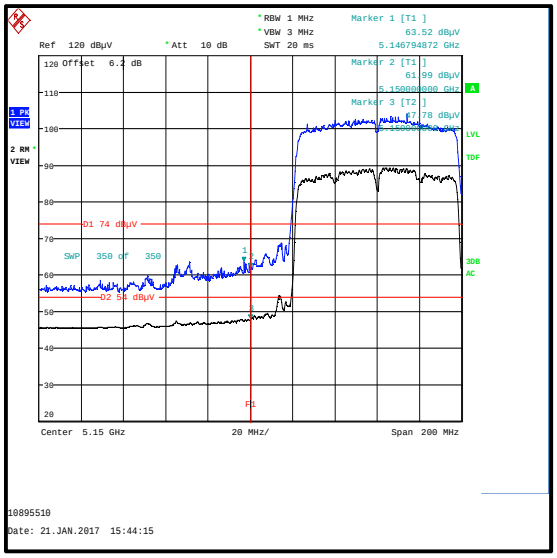
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

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

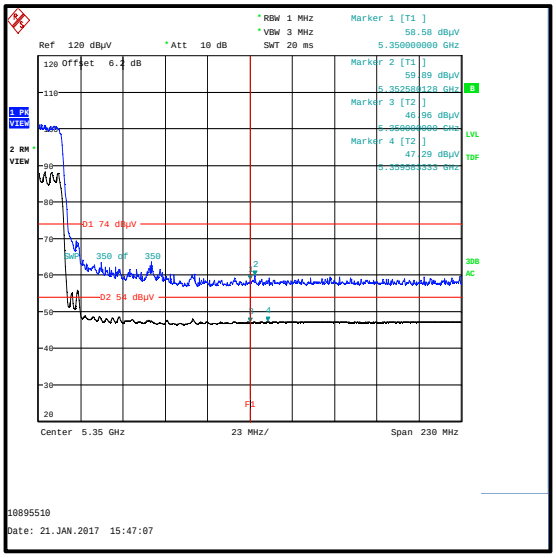
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5146.795	63.5	74.0	10.5	Complied
5150	62.0	74.0	12.0	Complied
5350	58.6	74.0	15.4	Complied
5352.580	59.9	74.0	14.1	Complied

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
5150	47.8	4.5	52.3	54.0	1.7	Complied
5350	47.0	4.5	51.5	54.0	2.5	Complied
5359.583	47.3	4.5	51.8	54.0	2.2	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:**	21 January 2017
Test Sample Serial Number:	92997		

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 (%):	28

Note(s):

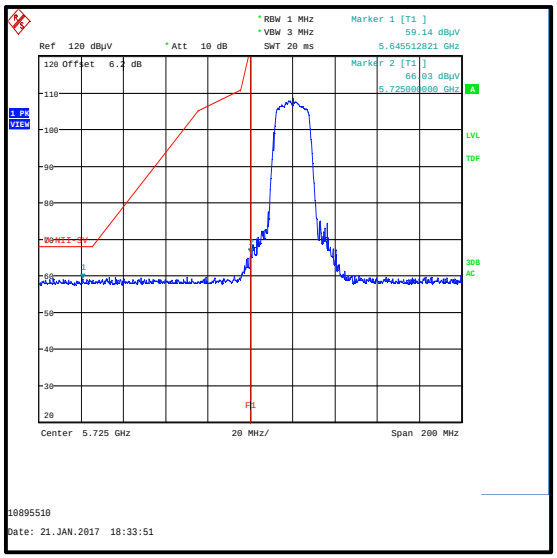
1. Band edge measurements were performed in the EUT modes that produce the highest power and the widest bandwidths. The modes were:
    - 802.11a - BPSK / 6 Mbps
    - 802.11a CDD - BPSK / 6 Mbps
    - 802.11n HT20 SISO - BPSK / MCS0 & 16QAM / MCS3
    - 802.11n HT40 SISO - BPSK / MCS0 & 16QAM / MCS3
    - 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 completeness, results are also shown as EIRP in dBm and also as field strength in dBµV/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)

