



Certification Test Report

FCC ID: 2ADDKFLY4KW01

IC: 12404A-FLY4KW01

FCC Rule Part: 15.407

ISED Canada's Radio Standards Specification: RSS-247

Report Number: BO72131093.401

Applicant: 360fly, Inc.

Model(s): FLY4KW01

Test Begin Date: **September 28, 2017**

Test End Date: **October 25, 2017**

Report Issue Date: November 6, 2017



FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER AT-1533

This report must not be used by the client to claim product certification, approval, or endorsement by ANAB, ANSI, or any agency of the Federal Government.

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This report contains 47 pages

TABLE OF CONTENTS

1	GENERAL	3
1.1	Purpose	3
1.2	Applicant Information	3
1.3	Product Description	3
1.4	Test Methodology and Considerations	4
2	TEST FACILITIES	5
2.1	Location	5
2.2	Laboratory Accreditations/Recognitions/Certifications.....	5
2.3	Radiated & Conducted Emissions Test Site Description	6
2.3.1	Semi-Anechoic Chamber Test Site	6
2.3.2	Conducted Emissions Test Site Description.....	7
3	APPLICABLE STANDARD REFERENCES	8
4	LIST OF TEST EQUIPMENT	9
5	SUPPORT EQUIPMENT	10
6	EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM.....	11
7	SUMMARY OF TESTS	12
7.1	Antenna Requirement – FCC: Section 15.203.....	12
7.2	26 dB Emission Bandwidth / Occupied Bandwidth - FCC: Section 15.407(e); ISED Canada: RSS-247 6.2, RSS-GEN 6.6	12
7.2.1	Measurement Procedure	12
7.2.2	Measurement Results	12
7.3	Maximum Conducted Output Power	23
7.3.1	Measurement Procedure (Conducted Method) – FCC: Section 15.407(a)(1); ISED Canada: RSS-247 6.2.1 Band 5.15 GHz-5.25GHz	23
7.3.2	Measurement Results	23
7.4	Maximum Power Spectral Density – FCC: Section 15.407(a)(1); ISED Canada: RSS-247 6.2.1 Band 5.15 – 5.25 GHz	29
7.4.1	PSD Measurement Procedure (Conducted Method).....	29
7.4.2	Measurement Results	29
7.5	Band-Edge Compliance and Spurious Emissions – FCC: 15.407(b); ISED Canada: RSS-247 6.2.31	31
7.5.1	Radiated Emissions below 1 GHz	31
7.5.2	Radiated Spurious Emissions above 1 GHz.....	32
7.5.3	Sample Calculation	35
7.6	Power Line Conducted Emissions – FCC: Section 15.207; ISED Canada: RSS-Gen 8.8.....	36
7.6.1	Measurement Procedure	36
7.6.2	Measurement Results	36
7.7	Frequency Stability – FCC: Section 15.407(g); ISED Canada: RSS-Gen 8.11.....	39
7.7.1	Measurement Procedure	39
7.7.2	Measurement Results	39
7.8	Duty Cycle	43
7.8.1	Measurement Procedure	43
7.8.2	Measurement Results	43
8	MEASUREMENT UNCERTAINTIES	46
9	CONCLUSION.....	47

1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations Section 15.407 and Innovation Science and Economic Development Canada's Radio Standards Specification RSS-247 for the tests documented herein.

1.2 Applicant Information

360fly, Inc.
1975 East Sunrise Blvd., Suite 400
Fort Lauderdale, FL 33304

1.3 Product Description

The 360fly, Inc. model FLY4KW01 is an in-vehicle video solution with complete 360-degree coverage. The device provides Bluetooth and 2.4/5 GHz Wi-Fi connectivity. This test report documents the compliance of the 5 GHz Wi-Fi Transmitter.

Technical Details

Mode of Operation: 5 GHz WLAN IEEE 802.11a/n/ac
Modulations: OFDM
Antenna Type/Gain: Loop with parasitic antenna, -0.36 dBi
Input Power: 5 VDC USB, 4 VDC Dock.

Table 1.3-1: 5 GHz WLAN Specifications

Band of Operation (MHz)	Mode of Operation	Frequency Range (MHz)	Number of Available Channels	Channel Spacing (MHz)	Data Rates (Mbps)
5150 – 5250 (U-NII-1)	802.11a	5180 – 5240	4	20	6, 9, 12, 18, 24, 36, 48, 54
	802.11n (HT20)	5180 – 5240	4	20	6.5, 13, 19.5, 26, 52, 58.5, 65, 72.2
	802.11 ac (VHT20)	5180 – 5240	4	20	6.5, 13, 19.5, 26, 39, 52, 58.5, 65, 78, 86.5
	802.11n (HT40)	5190 – 5230	2	40	13, 27, 40.5, 54, 81, 108, 121.5, 135
	802.11ac (VHT40)	5190 – 5230	2	40	13.5, 27, 40.5, 54, 81, 108, 121.5, 135, 162, 180
	802.11ac (VHT80)	5210	1	N/A	29.3, 58.5, 87.8, 117, 175.5, 234, 263.3, 292.5, 351, 390

Model Number: FLY4KW01

Test Sample Serial Number(s): 1708174355 (RF Conducted Measurements), 1709174742 (Radiated and Power Line Conducted Emissions).

Test Sample Condition: The samples were in good operating condition with no physical damages.

1.4 Test Methodology and Considerations

The EUT was evaluated for RF Conducted, Radiated and Power Line Conducted emissions. All the available data rates were investigated. Where applicable, the data rate leading to the highest emissions with respect to the limits are reported.

Preliminary radiated emission measurements were performed for the EUT standalone, the EUT powered via USB and the EUT set within the dock. Additionally, the EUT worst position with respect to the ground plane was investigated as well. The configuration with the dock led to the highest emissions. The EUT set sideways on the table top was determined as the worst case orientation. The results reported accordingly.

The RF conducted measurements were performed on a sample modified with a temporary RF connector to allow direct coupling to the spectrum analyzer.

The power line conducted emission measurements were performed on the EUT powered via USB using an off-the-shelf power supply.

The EUT was also investigated for compliance to the unintentional emission requirements. The results are documented in a verification test report.

Table 1.4-1: IEEE 802.11a/n/ac Radio Test Configuration

Mode of Operation	Frequency (MHz)	Channel	Test Software Power Setting	Data Rate (Mbps)
802.11a	5180	36	14	6
	5200	40		
	5240	48		
802.11n 20 MHz (HT20)	5180	36	14	6.5
	5200	40		
	5240	48		
802.11n 40 MHz (HT40)	5190	38	13	13
	5230	46		
802.11ac 80 MHz (VHT80)	5210	42	13	29.3

Note: 802.11n(HT20) and 802.11n(HT40) test results are deemed representative of the 802.11ac(VHT20) and 802.11ac(VHT40), respectively.

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

TÜV SÜD America, Inc.
3998 FAU Blvd, Suite 310
Boca Raton, Florida 33431
Phone: (561) 961-5585
Fax: (561) 961-5587
<http://www.tuv-sud-america.com>

2.2 Laboratory Accreditations/Recognitions/Certifications

TÜV SÜD America, Inc. is accredited to ISO/IEC 17025 by ANSI-ASQ National Accreditation Board under their ANAB program and has been issued certificate number AT-1533 in recognition of this accreditation. Unless otherwise specified, all test methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

FCC Test Firm Registration #: 475089
Innovation, Science and Economic Development Canada Lab Code: 4175C

2.3 Radiated & Conducted Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The EMC radiated test facility consists of an RF-shielded enclosure. The interior dimensions of the indoor semi-anechoic chamber are approximately 48 feet (14.6 m) long by 36 feet (10.8 m) wide by 24 feet (7.3 m) high and consist of rigid, 1/8 inch (0.32 cm) steel-clad, wood core modular panels with steel framing. In the shielded enclosure, the faces of the panels are galvanized and the chamber is self-supporting. 8-foot RF absorbing cones are installed on 4 walls and the ceiling. The steel-clad ground plane is covered with vinyl flooring.

The turntable is driven by pneumatic motor, which can support a 2000 lb. load. The turntable is flush with the chamber floor which it is connected to, around its circumference, with a continuous metallic loaded spring. An EMCO Model 1060 Multi-device controller controls the turntable position.

A pneumatic motor is used to control antenna polarizations and height relative to the ground. The height information is displayed on the control unit EMCO Model 1050.

The control room is an RF shielded enclosure attached to the semi-anechoic chamber with two bulkhead panels for connecting RF, and control cables. The dimension of the room is 7.3 m x 4.9 m x 3 m high and the entrance doors of both control and conducted rooms are 3 feet (0.91 m) by 7 feet (2.13 m).

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3.1-1 below:

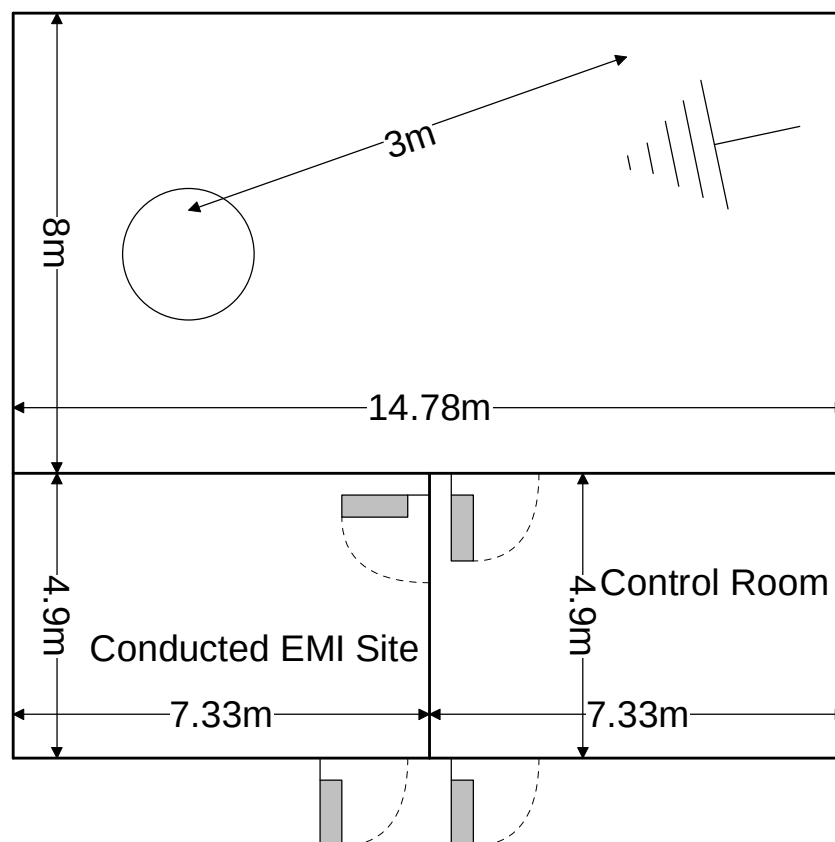


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.3.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are 7.3 x 4.9 x 3 m³. The power line conducted emission site includes two LISNs: a Solar Model 8028-50 50 Ω /50 μ H and an EMCO Model 3825/2R, which are installed as shown in the figure below. For evaluations requiring 230 V, 50 Hz AC input, a Polarad LISN (S/N 879341/048) is used in conjunction with a California Instruments signal generator Model 2001RP-OP1.

