

ELECTROMAGNETIC COMPATIBILITY TEST REPORT

PREPARED FOR SIX GUYS LABS
BY QAI LABORATORIES



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EMC Test Laboratory: **QAI Laboratories Inc.**
Address: 3980 North Fraser Way, Burnaby, BC, V5J 5K5 Canada
Phone: (604) 527-8378
Fax: (604) 527-8368

Laboratory Accreditations (per ISO/IEC 17025:2005):



American Association for Laboratory Accreditation Certificate Number: 3657.02

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EMC Client: Six Guys Labs, s.r.o.
Address: Slovanska 16, 326 00, Pilsen, Czech Republic.
Phone: 00420 604 204 479

Applicable Test Standards: FCC Title 47 CFR Part 15: Subpart B
FCC Title 47 CFR Part 15: Subpart C - § 15.247
RSS-247 Issue 2, RSS-Gen Issue 5, ICES-003 Issue 6

Equipment Tested Actijoy Health & Activity Tracker
Model Number: AJT02
FCC ID: 2AQVI-AJT02
IC Certification Number: 24198-AJT02
Manufacturer: Six Guys Labs



REVISION HISTORY

Date	Report Number	Rev #	Details	Author
December 18, 2018	E11003-1801_SixGuysLabs-AJT02_Rev 2.0	2.0	Section 3.9: Added EUT configuration and Worst-case test details; Provided clear photo.	JQ
December 18, 2018	E11003-1801_SixGuysLabs-AJT02_Rev 1.1	1.1	TCB requested updates and administrative changes	JQ
November 16, 2018	E11003-1801_SixGuysLabs-AJT02_Rev 1.0	1.0	Final Release	JQ
November 6, 2018	E11003-1801_SixGuysLabs-AJT02_Rev 0.0	0.0	Initial Release	JQ
<i>All previous versions of this report have been superseded by the latest dated revision as listed in the above table. Please dispose of all previous electronic and paper printed revisions accordingly.</i>				

REPORT AUTHORIZATION

The data documented in this report is for the test equipment provided by Six Guys Labs Tests were conducted on the sample equipment as requested by Six Guys Labs for the purpose of demonstrating compliance with FCC Title 47 CFR Part 15: Subpart B, FCC Title 47 CFR Part 15: Subpart C - § 15.247, RSS-247 Issue 2, RSS-Gen Issue 5 & ICES-003 Issue 6 as agreed upon by Six Guys Labs as per Quote 18RM01249R2.

Six Guys Labs is responsible for the tested product configuration, continued product compliance, and for the appropriate auditing of subsequent products as required. This report may comprise partial list of tests that are required for FCC & IC Declaration of Conformity and can only be produced by the manufacturer.

This is to certify that the following report is true and correct to the best of our knowledge.

X 

Written by Jack Qin
RF/EMC Test Engineer/Technical Writer



Tested by Jack Qin
EMC Division Project Manager



Approved by Parminder Singh
Director for the EMC Department

QAI FACILITIES

Founded in 1994 by a group of experienced certification and testing experts, QAI is an independent third-party testing, inspection and certification organization which serves the building industry, government and individuals with cost effective solutions through our in-house capabilities / services, and an established world-wide network of qualified affiliates. To help get your product to market, trust the provider that many leading global manufacturers do: QAI.

British Columbia

QAI Laboratories Inc.

Main Laboratory/Headquarters
3980 North Fraser Way,
Burnaby, BC V5J Canada

Ontario

QAI Laboratories Inc.

1081 Meyerside Drive, Unit #14
Mississauga, ON L5T 1M4 Canada

Virginia

QAI Laboratories Ltd.

1047 Zachary Taylor Hwy,
Suite A Huntly, VA 22640 USA

California

QAI Laboratories Ltd.

8385 White Oak Avenue Rancho
Cucamonga, CA 91730 USA

Oklahoma

QAI Laboratories Ltd.

108th East Avenue,
Tulsa, OK 74116 USA

QAI EMC ACCREDITATION

QAI EMC is your one-stop regulatory compliance partner for electromagnetic compatibility (EMC) and electromagnetic interference (EMI). Products are tested to the latest and applicable EMC/EMI requirements for domestic and international markets. QAI EMC goes above and beyond being a testing facility—we are your regulatory compliance partner. QAI EMC has the capability to perform RF Emissions and Immunity for all types of electronics manufacturing including Industrial, Scientific, Medical, Information Technology, Telecom, Wireless, Automotive, Marine and Avionics.