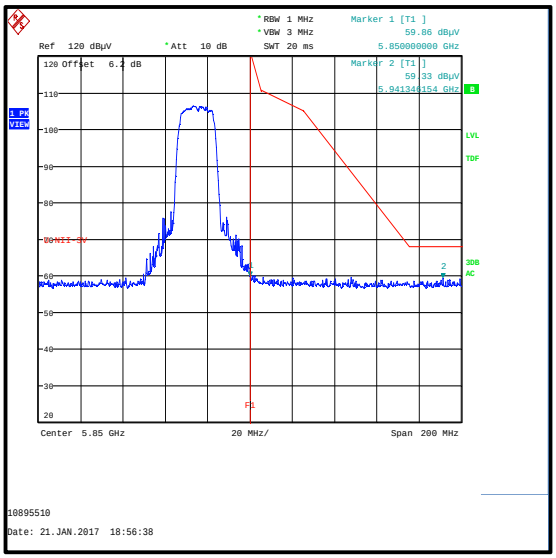
Results: 802.11a / 20 MHz / BPSK / 6 Mbps / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5645.513	-36.1	-27.0	9.1	Complied
5725	-29.2	27.0	56.2	Complied
5850	-35.3	27.0	62.3	Complied
5941.346	-35.9	-27.0	8.9	Complied

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5645.513	59.1	68.2	9.1	Complied
5725	66.0	122.2	56.2	Complied
5850	59.9	122.2	62.3	Complied
5941.346	59.3	68.2	8.9	Complied



Lower Band Edge Measurement



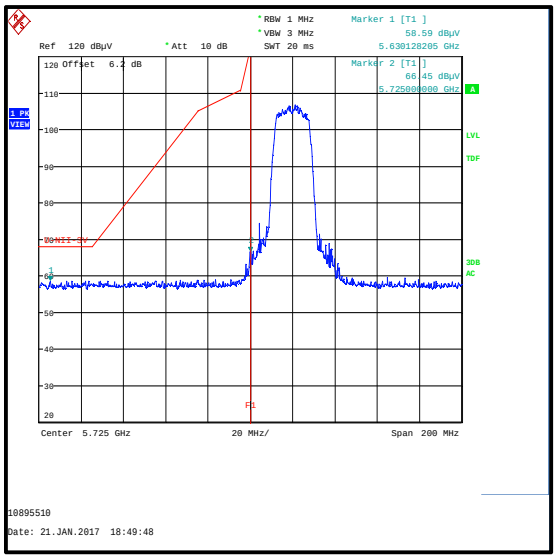
Upper Band Edge Measurement

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

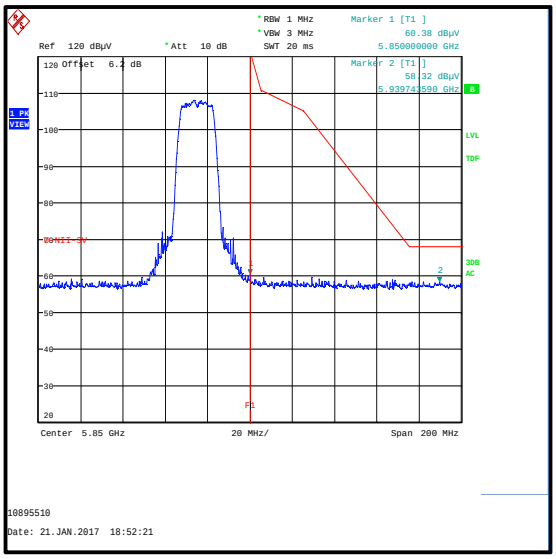
Results: 802.11a / 20 MHz / CDD / BPSK / 6 Mbps / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5630.128	-36.6	-27.0	9.6	Complied
5725	-28.7	27.0	55.7	Complied
5850	-34.8	27.0	61.8	Complied
5939.744	-36.9	-27.0	9.9	Complied

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5630.128	58.6	68.2	9.6	Complied
5725	66.5	122.2	55.7	Complied
5850	60.4	122.2	61.8	Complied
5939.744	58.3	68.2	9.9	Complied