A diagram of the room is shown below in figure 2.3.2-1:

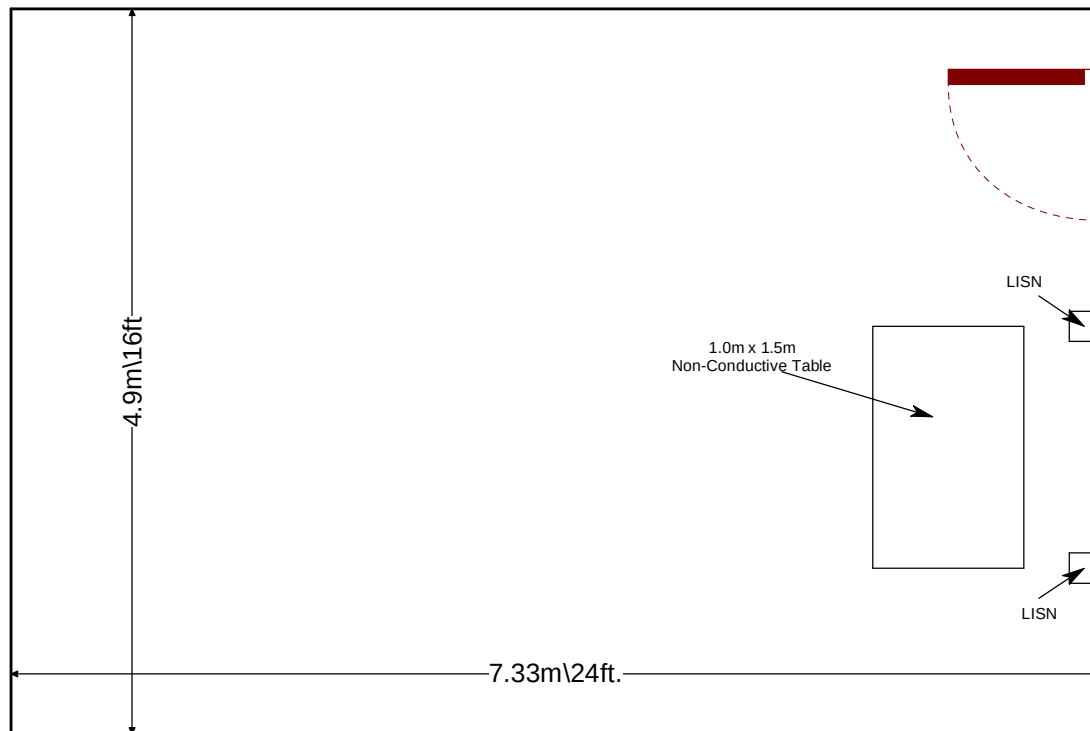


Figure 2.3.2-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ❖ ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2017.
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2017
- ❖ FCC OET KDB Publication No. 789033 D02 General U-NII Test Procedures New Rules v01r04: Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E, May 2, 2017.
- ❖ FCC OET KDB Publication No. 905462 D06 802.11 Channel Plans New Rules v02: Operation in U-NII Bands – 802.11 Channel Plan, 15.407.
- ❖ FCC OET KDB Publication No. 644545 D03 Guidance for IEEE 802.11ac New Rules v01: Guidance for IEEE Standard 802.11ac™ Devices Emission Testing, August 2014
- ❖ Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-247 — Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices, Issue 2, February 2017.
- ❖ Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 4, November 2014.

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment List

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
282	Microwave Circuits	H2G020G4	Filters	74541	5/23/2017	5/23/2018
283	Rohde & Schwarz	FSP40	Spectrum Analyzers	1000033	7/21/2016	7/21/2018
332	Rohde & Schwarz	TS-PR40	Amplifiers	100021	3/14/2016	3/14/2018
333	Rohde&Schwarz	3160-10	Antennas	45576	11/4/2010	NCR
479	Electro-Metrics	ALP-70	Antennas	158	12/3/2015	12/3/2017
523	Agilent	E7405	Spectrum Analyzers	MY45103293	12/9/2016	12/9/2018
653	Suhner	SF-102A	Cables	0944/2A	9/5/2017	9/5/2018
2002	EMCO	3108	Antennas	2147	11/19/2015	11/19/2017
2004	EMCO	3146	Antennas	1385	11/19/2015	11/19/2017
2006	EMCO	3115	Antennas	2573	4/7/2017	4/7/2019
2008	COM-Power	AH-826	Antennas	81009	NCR	NCR
2045	ACS Boca	Conducted Cable Set	Cable Set	2045	10/31/2016	10/31/2017
2082	Teledyne Storm Products	90-010-048	Cables	2082	4/7/2017	4/7/2018
2086	Merrimac	FAN-6-10K	Attenuators	23148-83-1	11/2/2016	11/2/2017
2089	Agilent Technologies, Inc.	83017A	Amplifiers	3123A00214	12/2/2016	12/2/2017
2095	ETS Lindgren	TILE4! - Version 4.2.A	Software	85242	NCR	NCR
2102	Test Equity	115	Environmental Chamber	150892	NCR	NCR
2108	Fluke	115	Digital MultiMeter	99211160	4/25/2017	4/25/2018
2111	Aeroflex Inmet	40AH2W-20	Attenuator	2111	7/20/2017	7/20/2018
2112	Teledyne Storm Products	921-0101-036	Cables	12-06-698	11/2/2016	11/2/2017
2121	ACS Boca	Radiated Cable Set	Cable Set	2121	7/31/2017	7/31/2018
2124	Fluke	51II	Digital Thermometer	97060019	6/1/2017	6/1/2018
3004	Teseq	CFL 9206A	Attenuators	34720	8/29/2017	8/29/2018
TEMC00153	Rohde and Schwarz	ESH3-Z5	LISN	894785/012	9/27/2017	9/27/2018

Notes:

- NCR=No Calibration Required
- The assets were only used during the active period of the calibration cycle.

5 SUPPORT EQUIPMENT**Table 5-1: EUT and Support Equipment Description – Radiated Emissions**

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	360fly, Inc.	FLY4KW01	1709174742
2	Car Cradle	360fly, Inc.	FLYCRD01	N/A
3	Cigarette Lighter Adapter (CLA)	N/A	N/A	N/A
4	Power Supply	MPJA	HY5003	3700278

Table 5-2: Cable Description – Radiated Emissions

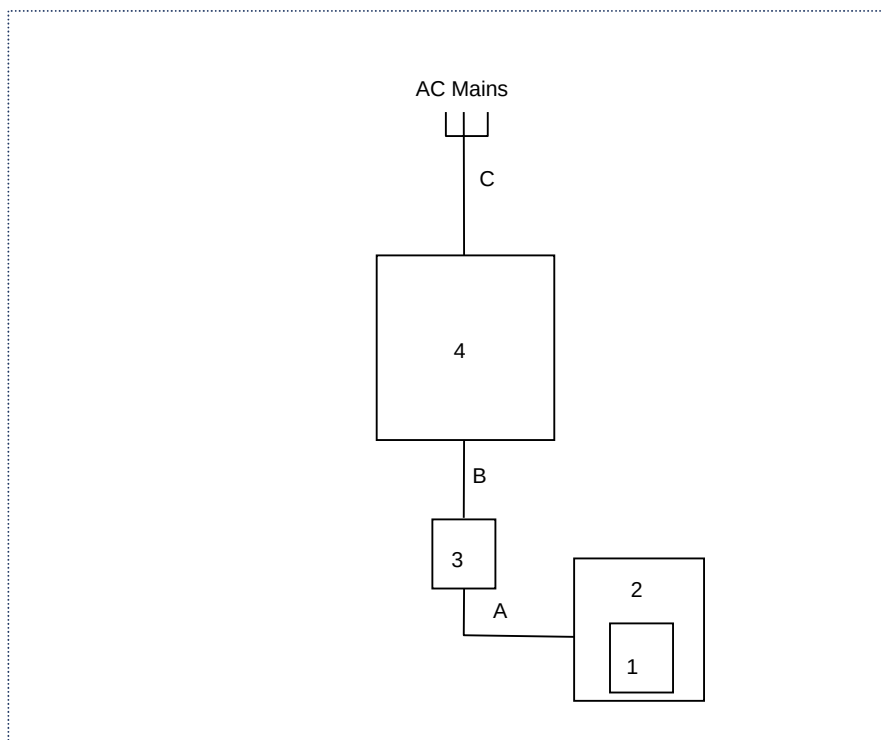
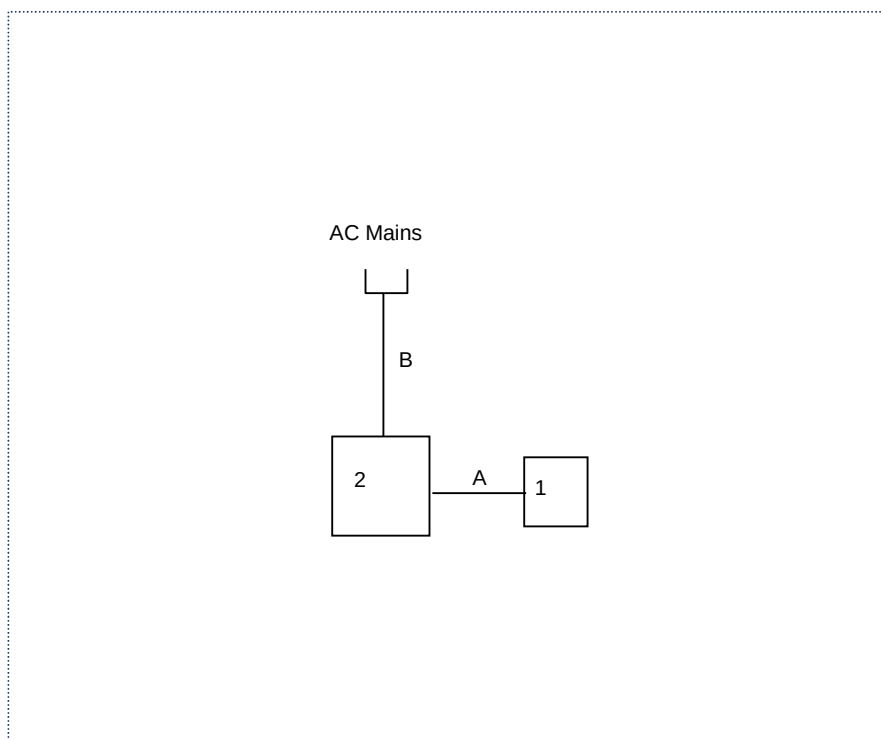
Cable #	Cable Type	Length	Shield	Termination
A	DC Cable	2.05 m	No	CLA to EUT
B	DC Leads	2.9 m	No	CLA to Power Supply
C	Power Cord	2.3 m	No	Power Supply to AC Mains

Table 5-3: EUT and Support Equipment Description – Power Line Conducted Emissions

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	360fly, Inc.	FLY4KW01	1709174742
2	5 VDC Power Supply	VSN Mobil	C-P06	141119001574

Table 5-4: Cable Description – Power Line Conducted Emissions

Cable #	Cable Type	Length	Shield	Termination
A	USB Cable	0.98 m	No	EUT to Power Supply
B	Extension Cord	1.85 m	No	Power Supply to AC Mains

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM**Figure 6-1: EUT and Support Equipment Block Diagram – Radiated Emissions****Figure 6-2: EUT and Support Equipment Block Diagram – Power Line Conducted Emissions**

7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement – FCC: Section 15.203

The EUT uses an internal -0.36 dBi loop with parasitic antenna that is connected to the main PCB via contact springs. The antenna is not replacable without damaging the equipment and therefore meets the requirements of FCC Section 15.203.

7.2 26 dB Emission Bandwidth / Occupied Bandwidth - FCC: Section 15.407(e); ISED Canada: RSS-247 6.2, RSS-GEN 6.6

7.2.1 Measurement Procedure

The 26 dB Emission Bandwidth (EBW) was measured in accordance with the FCC KDB Publication No. 789033 D02 General UNII Test Procedures New Rules v01r04 “Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E” Emission Bandwidth (EBW). The RBW was set to approximately 1% of the emission bandwidth. The bandwidth was measured as the maximum width of the emission that is 26 dB down from the maximum of the emission.