EMC Laboratory Location	FCC Designation (3m SAC)	IC Registration (3m SAC)	A2LA Certificate
Burnaby, BC, Canada	CA9543	21146-1	3657.02



**Headquarters & EMC Laboratory in
Burnaby, BC**

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Section I: EXECUTIVE SUMMARY

1.1 Purpose

The purpose of this report is to demonstrate and document the compliance of Actijoy Health & Activity Tracker as per Sections 1.2 & 1.3.

1.2 Scope

The information documented in this report is based on the test methods and levels as per Quote 18SH05142:

FCC Title 47 Part 15 - Radio Frequency Devices, Subpart C – Intentional Radiators.

- 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz.

CFR Title 47 FCC Part 15 - Radio Frequency Devices, Subpart B – Unintentional Radiators.

RSS-247 Issue 2 – Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

RSS-Gen Issue 5 – General Requirements and Information for the Certification of Radio Apparatus

ICES-003 Issue 6 – Information Technology Equipment (Including Digital Apparatus) – Limits and Methods of Measurement

The tests documented in this report were performed in accordance with ANSI C63.4-2014, ANSI C63.10-2013, and FCC KDB 558074 D01 DTS Meas Guidance v05.

1.3 Summary of Results

The following tests were performed pursuant to the FCC/IC Unintentional Radiated Emissions, Intentional Radiated Emissions, and Radio Testing Standards:

No.	Test Description	Standard Clause	Result
1	Antenna Requirement	FCC 47 CFR Part 15.203 IC RSS-Gen Issue 5 Section 7.1.2	Complies
2	RF Peak Power Output	FCC Title 47 CFR Part 15: Subpart C - §15.247 (b)(1) RSS-247 Issue 2	Complies
3	Power Spectral Density	FCC Title 47 CFR Part 15: Subpart C §15.247 (e), RSS-247 Issue 2: 5.2 (2)	Complies
4	Radiated Spurious Emissions	RSS-247-Issue 2, RSS-Gen Issue 5 FCC Subpart C §15.205, §15.209 & §15.247	Complies
5	6 dB Bandwidth	RSS-247-Issue 2, RSS-Gen Issue 5 FCC Subpart C §15.247	Complies
6	99% Bandwidth	RSS-247 Issue 2, RSS-Gen Issue 5	Complies
7	Out-of-Band Emissions (Band Edge)	FCC Title 47 CFR Part 15: Subpart C - §15.247 (d) RSS-247-Issue 2	Complies
8	Unintentional Radiated Emissions	FCC Title 47 CFR Part 15: Subpart B - §15.109 ICES-003 Issue 6	Complies
9	AC Mains Conducted Emissions	FCC Title 47 CFR Part 15: Subpart B - §15.109 ICES-003 Issue 6	Complies
10	RF Exposure Evaluation	FCC 47 CFR §1.1310: RSS-102 Section 2.5.2	Complies

Section II: GENERAL INFORMATION

2.1 Product Description

The information provided in this section is for the Equipment Under Test (EUT) and the corresponding Auxiliary Equipment needed to perform the tests as a complete system.

Equipment Under Test (EUT) Information

EUT	Actijoy Health & Activity Tracker
Model No./Serial No.	AJT02 / 20000
Functional Description	Wearable for dogs, measuring activity using 6g accelerometer, transferring analyzed data to user phone using BLE 4.0 (4.1) Powered by an AC/DC adapter and internal rechargeable battery
Operating Frequency	2402 MHz to 2480 MHz
FCC ID	2AQVI-AJT02
IC Certification Number	24198-AJT02
Manufacturer	Six Guys Labs, s.r.o.



Equipment Under Test (EUT) - Actijoy Health & Activity Tracker

Auxiliary Equipment Information

Equipment	Manufacturer	Product Description	Model No.
Auxiliary 1	XP Power	AC/DC Power Adapter	HOMEPWS

2.2 Environmental Conditions

The equipment under test was operated and tested under the following environmental conditions:

Parameter	Conditions
Location	Indoors
Temperature	22-28°C
Relative Humidity	39.7 - 54.4%

2.3 Measurement Uncertainty

Parameter	Uncertainty
Radiated Emissions, 30MHz-1GHz	± 2.40 dB
Radiated Emissions, 1GHz-40GHz	± 2.48 dB
Radio Frequency	±1.5 x 10 ⁻⁵ MHz
Total RF Power Conducted	±1.36 dB
Spurious Emissions Conducted	±1.36 dB
RF Power Density Conducted	±1.36 dB
Temperature	±1°C
Humidity	±5 %
DC and low frequency voltages	±3 %

2.4 Worst Test Case

Worst-case orientation was determined during the preliminary testing. The final radiated emissions were performed in the worst-case orientation.