Lower Band Edge Measurement



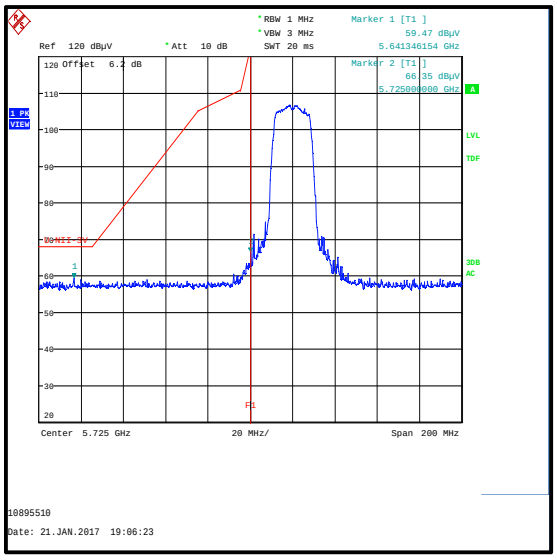
Upper Band Edge Measurement

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

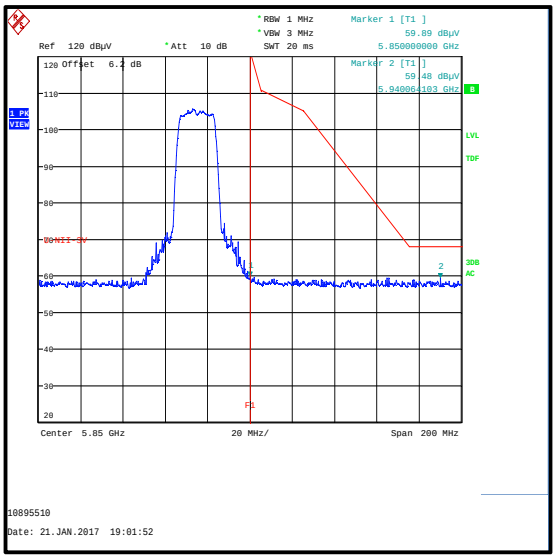
Results: 802.11n / 20 MHz / SISO / BPSK / MCS0 / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5641.346	-35.7	-27.0	8.7	Complied
5725	-28.8	27.0	55.8	Complied
5850	-35.3	27.0	62.3	Complied
5940.064	-35.7	-27.0	8.7	Complied

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5641.346	59.5	68.2	8.7	Complied
5725	66.4	122.2	55.8	Complied
5850	59.9	122.2	62.3	Complied
5940.064	59.5	68.2	8.7	Complied



Lower Band Edge Measurement



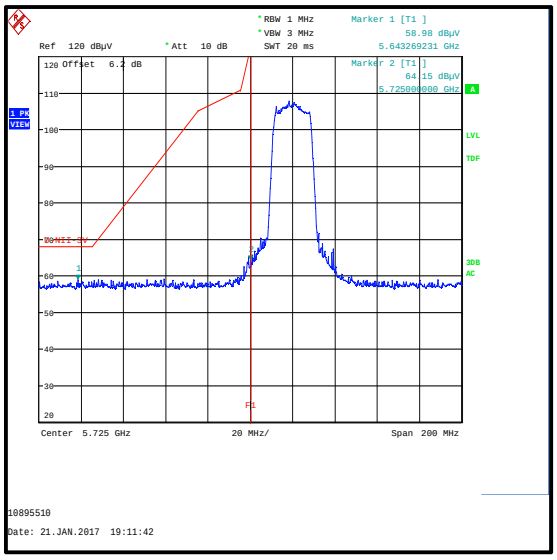
Upper Band Edge Measurement

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

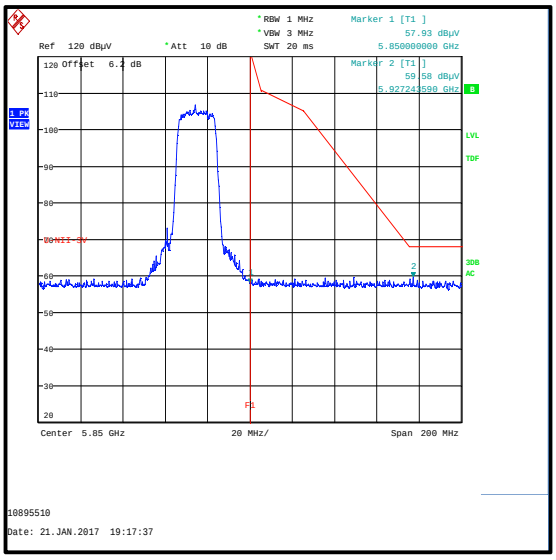
Results: 802.11n / 20 MHz / SISO / 16QAM / MCS3 / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5643.269	-36.2	-27.0	9.2	Complied
5725	-31.0	27.0	58.0	Complied
5850	-37.3	27.0	64.3	Complied
5927.244	-35.6	-27.0	8.6	Complied

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5643.269	59.0	68.2	9.2	Complied
5725	64.2	122.2	58.0	Complied
5850	57.9	122.2	64.3	Complied
5927.244	59.6	68.2	8.6	Complied