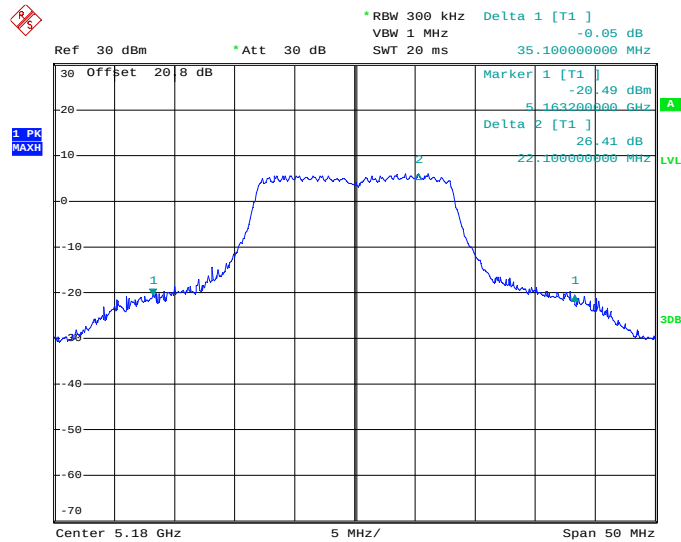
The 99% occupied bandwidth was measured with the spectrum analyzer span set to fully display the emission, including the emissions skirts. The RBW was to 1% to 5% of the occupied bandwidth. The occupied 99% bandwidth was measured using the occupied bandwidth function of the analyzer.

7.2.2 Measurement Results

Performed by: Thierry Jean-Charles

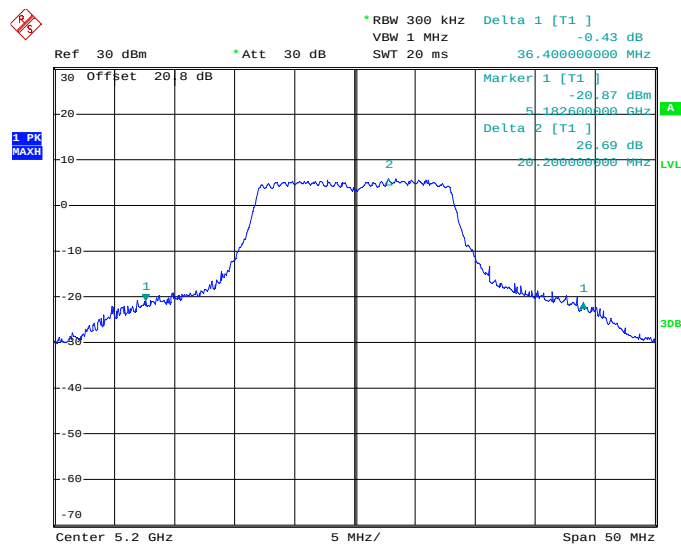
Table 7.2.2-1: EBW / 99% Bandwidth – 802.11a

Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
5180	35.1	18.4
5200	36.4	18.3
5240	33.7	18.3



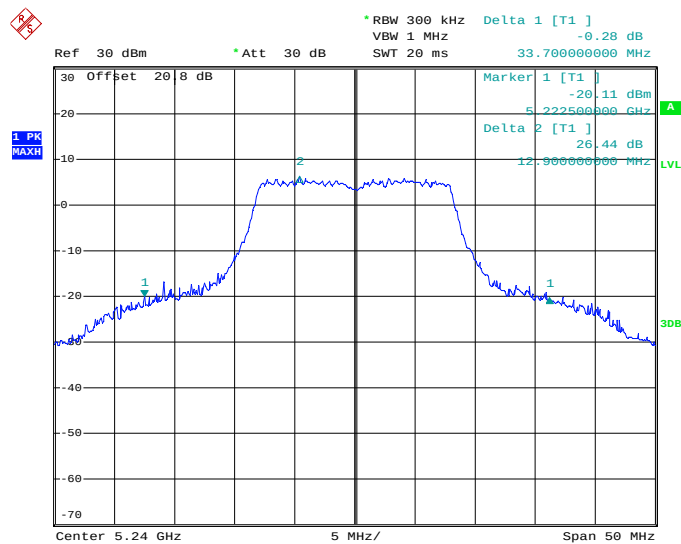
Date: 19.OCT.2017 14:02:09

Figure 7.2.2-1: 26 dB EBW - Low Channel – 802.11a



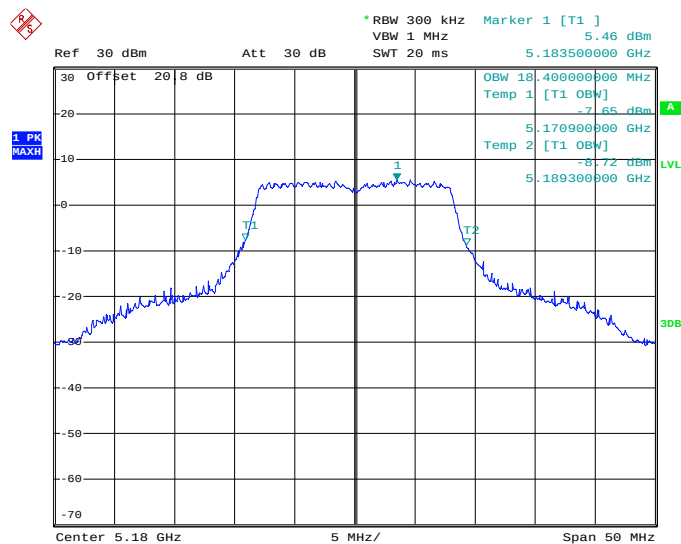
Date: 19.OCT.2017 13:58:25

Figure 7.2.2-2: 26 dB EBW - Middle Channel – 802.11a



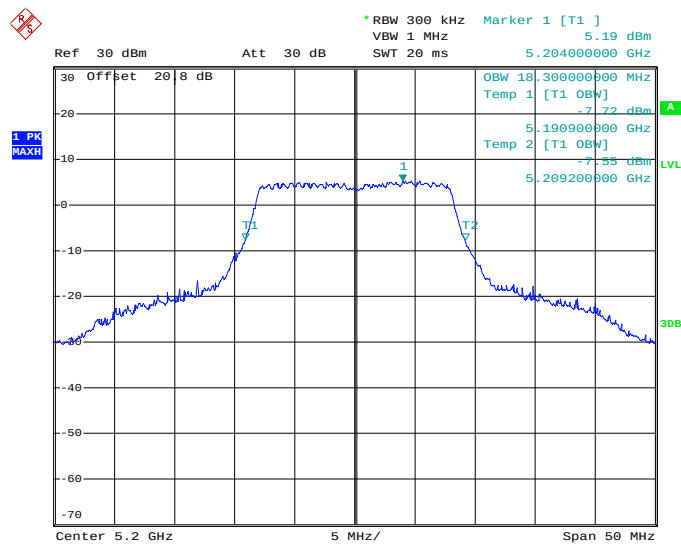
Date: 19.OCT.2017 14:05:20

Figure 7.2.2-3: 26 dB EBW - High Channel – 802.11a



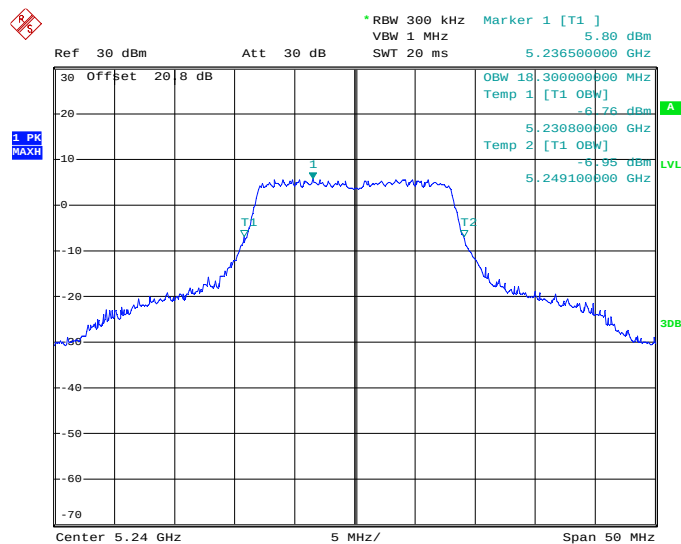
Date: 19.OCT.2017 11:15:57

Figure 7.2.2-4: 99% OBW - Low Channel – 802.11a



Date: 19.OCT.2017 11:26:20

Figure 7.2.2-5: 99% OBW - Middle Channel – 802.11a

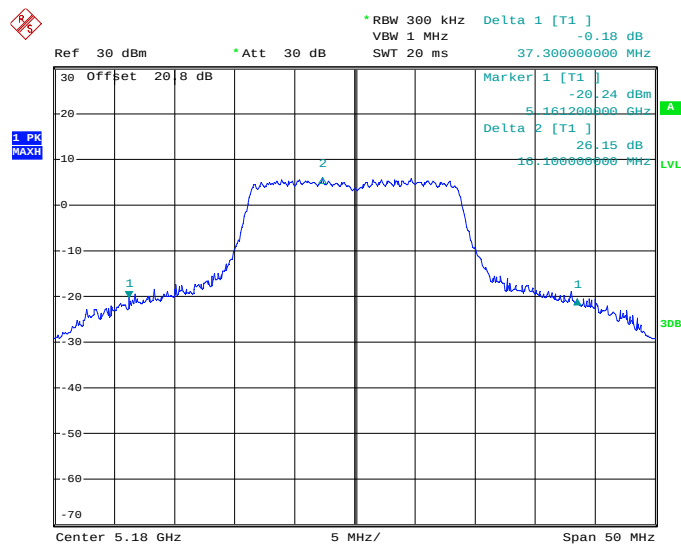


Date: 19.OCT.2017 11:32:05

Figure 7.2.2-6: 99% OBW - High Channel – 802.11a

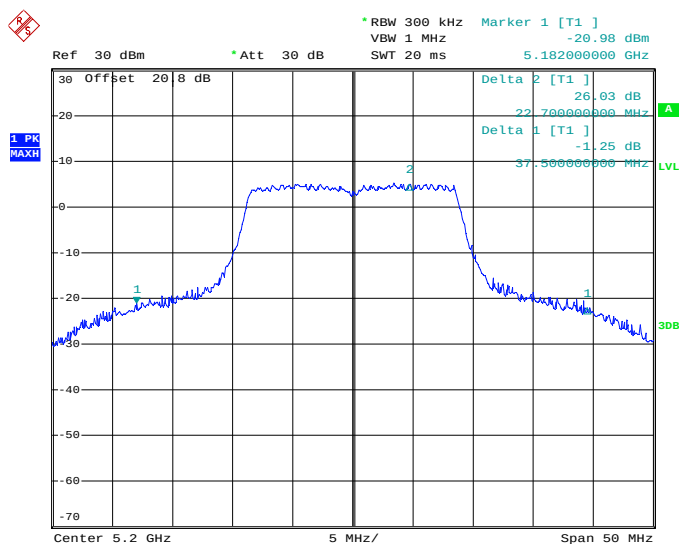
Table 7.2.2-2: EBW / 99% Bandwidth – 802.11n 20 MHz

Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
5180	37.3	19.1
5200	37.5	19.1
5240	37.7	19.0