2.5 Sample Calculations of Emissions Data

Radiated and conducted emissions were performed using EMC32 software developed by Rohdes & Schwarz. Transducer factors like Antenna factors, Cable Losses and Amplifier gains were stored in the test templates which are used to perform the emissions measurements. After test is finished, data is generated from the EMC32 consisting of product details, emission plots and final data tables as shown below.

Frequency (MHz)	QPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Ant. Ht. (cm)	Pol	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
42.663900	33.0	1000.000	120.000	100.0	H	70.0	13.2	7.5	40.5

Quasi Peak reading shown in the table above is already corrected by the software using correction factor shown in column “Corr.” The correction factor listed under “Corr.” table calculated as:

$$\text{Corr. (dB)} = \text{Antenna factor} + \text{Cable loss}$$

Or

$$\text{Corr. (dB)} = \text{Antenna factor} + \text{Cable Loss} - \text{Amp gain (if pre-amplifier was used)}$$

The final Quasi peak reading shown in the data is calculated by the software using following equation:

$$\text{Corrected Quasi Peak (dBµV/m)} = \text{Raw Quasi Peak Reading} + \text{Antenna factor} + \text{Cable loss}$$

To obtain the final Quasi-Peak or Average reading during power line conducted emissions, transducer factors are included in the final measurement as shown below.

Frequency (MHz)	QPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150	44.3	1000.000	9.000	GND	0.6	21.7	66.0

Frequency (MHz)	QPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150	27.2	1000.000	9.000	GND	0.6	28.8	56.0

Quasi Peak or Average reading shown in above table is already corrected by the software using the correction factor shown in column "Corr." The correction factor listed under "Corr." table calculated as:

$$\text{Corr. (dB)} = \text{Antenna factor} + \text{Cable loss}$$

The final Quasi peak or Average reading shown in the data is calculated by the software using following equation:

$$\text{Corr. Quasi Peak/Average Reading (dBµV)} = \text{Raw Quasi Peak/Average Reading} + \text{Antenna factor} + \text{Cable loss}$$

The allowable margin from the limits, as per the standards, were calculated for both radiated and conducted emissions:

$$\text{Margin (dB)} = \text{Limit} - \text{Quasi-Peak or Average reading}$$

2.6 Test Equipment List

The tables below contain all the equipment used by QAI Laboratories in conducting all tests on the Equipment Under Test (EUT) as per Section 1.3.

Emissions Test Equipment

Manufacturer	Model	Description	Serial No.	Last Calibration Date	Calibration Due Date
ETS Lindgren	S201	5-meter Semi-Anechoic Chamber	1030	N/A	N/A
Sunol Sciences	SM46C	Turntable	051204-2	N/A	N/A
Sunol Sciences	TWR95	Mast	TREML0001	N/A	N/A
Sunol Sciences	JB3	Biconilog Antenna 30MHz – 3GHz	A120106	2017-Sep-24	2020-Sep-24
Sunol Sciences	DRH-118	Horn Antenna 1GHz-18GHz	A050905	2016-Mar-10	2019-Mar-10
Rohde & Schwarz	ESU40	EMI Receiver	100011	2017-Nov-20	2020-Nov-20
Fischer	FCC-LISN-50-25-2-08	LISN (150kHz-30MHz)	2041	2015-Nov-19	2018-Nov-19
EMCO	6502	Loop Antenna	6502	11/13/2017	2020-Nov-13
EMCO	3160-09	Horn Antenna 18-26.5GHz	9701-1071	13-Sep-17	2020-Sep-13

The following components and equipment are calibrated as a complete signal path.

Manufacturer	Model	Description	Serial No.	Last Calibration Date	Calibration Due Date
AH Systems	PAM118	Amplifier 10KHz-18GHz	189	January 1, 2018	January 1, 2019
Insulated Wire Inc.	SPS-1753-1140-SPS	Yellow cable, 3m	102395		
Insulated Wire Inc.	SPS-1753-2400-SPS	Yellow cable, 6m	091096		
WEINSCHTEL ENGINEERING	44	6db attenuator	665	January 1, 2018	January 1, 2019
A.H.Systems	PAM-1840VH	Preamplifier 18-40GHz	152		
A.H.Systems	2649-03	Green short input cable	395		
A.H.Systems	2649-225	Green short output cable	396		

Measurement Software List

Manufacturer	Model	Version	Description
Rohde & Schwarz	EMC 32	6.20.0	Emissions Test Software

Section III: TEST RESULTS

3.1 Antenna Requirements

Date Performed:

October 9, 2018

Test Standard:

FCC 47 CFR Part 15.203 and IC RSS-Gen Issue 5 Section 7.1.2

Applicable Regulation:

The purpose of this requirement is to make certain that no other antenna, except for that provided by the responsible party, shall be used with the Equipment-Under-Test (EUT) as defined in FCC CFR 47 Part 15.203 & RSS-Gen Issue 5:

“An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited.” ... “the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.”