Lower Band Edge Measurement



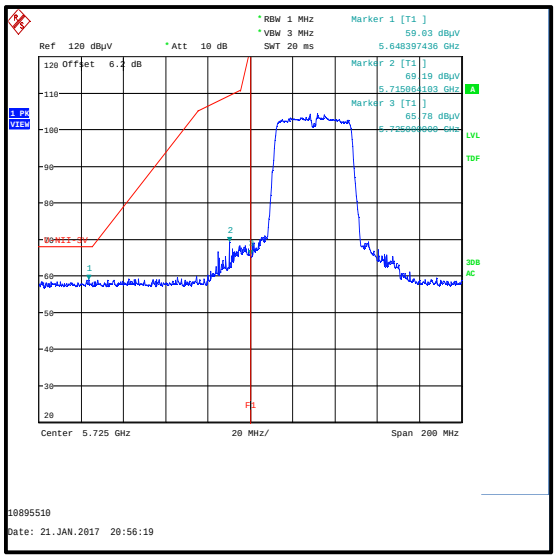
Upper Band Edge Measurement

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

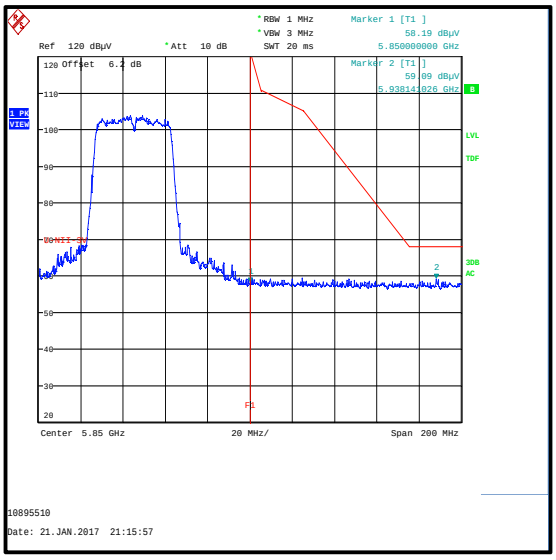
Results: 802.11n / 40 MHz / SISO / BPSK / MCS0 / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5648.397	-36.2	-27.0	9.2	Complied
5725	-29.4	27.0	56.4	Complied
5850	-37.0	27.0	64.0	Complied
5938.141	-36.1	-27.0	9.1	Complied

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5648.397	59.0	68.2	9.2	Complied
5725	65.8	122.2	56.4	Complied
5850	58.2	122.2	64.0	Complied
5938.141	59.1	68.2	9.1	Complied



Lower Band Edge Measurement



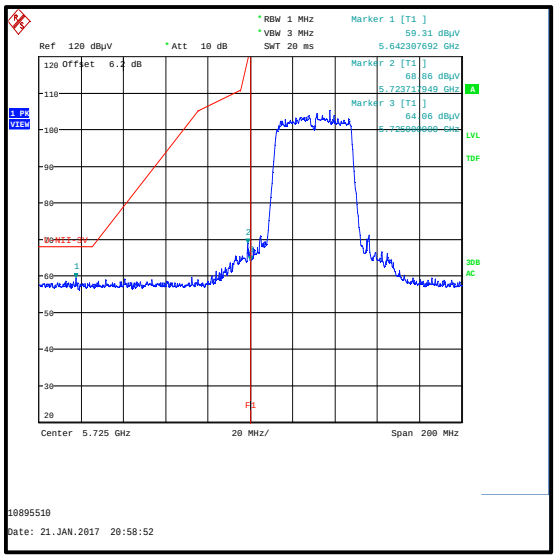
Upper Band Edge Measurement

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

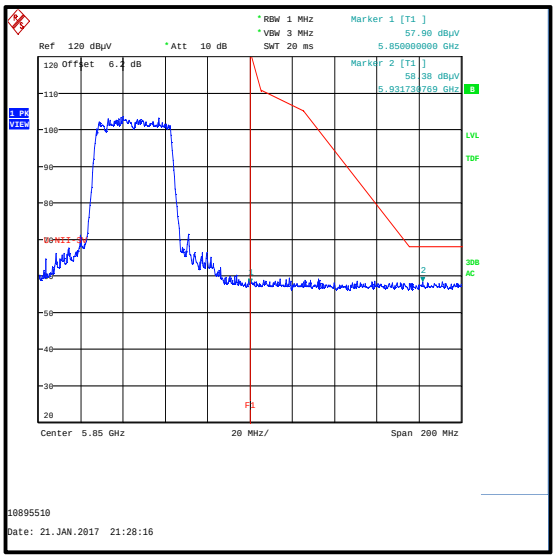
Results: 802.11n / 40 MHz / SISO / 16QAM / MCS3 / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5642.308	-35.9	-27.0	8.9	Complied
5725	-31.1	27.0	58.1	Complied
5850	-37.3	27.0	64.3	Complied
5931.731	-36.8	-27.0	9.8	Complied