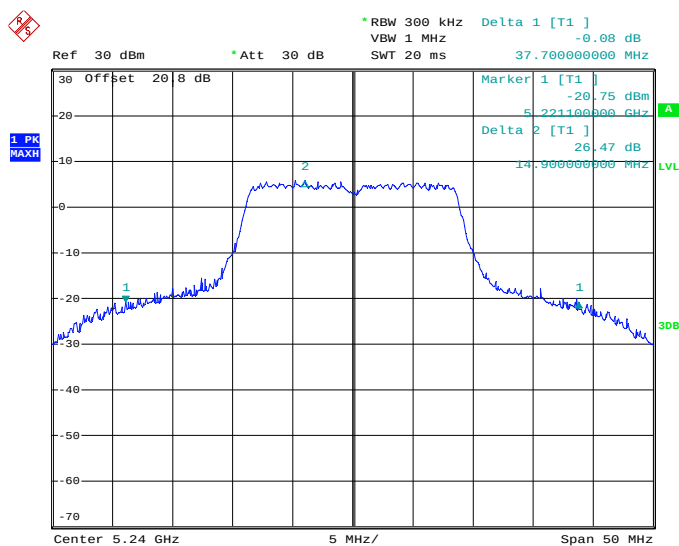
Date: 19.OCT.2017 14:11:43

Figure 7.2.2-7: 26 dB EBW - Low Channel – 802.11n 20 MHz



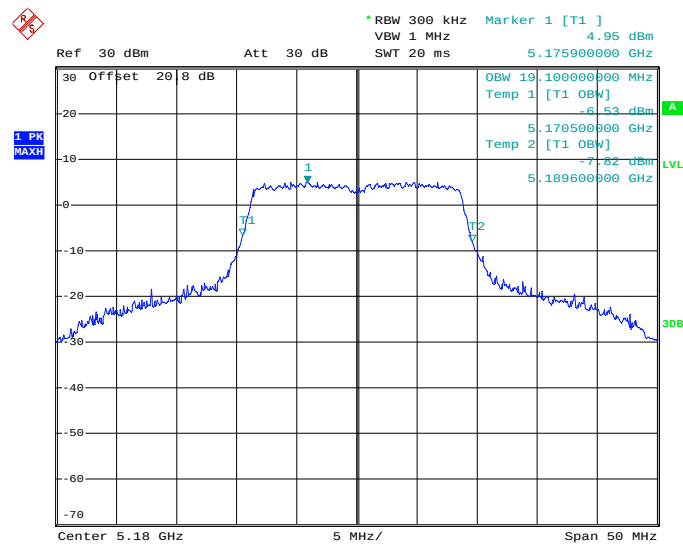
Date: 19.OCT.2017 14:15:47

Figure 7.2.2-8: 26 dB EBW - Middle Channel – 802.11n 20 MHz



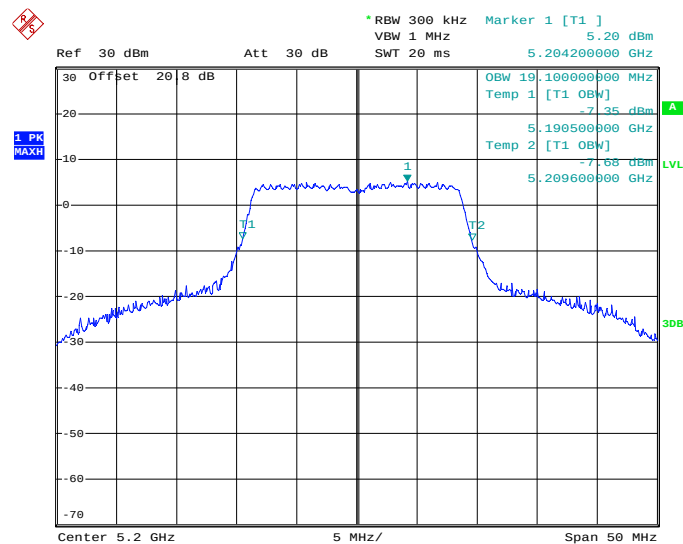
Date: 19.OCT.2017 14:18:37

Figure 7.2.2-9: 26 dB EBW - High Channel – 802.11n 20 MHz



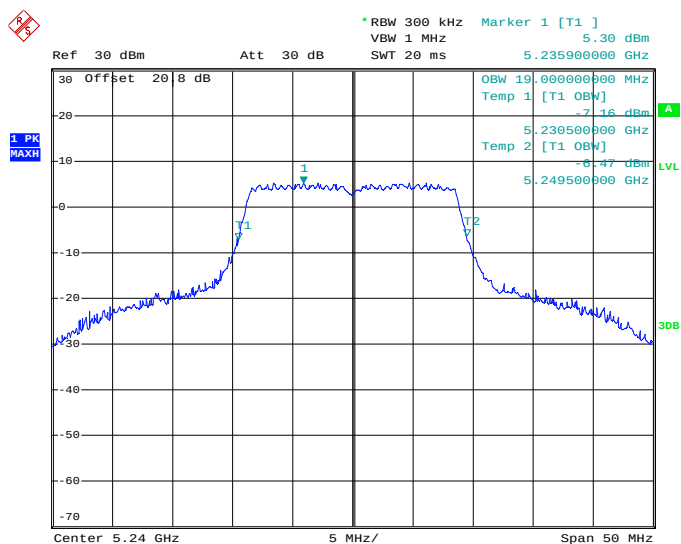
Date: 19.OCT.2017 11:38:35

Figure 7.2.2-10: 99% OBW - Low Channel – 802.11n 20 MHz



Date: 19.OCT.2017 12:04:12

Figure 7.2.2-11: 99% OBW - Middle Channel – 802.11n 20 MHz

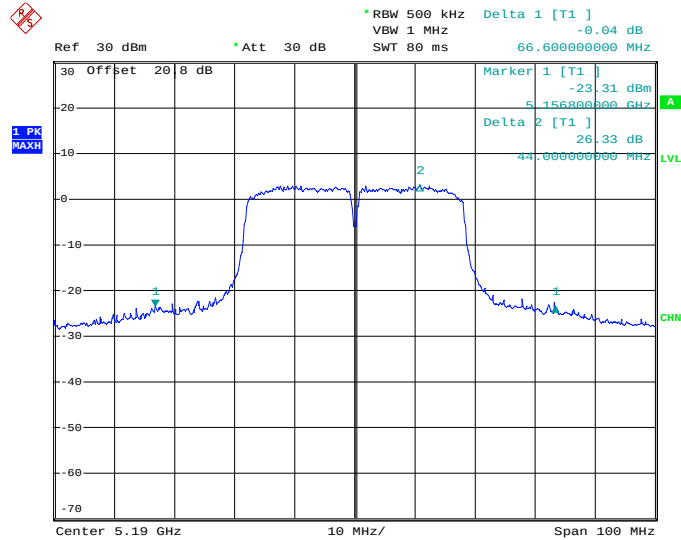


Date: 19.OCT.2017 11:49:05

Figure 7.2.2-12: 99% OBW - High Channel – 802.11n 20 MHz

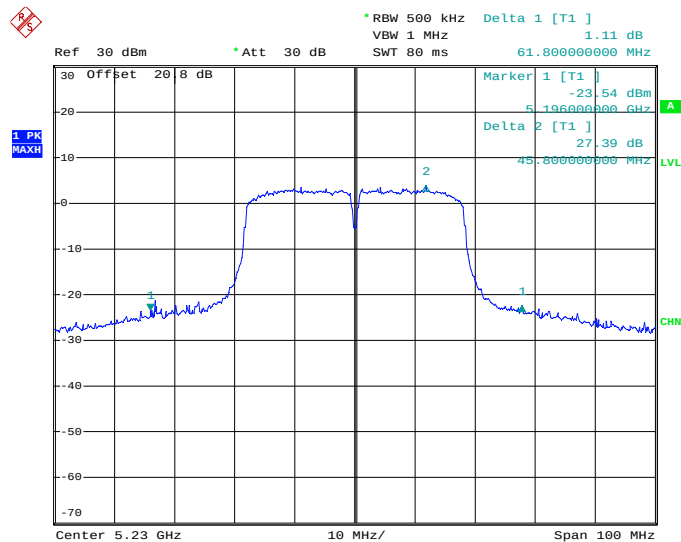
Table 7.2.2-3: EBW / 99% Bandwidth – 802.11n 40 MHz

Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
5190	66.6	38.4
5230	61.8	38.4