Modifications:

No modification was required to comply for this test.

Result:

An integrated antenna is used on this product and it is not field replaceable.

3.2 RF Peak Power Output

Date Performed: September 12, 2018

Test Standard: FCC Title 47 CFR Part 15: Subpart C - §15.247 (b)(3), RSS-247 Issue 2

Test Method: FCC KDB 558074 D01 DTS Meas Guidance v05

Test Requirement: For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels: 1 watt.

Result: The EUT complies with the applicable standard.

Measurement Data:

Mode	Carrier Frequency	Raw Peak @ 3m	Ant. Pol.	Ant. Factor	System Loss	Corr. Peak @ 3m	EIRP	Ant. Gain	Peak Conducted Output Power	Limit	Margin
	MHz	dBµV	V or H	dB/m	dB	dBµV/m	dBm	dB	dBm	dBm	dB
Bluetooth	2402	55	V	32.5	5.28	92.78	-2.48	2.2	-4.68	30	34.68
		62	H	32.5	5.28	99.78	4.52	2.2	2.32	30	27.68
	2413	58.5	V	32.5	6	97	1.74	2.2	-0.46	30	30.46
		65.7	H	32.5	6	104.2	8.94	2.2	6.74	30	23.26
	2480	55	V	32.5	6.4	96.9	1.64	2.2	-0.56	30	30.56
		61	H	32.5	6.4	101.9	6.64	2.2	4.44	30	25.56

Note: $\text{Corr. Peak@3m} = \text{Raw Peak@3m} + \text{Ant. Factor} + \text{System Loss}$

$\text{EIRP} = \text{Corr. Peak@3m} - 95.26$

$\text{Peak Conducted Output Power} = \text{EIRP} - \text{Ant. Gain}$

3.3 Power Spectral Density (PSD)

Date Performed: Aug 9 2018

Test Standard: FCC Title 47 CFR Part 15: Subpart C §15.247 (e), RSS-247 Issue 2: 5.2 (2)

Test Method: FCC KDB 558074 D01 DTS Meas Guidance v05

Test Requirement:

The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission. The power spectral density was determined using the same method as is used to determine the conducted output power).