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5642.308	59.3	68.2	8.9	Complied
5725	64.1	122.2	58.1	Complied
5850	57.9	122.2	64.3	Complied
5931.731	58.4	68.2	9.8	Complied



Lower Band Edge Measurement



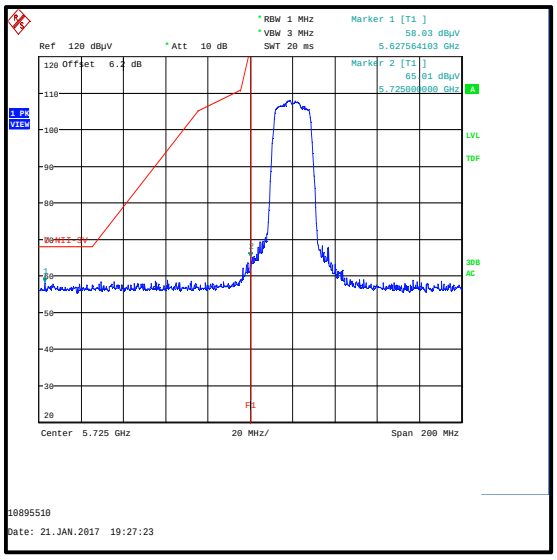
Upper Band Edge Measurement

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

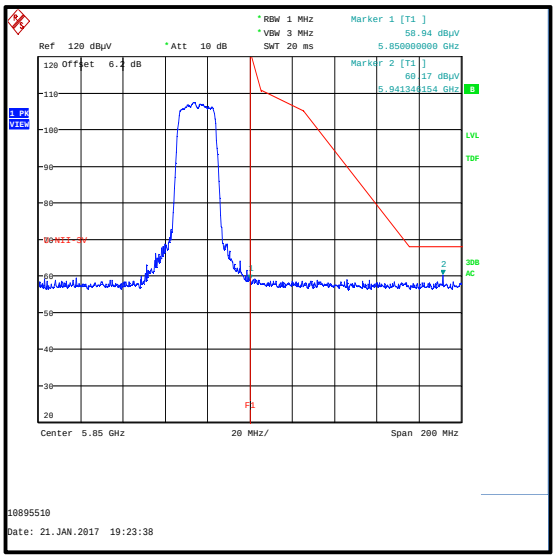
Results: 802.11n / 20 MHz / MIMO / BPSK / MCS0 / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5627.564	-37.2	-27.0	10.2	Complied
5725	-30.2	27.0	57.2	Complied
5850	-36.3	27.0	63.3	Complied
5941.346	-35.0	-27.0	8.0	Complied

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5627.564	58.0	68.2	10.2	Complied
5725	65.0	122.2	57.2	Complied
5850	58.9	122.2	63.3	Complied
5941.346	60.2	68.2	8.0	Complied



Lower Band Edge Measurement



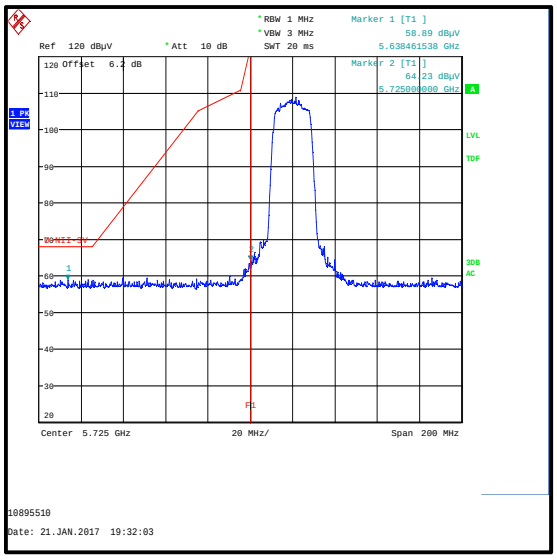
Upper Band Edge Measurement

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

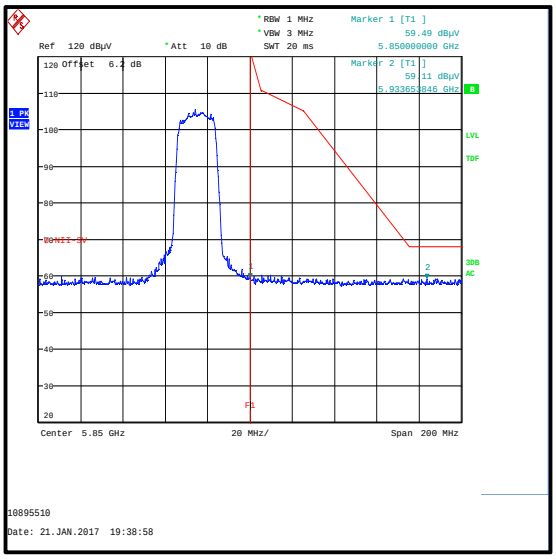
Results: 802.11n / 20 MHz / MIMO / QPSK / MCS1 / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5638.462	-36.3	-27.0	9.3	Complied
5725	-31.0	27.0	58.0	Complied
5850	-35.7	27.0	62.7	Complied
5933.654	-36.1	-27.0	9.1	Complied