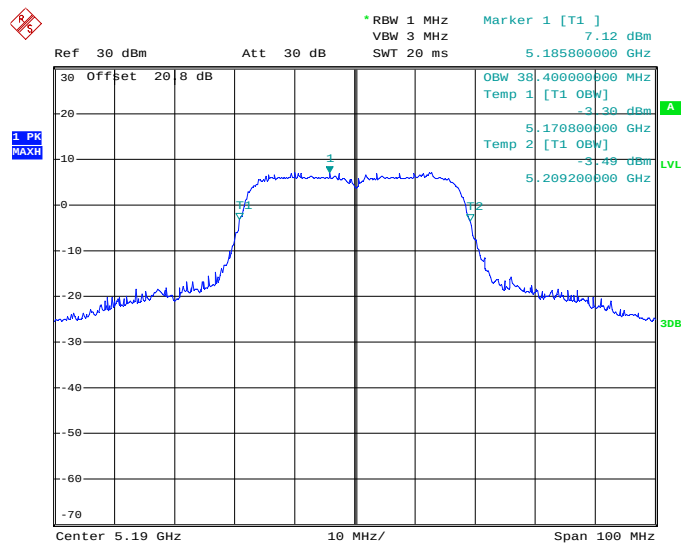
Date: 19.OCT.2017 14:25:09

Figure 7.2.2-13: 26 dB EBW - Low Channel – 802.11n 40 MHz



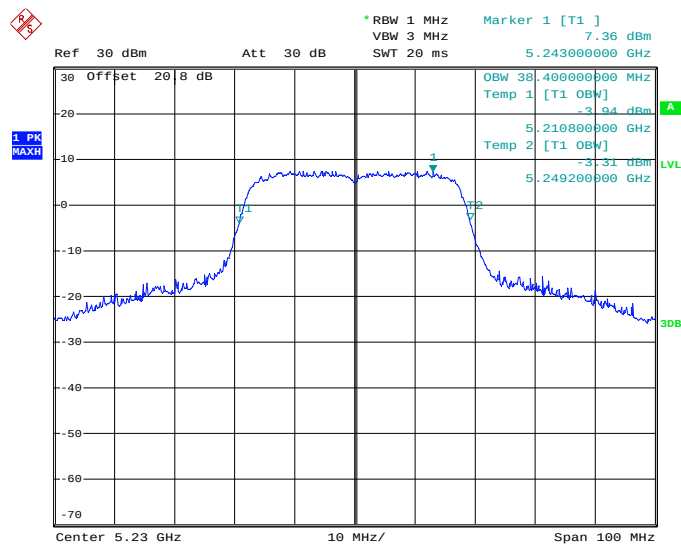
Date: 19.OCT.2017 14:29:58

Figure 7.2.2-14: 26 dB EBW - High Channel – 802.11n 40 MHz



Date: 19.OCT.2017 12:17:25

Figure 7.2.2-15: 99% OBW - Low Channel – 802.11n 40 MHz

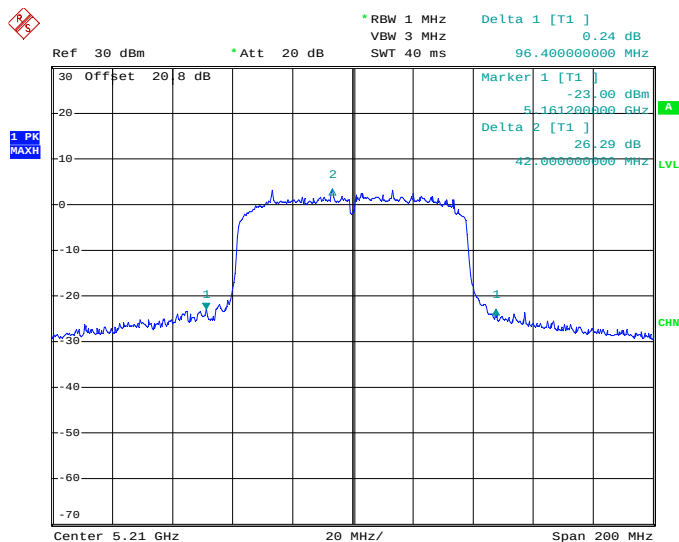


Date: 19.OCT.2017 12:25:56

Figure 7.2.2-16: 99% OBW - High Channel – 802.11n 40 MHz

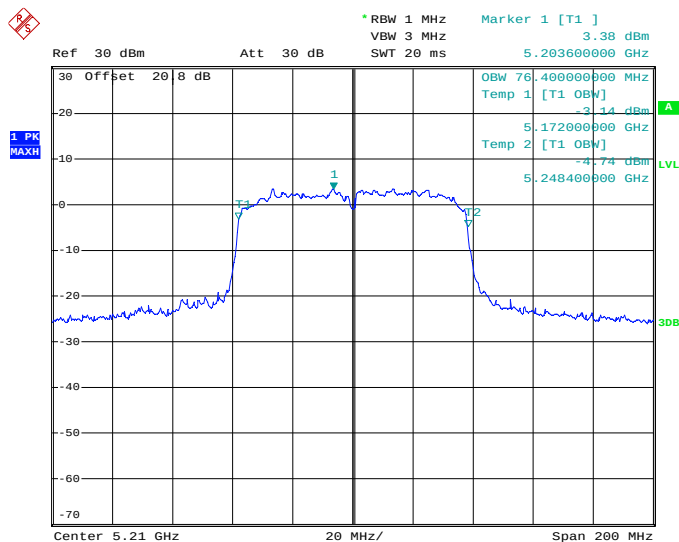
Table 7.2.2-4: EBW / 99% Bandwidth – 802.11ac 80 MHz

Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
5210	96.4	76.4



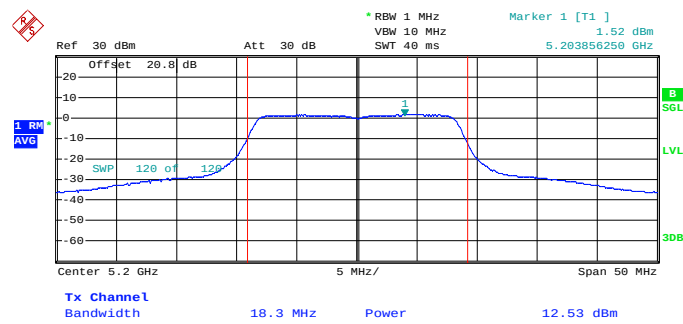
Date: 19.OCT.2017 14:34:22

Figure 7.2.2-17: 26 dB EBW - Middle Channel – 802.11ac 80 MHz



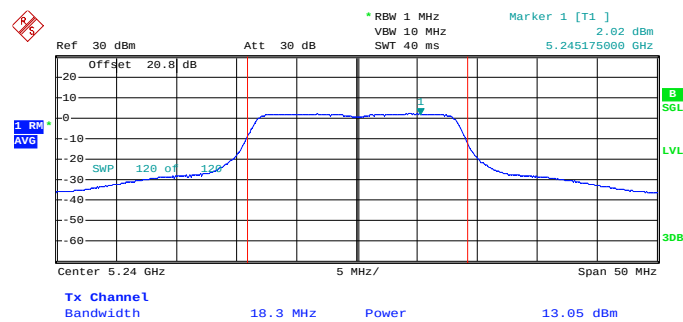
Date: 19.OCT.2017 12:35:21

Figure 7.2.2-118: 99% OBW - High Channel – 802.11ac 80 MHz



Date: 19.OCT.2017 11:28:42

Figure 7.3.2-2: RF Output Power - Middle Channel – 802.11a

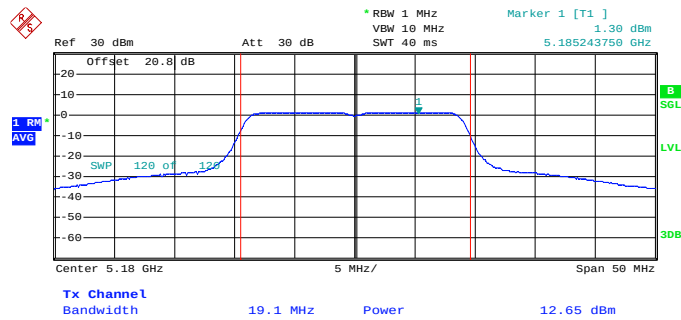


Date: 19.OCT.2017 11:34:42

Figure 7.3.2-3: RF Output Power - High Channel – 802.11a

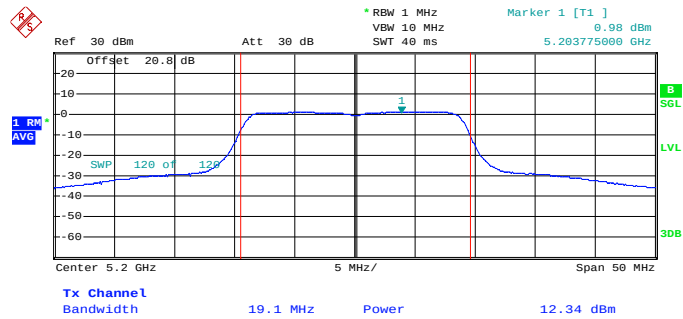
Table 7.3.2-2: RF Output Power – 802.11n 20 MHz

Frequency (MHz)	Level (dBm)
5180	12.65
5200	12.34
5240	12.95



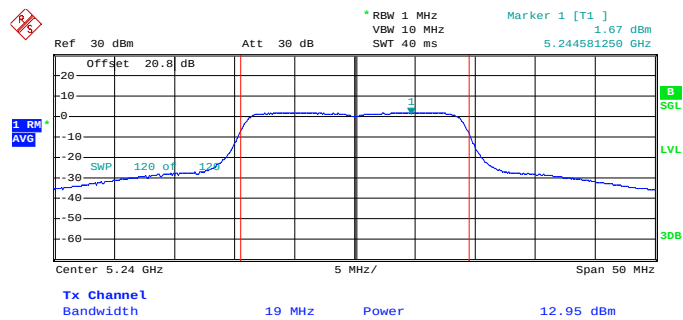
Date: 19.OCT.2017 11:40:57

Figure 7.3.2-4: RF Output Power - Low Channel – 802.11n 20 MHz



Date: 19.OCT.2017 11:45:58

Figure 7.3.2-5: RF Output Power - Middle Channel – 802.11n 20 MHz

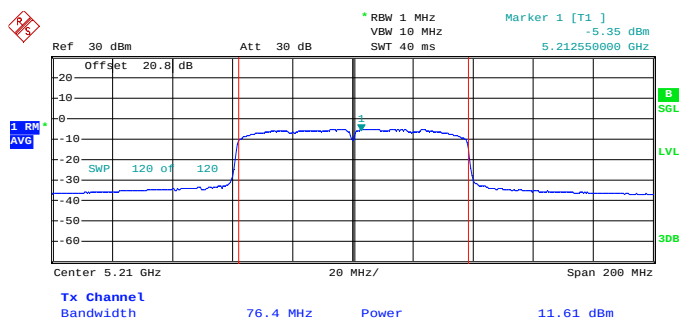


Date: 19.OCT.2017 11:59:42

Figure 7.3.2-6: RF Output Power - High Channel – 802.11n 20 MHz

Table 7.3.2-4: RF Output Power – 802.11ac 80 MHz

Frequency (MHz)	Level (dBm)
5210	11.61



Date: 19.OCT.2017 12:39:34

Figure 7.3.2-9: RF Output Power - Middle Channel – 802.11ac 80 MHz

7.4 Maximum Power Spectral Density – FCC: Section 15.407(a)(1); ISED Canada: RSS-247 6.2.1 Band 5.15 – 5.25 GHz

7.4.1 PSD Measurement Procedure (Conducted Method)

The power spectral density was measured in accordance with the FCC KDB Publication No. 789033 D02 General UNII Test Procedures New Rules v01 “Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E” Maximum Power Spectral Density (PSD). The RF output port of the EUT was directly connected to the input of the spectrum analyzer. Offset values were input for cable, external attenuation. The spectrum analyzer RBW was set to 1 MHz and VBW $\gg 3 \times$ RBW. The power spectral density was measured from the Maximum Conducted Output Power Measurement.

7.4.2 Measurement Results

Performed by: Thierry Jean-Charles

Table 7.4.2-1: Power Spectral Density – 802.11a

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
5180	1.65	11	9.35
5200	1.52	11	9.48
5240	2.02	11	8.98

Note: Graphical data for the measurement is provided in Section 7.3

Table 7.4.2-2: Power Spectral Density – 802.11n 20 MHz

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
5180	1.30	11	9.7
5200	0.98	11	10.02
5240	1.67	11	9.33

Note: Graphical data for the measurement is provided in Section 7.3

Table 7.4.2-3: Power Spectral Density – 802.11n 40 MHz

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
5190	-2.94	11	13.94
5230	-2.47	11	13.47

Note: Graphical data for the measurement is provided in Section 7.3

Table 7.4.2-4: Power Spectral Density – 802.11ac 80 MHz

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
5210	-5.35	11	16.36

Note: Graphical data for the measurement is provided in Section 7.3

7.5 Band-Edge Compliance and Spurious Emissions – FCC: 15.407(b); ISED Canada: RSS-247 6.2

7.5.1 Radiated Emissions below 1 GHz

7.5.1.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 9 kHz to 1 GHz.

For measurements below 30 MHz, the receive antenna height was set to 1m and the EUT was rotated through 360 degrees. The resolution bandwidth was set to 200 Hz below 150 kHz and to 9 kHz above 150 kHz.

For frequencies from 30 MHz to 1000 MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected.

7.5.1.2 Measurement Results

The highest radiated emissions with respect to the limits found in from 9 kHz to 1 GHz are reported in the tables below.

Table 7.5.1.2-1: Radiated Emissions Below 1 GHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
146.79	-----	43.43	H	-13.92	-----	29.51	-----	43.5	-----	14.0
195.964	-----	37.35	H	-12.45	-----	24.90	-----	43.5	-----	18.6
311.998	-----	53.21	H	-11.26	-----	41.94	-----	46.0	-----	4.1
408.022	-----	42.93	H	-10.57	-----	32.35	-----	46.0	-----	13.6
431.989	-----	45.67	H	-9.69	-----	35.98	-----	46.0	-----	10.0
575.996	-----	40.82	H	-6.44	-----	34.38	-----	46.0	-----	11.6
600.003	-----	39.95	H	-6.50	-----	33.44	-----	46.0	-----	12.6
623.997	-----	42.96	H	-5.98	-----	36.98	-----	46.0	-----	9.0
648.003	-----	39.01	H	-4.62	-----	34.39	-----	46.0	-----	11.6
146.764	-----	37.34	V	-13.92	-----	23.42	-----	43.5	-----	20.1
246.389	-----	42.36	V	-14.46	-----	27.90	-----	46.0	-----	18.1
311.996	-----	43.13	V	-11.26	-----	31.87	-----	46.0	-----	14.1
576.005	-----	40.22	V	-6.44	-----	33.78	-----	46.0	-----	12.2
600.005	-----	38.12	V	-6.50	-----	31.62	-----	46.0	-----	14.4
623.987	-----	38.37	V	-5.98	-----	32.39	-----	46.0	-----	13.6
648.003	-----	36.29	V	-4.62	-----	31.67	-----	46.0	-----	14.3

Notes:

- The levels reported correspond to Quasi-Peak measurements.
- The data reported is representative of all the modes of operation of the WLAN transceiver.

7.5.2 Radiated Spurious Emissions above 1 GHz

7.5.2.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 1 GHz to 40 GHz. Each emission found to be in a restricted band as defined by section 15.205, including any emission at the operational band-edge, was compared to the radiated emission limits as defined in section 15.209. The other emissions were evaluated either per the general radiated emission limits of FCC Section 15.209 or the limits of FCC Section 15.407(b) / IC RSS-247 6.2. The EIRP limits of FCC Section 15.407(b) / IC RSS-247 6.2 were converted to field strength limits using a correction factor of 95.2 dB.

The EUT was rotated through 360° and the receive antenna height was varied from 1 m to 4 m so that the maximum radiated emissions level would be detected. Peak measurements are made with RBW of 1 MHz and VBW of 3 MHz. Average measurements are performed in the linear scale using VBW of 30 Hz.

7.5.2.2 Measurement Results

Radiated band-edge and spurious emissions found within or outside of the restricted frequency bands from 1 GHz to 40 GHz are reported in the tables below.

Table 7.5.2.2-1: Radiated Spurious Emissions Tabulated Data – 802.11a

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel (5180 MHz)										
5150	58.73	42.5	H	4.65	63.38	47.15	74.0	54.0	10.6	6.8
5150	57.57	41.55	V	4.65	62.22	46.20	74.0	54.0	11.8	7.8
10360	44.21	34.26	H	14.71	58.92	48.97	77.7	-----	18.8	-----
10360	44.37	35.59	V	14.71	59.08	50.30	77.7	-----	18.7	-----
20720	43.97	30.51	H	13.27	57.24	43.78	83.5	63.5	26.3	19.7
20720	44.43	31.85	V	13.27	57.70	45.12	83.5	63.5	25.8	18.4
Middle Channel (5200 MHz)										
10400	44.24	33.96	H	14.80	59.04	48.76	77.7	-----	18.7	-----
10400	44.63	35.36	V	14.80	59.43	50.16	77.7	-----	18.3	-----
20800	43.73	30.35	H	13.12	56.85	43.47	83.5	63.5	26.7	20.0
20800	44.11	31.13	V	13.12	57.23	44.25	83.5	63.5	26.3	19.3
High Channel (5240 MHz)										
10480	44.66	35.40	H	14.98	59.64	50.38	77.7	-----	18.1	-----
10480	44.68	35.56	V	14.98	59.66	50.54	77.7	-----	18.1	-----
20960	43.28	30.22	H	12.83	56.11	43.05	83.5	63.5	27.4	20.5
20960	43.82	30.53	V	12.83	56.65	43.36	83.5	63.5	26.9	20.1

Notes:

- All emissions above 20.96 GHz were attenuated below the limits and the noise floor of the measurement equipment.
- The emissions above 10 GHz were measured at a test distance of 1m. The limits are corrected accordingly using a distance factor of $20 \cdot \log(3/1) = 9.5$ dB.

Table 7.5.2.2-2: Radiated Spurious Emissions Tabulated Data – 802.11n 20 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel (5180 MHz)										
5150	58.53	42.72	H	4.65	63.18	47.37	74.0	54.0	10.8	6.6
5150	58.15	42.63	V	4.65	62.80	47.28	74.0	54.0	11.2	6.7
10360	44.74	34.61	H	14.71	59.45	49.32	77.7	-----	18.3	-----
10360	45.11	36.04	V	14.71	59.82	50.75	77.7	-----	17.9	-----
20720	43.58	30.42	H	13.27	56.85	43.69	83.5	63.5	26.7	19.8
20720	44.37	31.69	V	13.27	57.64	44.96	83.5	63.5	25.9	18.5
Middle Channel (5200 MHz)										
10400	44.80	34.25	H	14.80	59.60	49.05	77.7	-----	18.1	-----
10400	44.87	35.46	V	14.80	59.67	50.26	77.7	-----	18.1	-----
15600	43.83	30.40	H	18.89	62.72	49.29	83.5	63.5	20.8	14.2
15600	44.27	31.43	V	18.89	63.16	50.32	83.5	63.5	20.3	13.2
High Channel (5240 MHz)										
10480	44.28	34.42	H	14.98	59.26	49.40	77.7	-----	18.5	-----
10480	45.32	36.38	V	14.98	60.30	51.36	77.7	-----	17.4	-----
20960	43.66	30.00	H	12.83	56.49	42.83	83.5	63.5	27.0	20.7
20960	43.81	30.49	V	12.83	56.64	43.32	83.5	63.5	26.9	20.2

Notes:

- All emissions above 20.96 GHz were attenuated below the limits and the noise floor of the measurement equipment.
- The emissions above 10 GHz were measured at a test distance of 1m. The limits are corrected accordingly using a distance factor of $20 \cdot \log(3/1) = 9.5$ dB.

Table 7.5.2.2-3: Radiated Spurious Emissions Tabulated Data – 802.11n 40 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel (5190 MHz)										
5150	68.03	47.18	H	4.65	72.68	51.83	74.0	54.0	1.3	2.2
5150	64.48	46.02	V	4.65	69.13	50.67	74.0	54.0	4.9	3.3
10380	43.76	33.58	H	14.75	58.51	48.33	77.7	-----	19.2	-----
10380	44.13	35.15	V	14.75	58.88	49.90	77.7	-----	18.9	-----
20760	43.48	30.41	H	13.19	56.67	43.60	83.5	63.5	26.8	19.9
20760	44.46	30.93	V	13.19	57.65	44.12	83.5	63.5	25.8	19.4
High Channel (5230 MHz)										
10460	44.11	44.42	H	14.93	59.04	59.35	77.7	-----	18.7	-----
10460	44.55	35.84	V	14.93	59.48	50.77	77.7	-----	18.3	-----
20920	44.18	30.64	H	12.90	57.08	43.54	83.5	63.5	26.4	20.0
20920	43.90	30.90	V	12.90	56.80	43.80	83.5	63.5	26.7	19.7

Notes:

- All emissions above 20.92 GHz were attenuated below the limits and the noise floor of the measurement equipment.
- The emissions above 10 GHz were measured at a test distance of 1m. The limits are corrected accordingly using a distance factor of $20 \cdot \log(3/1) = 9.5$ dB.

Table 7.5.2.2-4: Radiated Spurious Emissions Tabulated Data – 802.11ac 80 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Middle Channel (5210 MHz)										
5150	62.31	47.70	H	4.65	66.96	52.35	74.0	54.0	7.0	1.6
5150	60.65	46.22	V	4.65	65.30	50.87	74.0	54.0	8.7	3.1
10420	43.69	33.46	H	14.84	58.53	48.30	77.7	-----	19.2	-----
10420	45.22	35.65	V	14.84	60.06	50.49	77.7	-----	17.7	-----
20840	43.75	30.56	H	13.05	56.80	43.61	83.5	63.5	26.7	19.9
20840	43.89	30.86	V	13.05	56.94	43.91	83.5	63.5	26.6	19.6

Notes:

- All emissions above 20.84 GHz were attenuated below the limits and the noise floor of the measurement equipment.
- The emissions above 10 GHz were measured at a test distance of 1m. The limits are corrected accordingly using a distance factor of $20 \cdot \log(3/1) = 9.5$ dB.

7.5.3 Sample Calculation

$$R_C = R_U + CF_T$$

Where:

CF_T = Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)

R_U = Uncorrected Reading

R_C = Corrected Level

AF = Antenna Factor

CA = Cable Attenuation

AG = Amplifier Gain

DC = Duty Cycle Correction Factor

Example Calculation: Peak

Corrected Level: $58.73 + 4.65 = 63.38$ dB μ V/m

Margin: 74 dB μ V/m – 63.38 dB μ V/m = 10.6 dB

Example Calculation: Average

Corrected Level: $42.5 + 4.65 = 47.15$ dB μ V/m

Margin: 54 dB μ V/m – 47.15 dB μ V/m = 6.8 dB

7.6 Power Line Conducted Emissions – FCC: Section 15.207; ISED Canada: RSS-Gen 8.8

7.6.1 Measurement Procedure

ANSI C63.10 section 6.2 was the guiding document for this evaluation. Conducted emissions were performed from 150 kHz to 30 MHz with the spectrum analyzer's resolution bandwidth set to 9 kHz and the video bandwidth set to 30 kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss