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5638.462	58.9	68.2	9.3	Complied
5725	64.2	122.2	58.0	Complied
5850	59.5	122.2	62.7	Complied
5933.654	59.1	68.2	9.1	Complied



Lower Band Edge Measurement



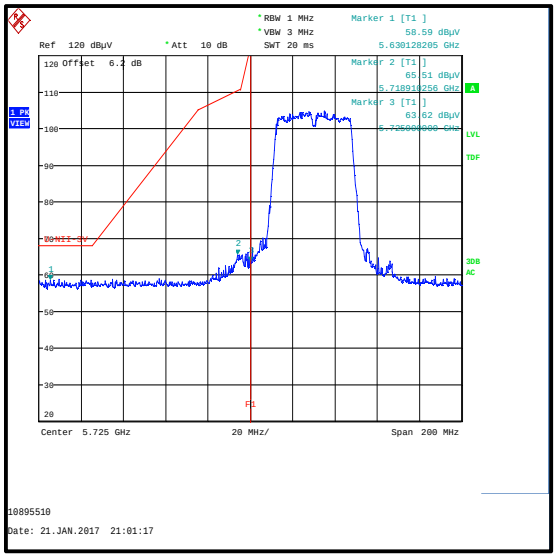
Upper Band Edge Measurement

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

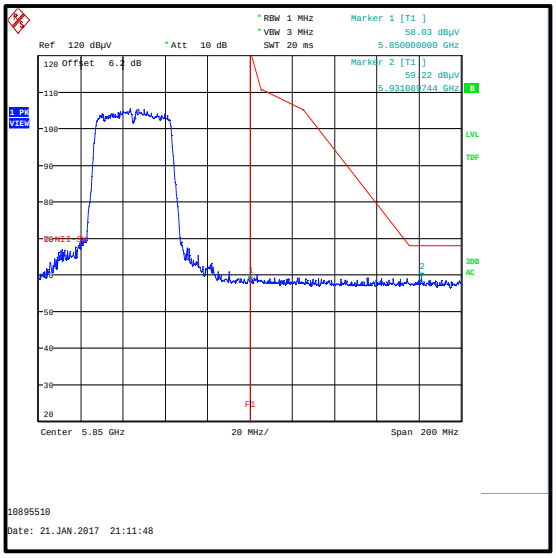
Results: 802.11n / 40 MHz / MIMO / BPSK / MCS0 / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5630.128	-36.6	-27.0	9.6	Complied
5725	-31.6	27.0	58.6	Complied
5850	-37.2	27.0	64.2	Complied
5931.090	-36.0	-27.0	9.0	Complied

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5630.128	58.6	68.2	9.6	Complied
5725	63.6	122.2	58.6	Complied
5850	58.0	122.2	64.2	Complied
5931.090	59.2	68.2	9.0	Complied