Margin = Applicable Limit - Corrected Reading

7.6.2 Measurement Results

Performed by: Thierry Jean-Charles

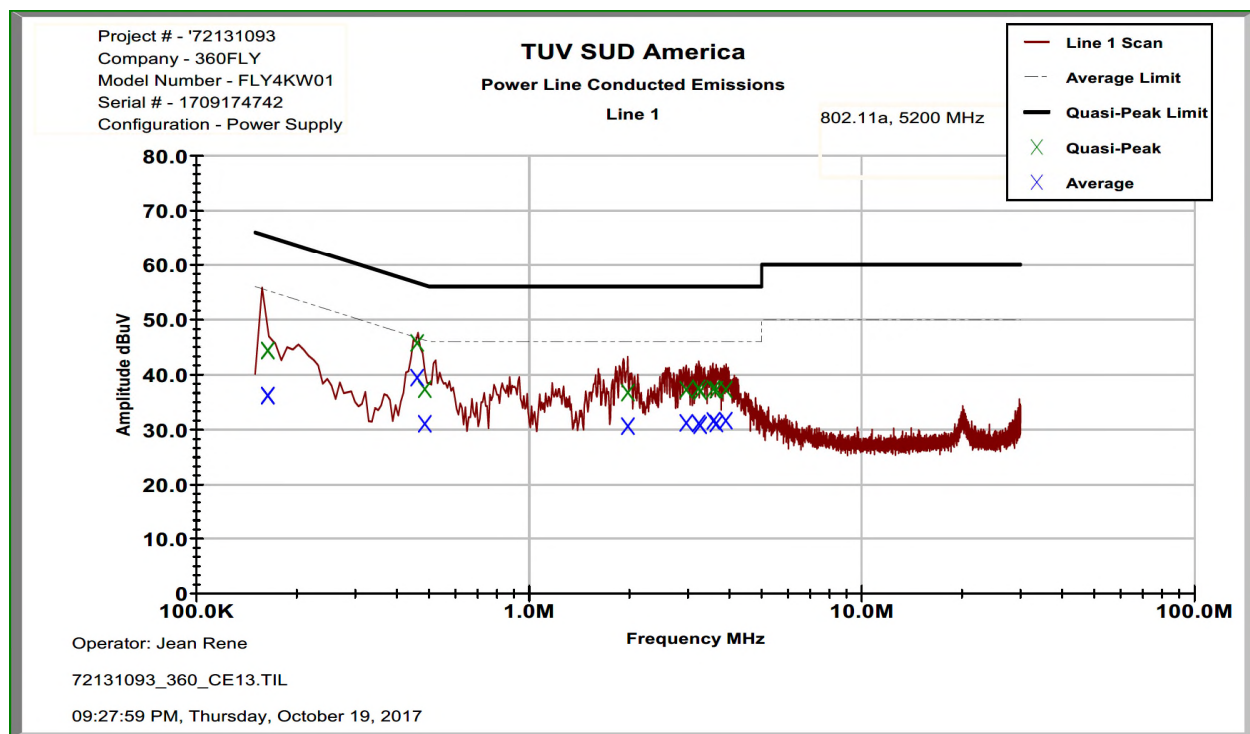


Figure 7.6.2-1: Conducted Emissions Results – Line 1

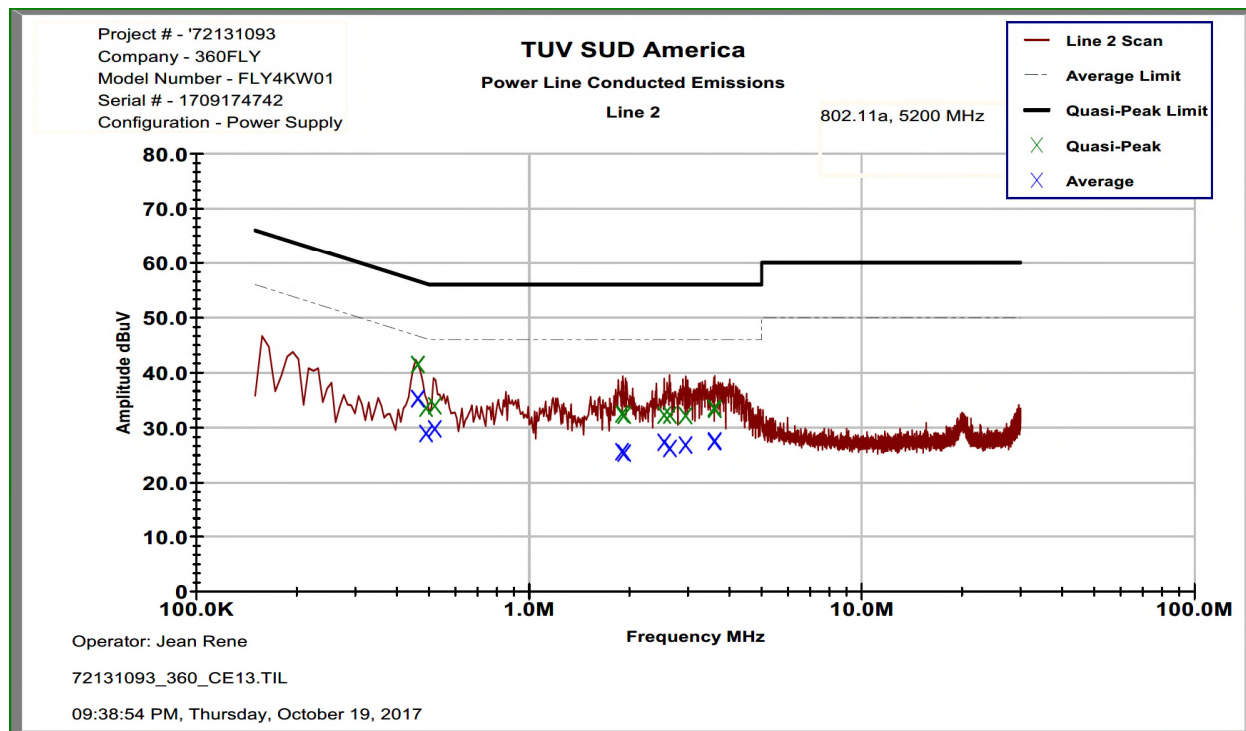


Figure 7.6.2-2: Conducted Emissions Results – Line 2

Table 7.6.2-1: Conducted EMI Results

☒ Line 1 ☒ Line 2 ☐ Line 3 ☐ Line 4 ☐ To Ground ☒ Floating ☐ Telecom Port _____ ☒ dBµV ☐ dBµA										
Plot Number: 72131093 360 CE13										
Power Supply Description: <u>5</u> VDC Power Supply										
Frequency (MHz)	Uncorrected Reading		Total Correction Factor (dB)	Corrected Level		Limit		Margin (dB)		
	Quasi- Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average	
Line 1										
0.163651	34.059	25.875	10.17	44.23	36.05	65.28	55.28	21.0	19.2	
0.460425	35.381	29.091	10.23	45.61	39.32	56.68	46.68	11.1	7.4	
0.485299	27.029	20.697	10.23	37.26	30.93	56.25	46.25	19.0	15.3	
1.97946	26.228	20.12	10.26	36.48	30.38	56.00	46.00	19.5	15.6	
2.96471	26.634	20.624	10.38	37.02	31.01	56.00	46.00	19.0	15.0	
3.23206	26.889	20.492	10.48	37.37	30.97	56.00	46.00	18.6	15.0	
3.26505	26.314	20.169	10.48	36.79	30.65	56.00	46.00	19.2	15.4	
3.57647	26.721	20.909	10.48	37.20	31.39	56.00	46.00	18.8	14.6	
3.65101	26.584	20.463	10.48	37.06	30.94	56.00	46.00	18.9	15.1	
3.9003	26.607	20.928	10.48	37.09	31.41	56.00	46.00	18.9	14.6	
Line 2										
0.462463	31.125	24.93	10.27	41.40	35.20	56.65	46.65	15.3	11.4	
0.489349	23.218	18.592	10.27	33.49	28.86	56.18	46.18	22.7	17.3	
0.519713	23.627	19.443	10.26	33.89	29.70	56.00	46.00	22.1	16.3	
1.9018	21.978	15.108	10.30	32.27	25.40	56.00	46.00	23.7	20.6	
1.92846	21.722	14.893	10.30	32.02	25.19	56.00	46.00	24.0	20.8	
2.54476	21.727	16.765	10.42	32.15	27.19	56.00	46.00	23.9	18.8	
2.64662	21.696	15.614	10.42	32.12	26.04	56.00	46.00	23.9	20.0	
2.95215	21.593	16.243	10.42	32.02	26.67	56.00	46.00	24.0	19.3	
3.60421	22.928	16.794	10.50	33.43	27.29	56.00	46.00	22.6	18.7	
3.6123	22.687	16.932	10.50	33.19	27.43	56.00	46.00	22.8	18.6	

7.7 Frequency Stability – FCC: Section 15.407(g); ISED Canada: RSS-Gen 8.11**7.7.1 Measurement Procedure**

The equipment under test is placed inside an environmental chamber. The RF output is directly coupled to the input of the measurement equipment and a power supply is attached to the primary supply voltage.

Frequency measurements were made at the extremes of the of temperature range -30° C to +50° C and at intervals of 10° C at normal supply voltage. A period of time sufficient to stabilize all components of the equipment was allowed at each frequency measurement. At a temperature 20° C the supply voltage was also varied at 115 % and 85 % of the nominal voltage. The maximum variation of frequency was recorded.

Results of the test are shown below

7.7.2 Measurement Results

Performed by: Thierry Jean-Charles

Frequency Stability

Frequency (MHz): 5180

Deviation Limit (PPM): 20

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	5179.988660	-2.189	100%	4.00
-20 C	5180.020370	3.932	100%	4.00
-10 C	5180.029050	5.608	100%	4.00
0 C	5180.028050	5.415	100%	4.00
10 C	5180.026550	5.125	100%	4.00
20 C	5180.011600	2.239	100%	4.00
30 C	5180.004288	0.828	100%	4.00
40 C	5179.998883	-0.216	100%	4.00
50 C	5179.999086	-0.176	100%	4.00
20 C	5180.013520	2.610	85%	3.40
20 C	5180.012930	2.496	115%	4.60

Frequency Stability vs. Temperature

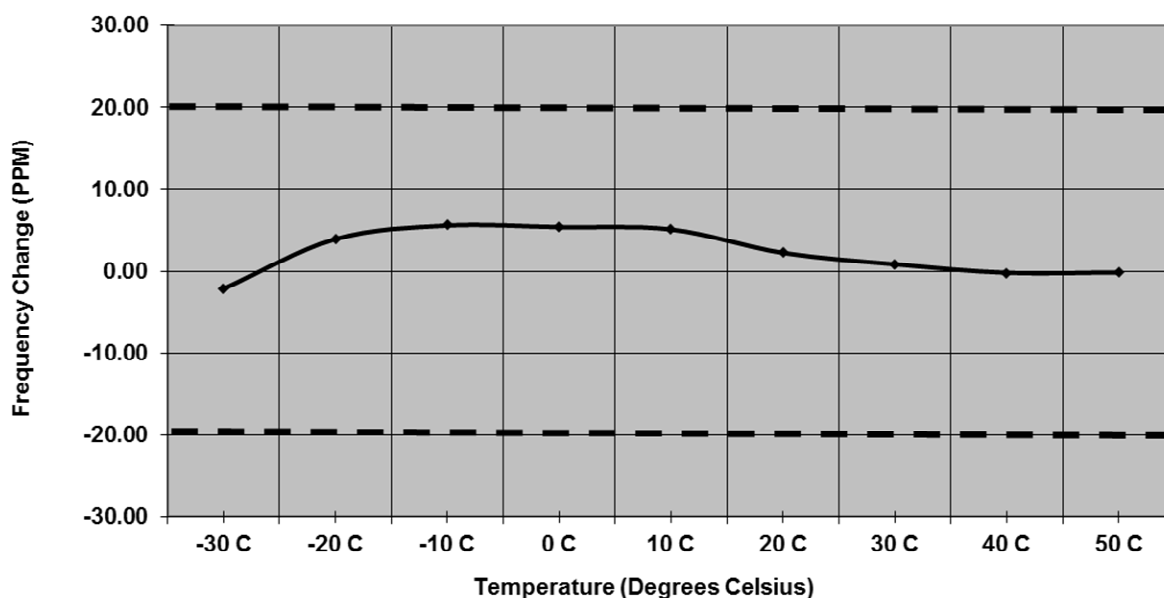


Figure 7.7.2-1: Frequency Stability – Low Channel

Frequency Stability

Frequency (MHz): 5200

Deviation Limit (PPM): 20

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	5199.979970	-3.852	100%	4.00
-20 C	5200.019010	3.656	100%	4.00
-10 C	5200.029010	5.579	100%	4.00
0 C	5200.028680	5.515	100%	4.00
10 C	5200.025010	4.810	100%	4.00
20 C	5200.013860	2.665	100%	4.00
30 C	5200.004128	0.794	100%	4.00
40 C	5199.998890	-0.213	100%	4.00
50 C	5199.999517	-0.093	100%	4.00
20 C	5200.014340	2.758	85%	3.40
20 C	5200.015350	2.952	115%	4.60