Lower Band Edge Measurement



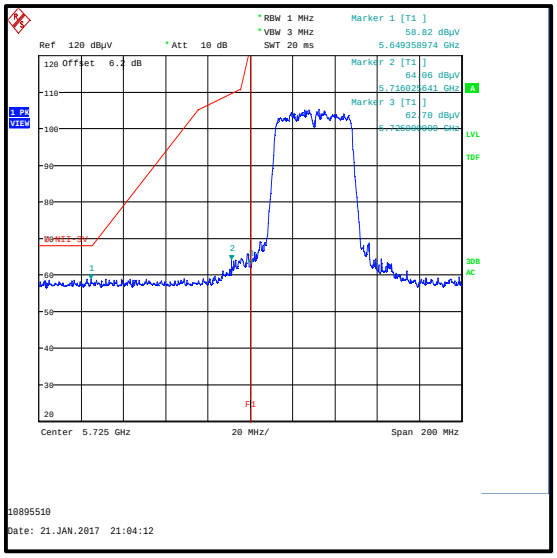
Upper Band Edge Measurement

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

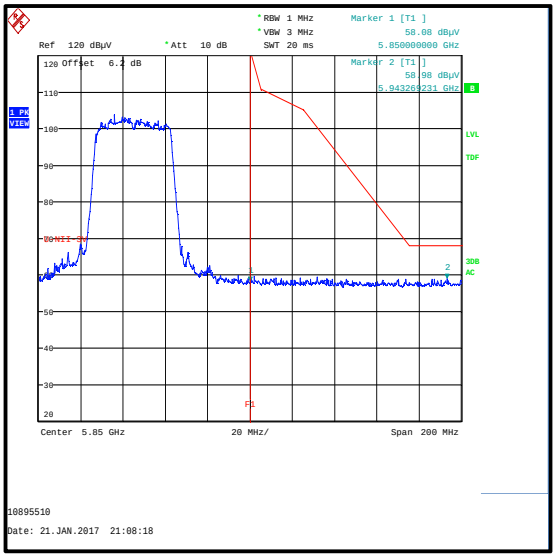
Results: 802.11n / 40 MHz / MIMO / 16QAM / MCS3 / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5649.359	-36.4	-27.0	9.4	Complied
5725	-32.5	27.0	59.5	Complied
5850	-37.1	27.0	64.1	Complied
5943.269	-36.2	-27.0	9.2	Complied

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5649.359	58.8	68.2	9.4	Complied
5725	62.7	122.2	59.5	Complied
5850	58.1	122.2	64.1	Complied
5943.269	59.0	68.2	9.2	Complied



Lower Band Edge Measurement



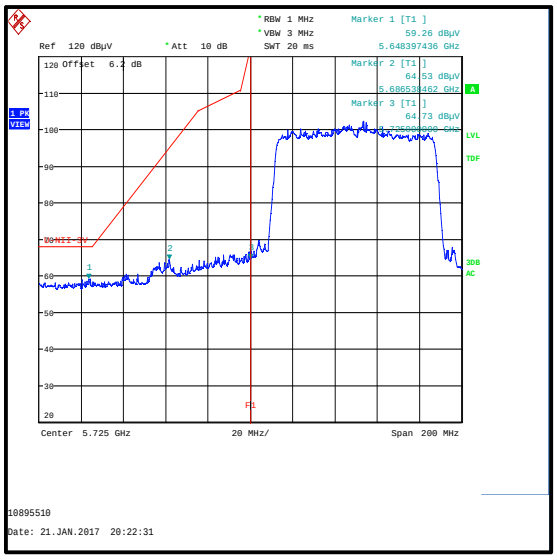
Upper Band Edge Measurement

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

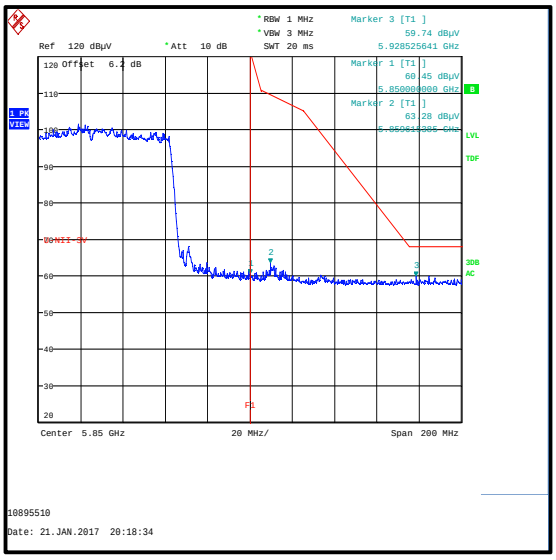
Results: 802.11ac / 80 MHz / SISO / QPSK / MCS2 / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5648.397	-35.9	-27.0	8.9	Complied
5725	-30.5	27.0	57.5	Complied
5850	-34.7	27.0	61.7	Complied
5928.526	-35.5	-27.0	8.5	Complied

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5648.397	59.3	68.2	8.9	Complied
5725	64.7	122.2	57.5	Complied
5850	60.5	122.2	61.7	Complied
5928.526	59.7	68.2	8.5	Complied