Frequency Stability vs. Temperature

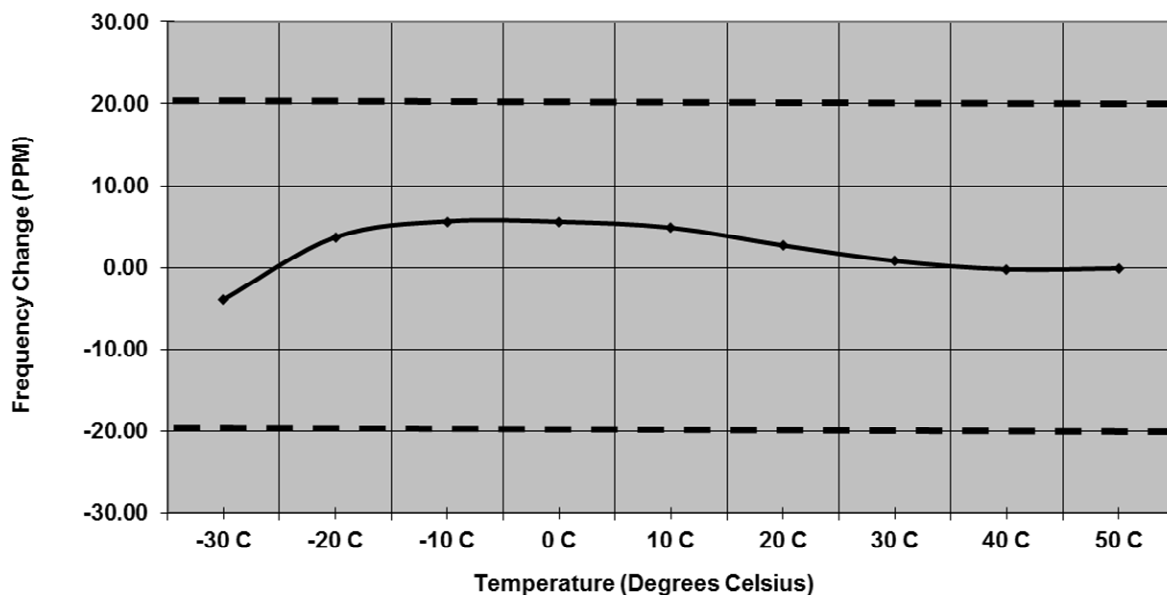


Figure 7.7.2-2: Frequency Stability – Middle Channel

Frequency Stability

Frequency (MHz): 5240

Deviation Limit (PPM): 20

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	5239.981970	-3.441	100%	4.00
-20 C	5240.019350	3.693	100%	4.00
-10 C	5240.029350	5.601	100%	4.00
0 C	5240.029010	5.536	100%	4.00
10 C	5240.025350	4.838	100%	4.00
20 C	5240.013736	2.621	100%	4.00
30 C	5240.004225	0.806	100%	4.00
40 C	5239.998874	-0.215	100%	4.00
50 C	5240.002063	0.394	100%	4.00
20 C	5240.014750	2.815	85%	3.40
20 C	5240.013000	2.481	115%	4.60

Frequency Stability vs. Temperature

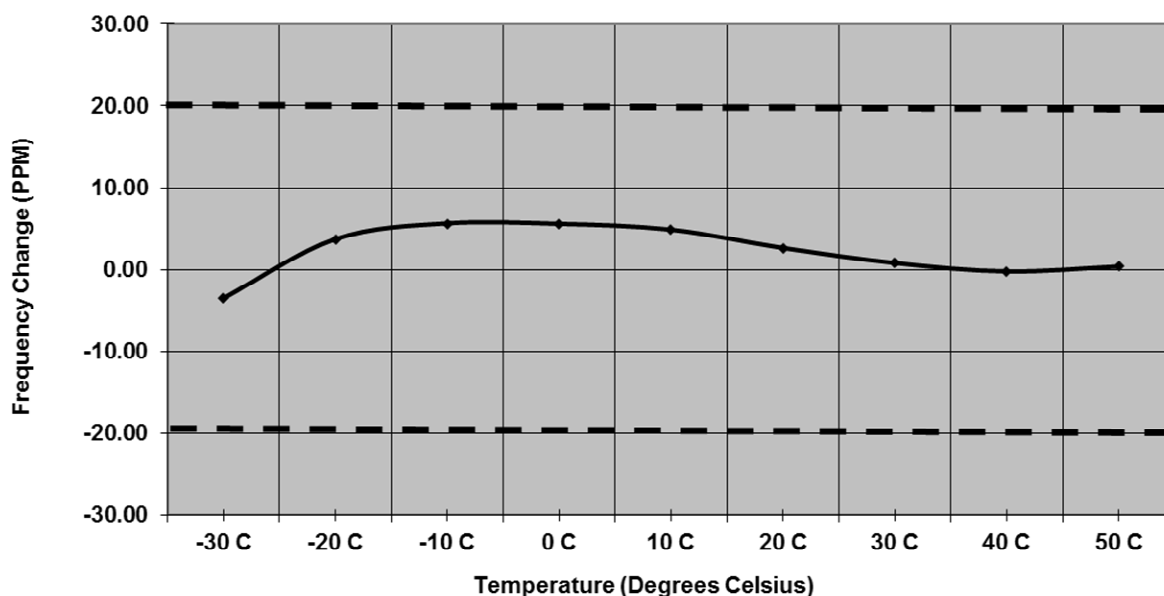


Figure 7.7.2-3: Frequency Stability – High Channel

7.8 Duty Cycle

7.8.1 Measurement Procedure

The duty cycle was measured in accordance with ANSI C63.10 Section 11.6 Duty cycle (D), transmission duration (T), and maximum power control level. The unit was connected directly to the input of the spectrum analyzer via suitable attenuation. The RBW and VBW were set to 10 MHz and the number of sweep points across duration T was set to exceed 100.

7.8.2 Measurement Results

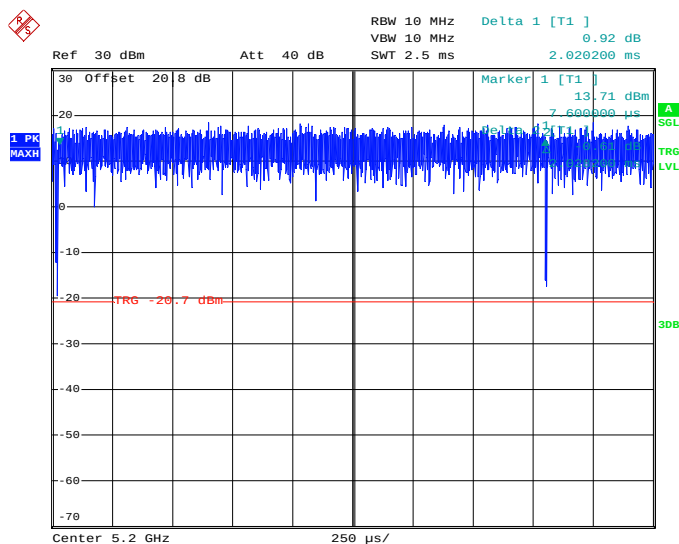
Performed by: Thierry Jean-Charles

Table 7.8.2-1 Duty Cycle Correction Factor

Mode	Data Rate (Mbps)	Time On (ms)	Period (ms)	Duty Cycle (%)	Correction Factor (dB)
802.11a	6	2.0202	2.0282	99.61%	N/A
802.11n 20 MHz	6.5	1.888	1.893	99.74%	N/A
802.11n 40 MHz	13	0.932	0.936	99.57%	N/A
802.11ac 80 MHz	29.3	0.248	0.253	98.02%	N/A

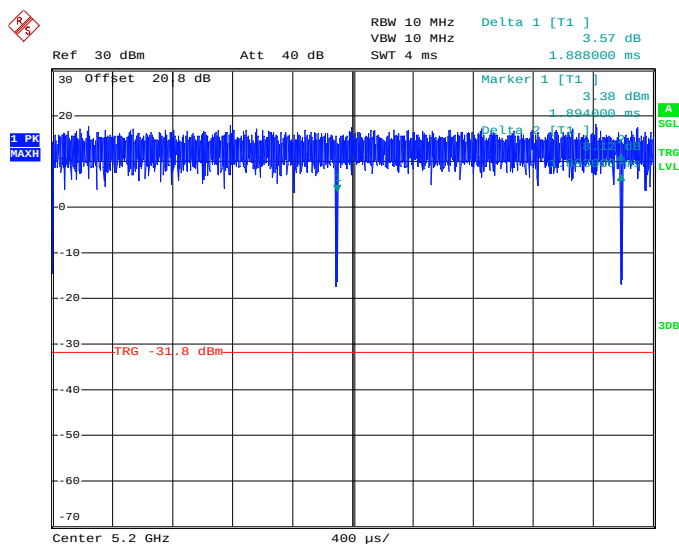
Notes:

Per FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r04 duty cycle correction factor is not needed for duty cycle > 98%



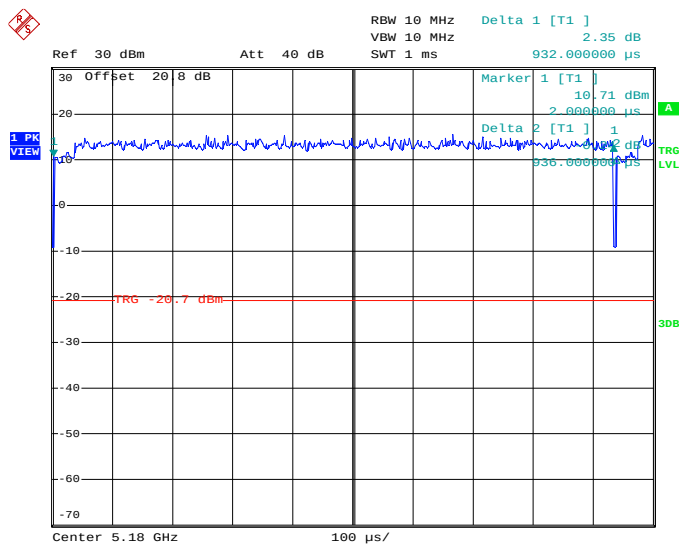
Date: 19.OCT.2017 13:40:39

Figure 7.8.2-1: Duty Cycle 802.11a



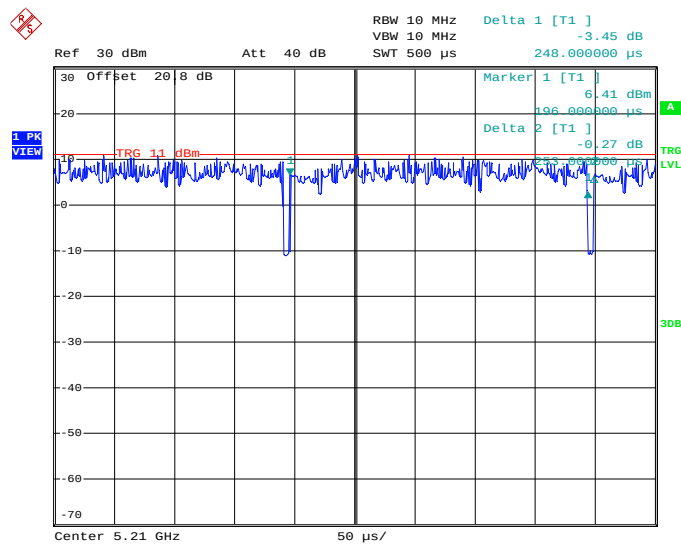
Date: 25.OCT.2017 13:28:51

Figure 7.8.2-2: Duty Cycle 802.11n 20 MHz



Date: 19.OCT.2017 12:50:27

Figure 7.8.2-3: Duty Cycle 802.11n 40 MHz



Date: 19.OCT.2017 12:44:34

Figure 7.7.2-4: Duty Cycle 802.11ac 80 MHz

8 MEASUREMENT UNCERTAINTIES

The expanded laboratory measurement uncertainty figures (U_{Lab}) provided below correspond to an expansion factor (coverage factor) $k = 1.96$ which provide confidence levels of 95%.

Table 8-1: Measurement Uncertainties

Parameter	U_{lab}
Occupied Channel Bandwidth	$\pm 0.009 \%$
RF Conducted Output Power	$\pm 1.15 \text{ dB}$
Power Spectral Density	$\pm 1.15 \text{ dB}$
Antenna Port Conducted Emissions	$\pm 1.15 \text{ dB}$
Radiated Emissions $\leq 1\text{GHz}$	$\pm 5.86 \text{ dB}$
Radiated Emissions $> 1\text{GHz}$	$\pm 4.65 \text{ dB}$
Temperature	$\pm 0.860 \text{ }^{\circ}\text{C}$
Radio Frequency	$\pm 2.832 \times 10^{-8}$
AC Power Line Conducted Emissions	$\pm 3.72 \text{ dB}$

9 CONCLUSION

In the opinion of TÜV SÜD America, Inc. the model FLY4KW01, manufactured by 360fly, Inc., meets the requirements of FCC Part 15.407 and Industry Canada's Radio Standards Specification RSS-247 for the tests documented herein.

END REPORT