Lower Band Edge Measurement



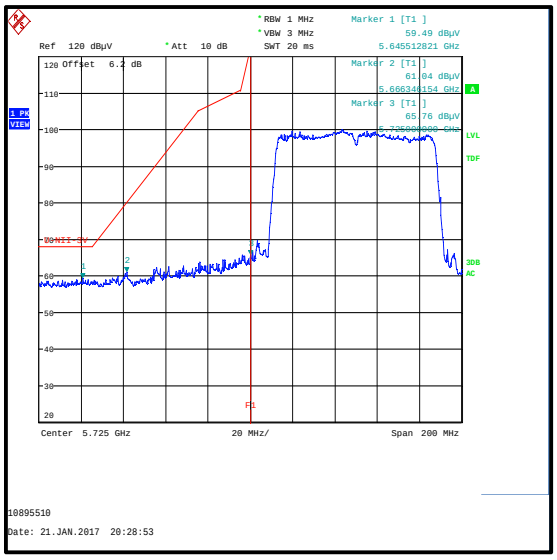
Upper Band Edge Measurement

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

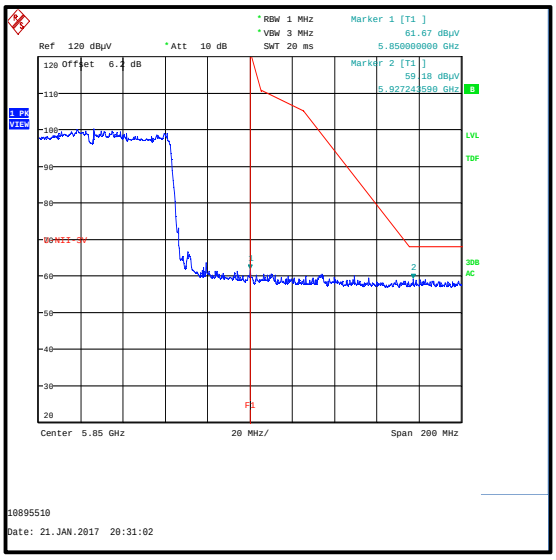
Results: 802.11ac / 80 MHz / MIMO / BPSK / MCS0 / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5645.513	-35.7	-27.0	8.7	Complied
5725	-29.4	27.0	56.4	Complied
5850	-33.5	27.0	60.5	Complied
5927.244	-36.0	-27.0	9.0	Complied

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5645.513	59.5	68.2	8.7	Complied
5725	65.8	122.2	56.4	Complied
5850	61.7	122.2	60.5	Complied
5927.244	59.2	68.2	9.0	Complied



Lower Band Edge Measurement



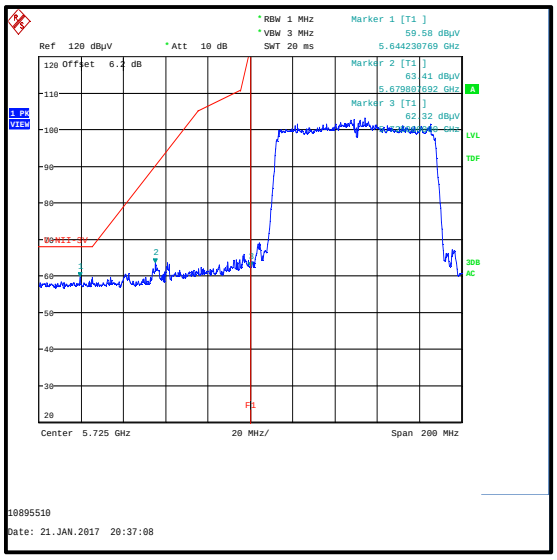
Upper Band Edge Measurement

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

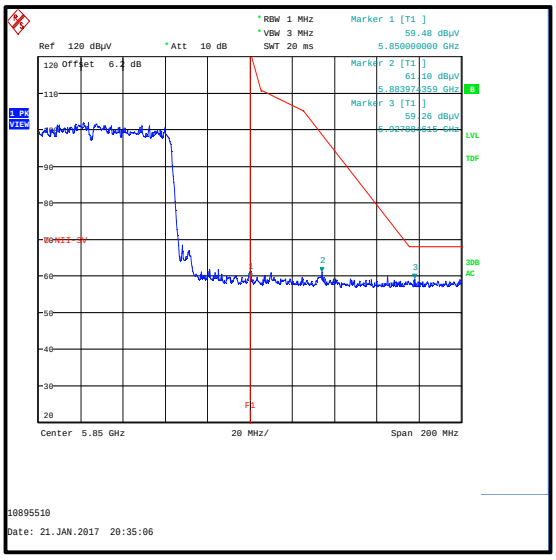
Results: 802.11ac / 80 MHz / MIMO / 16QAM / MCS3 / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5644.231	-35.6	-27.0	8.6	Complied
5725	-32.9	27.0	59.9	Complied
5850	-35.7	27.0	62.7	Complied
5927.885	-35.9	-27.0	8.9	Complied

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5644.231	59.6	68.2	8.6	Complied
5725	62.3	122.2	59.9	Complied
5850	59.5	122.2	62.7	Complied
5927.885	59.3	68.2	8.9	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

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 ---