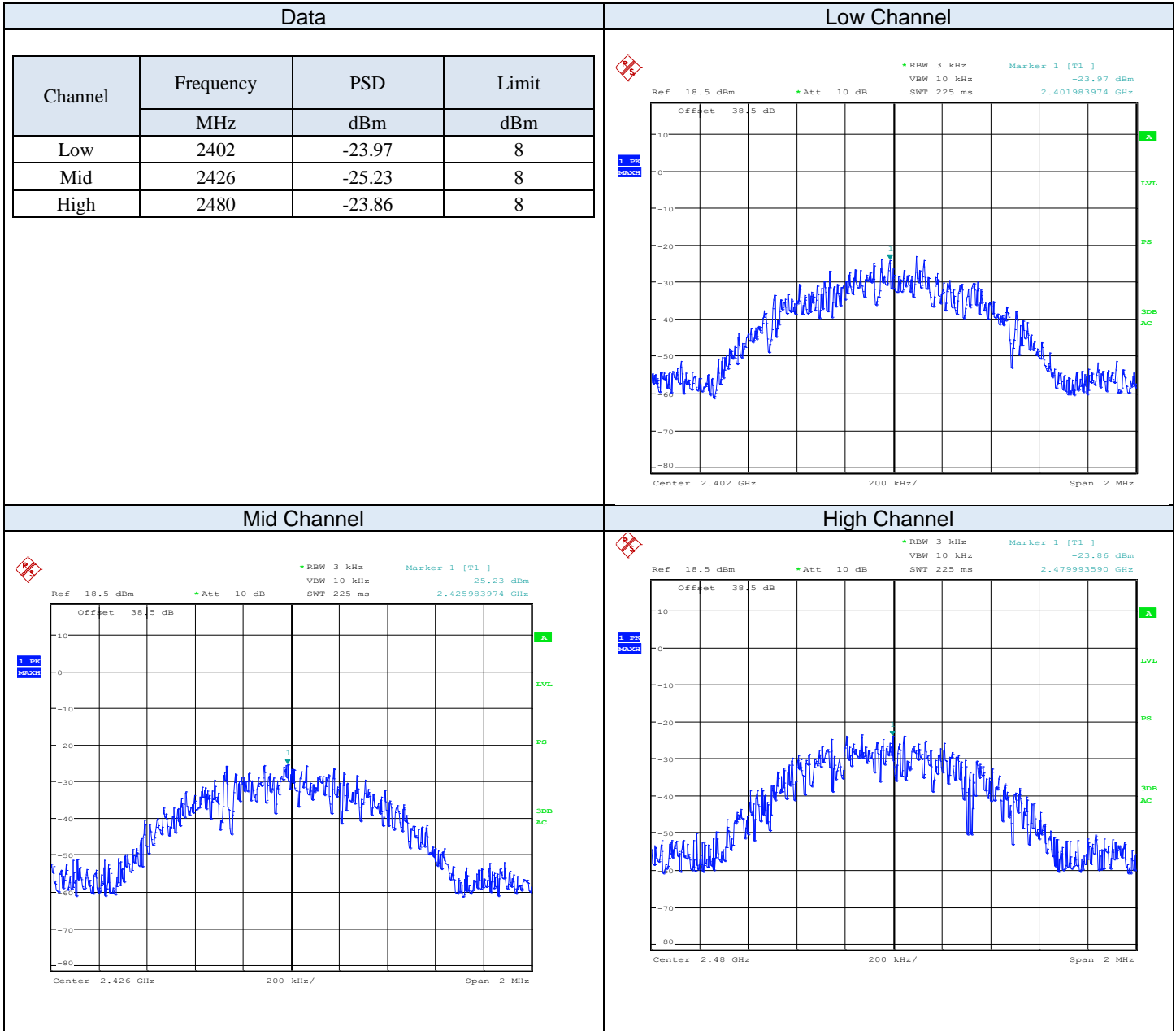
Modifications:

No modification was required to comply for this test.

Result:

The EUT complies with the applicable standard.

Measurement Data and Plot:



3.4 Radiated Spurious Emissions

Date Performed: November 9, 2018
Test Standard: RSS-247-Issue 2, RSS-Gen Issue 5
 FCC Subpart C §15.205, 15.209 & 15.247

Required Limits:

1) Radiated emission limits; general requirements.

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency, <i>f</i> (MHz)	Field strength (dBµV/m)
0.009 – 0.490	$(20 \cdot \log(2400/f \text{ (kHz)})) + 40 \text{ dB}$
0.490 – 1.705	$(20 \cdot \log(24000/f \text{ (kHz)})) + 20 \text{ dB}$
1.705 – 30.0	49.5
30 – 88	40.0
88 – 216	43.5
216 – 960	46.0
above 960	54.0

Note 1: The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.
Note 2: The emissions limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

2) Restricted bands of operation.

Unwanted emissions that fall into the restricted bands specified on the table below shall comply with the limits specified on the table limits above as per §15.209 and Clause 8.9 of RSS-Gen.

IC Restricted Bands:

MHz	MHz	GHz
0.090 - 0.110	149.9 - 150.05	9.0 - 9.2
0.495 - 0.505	156.52475 - 156.52525	9.3 - 9.5
2.1735 - 2.1905	156.7 - 156.9	10.6 - 12.7
3.020 - 3.026	162.0125 - 167.17	13.25 - 13.4
4.125 - 4.128	167.72 - 173.2	14.47 - 14.5
4.17725 - 4.17775	240 - 285	15.35 - 16.2
4.20725 - 4.20775	322 - 335.4	17.7 - 21.4
5.677 - 5.683	399.9 - 410	22.01 - 23.12
6.215 - 6.218	608 - 614	23.6 - 24.0
6.26775 - 6.26825	960 - 1427	31.2 - 31.8
6.31175 - 6.31225	1435 - 1626.5	36.43 - 36.5
8.291 - 8.294	1645.5 - 1646.5	Above 38.6
8.362 - 8.366	1660 - 1710	
8.37625 - 8.38675	1718.8 - 1722.2	
8.41425 - 8.41475	2200 - 2300	
12.29 - 12.293	2310 - 2390	
12.51975 - 12.52025	2483.5 - 2500	
12.57675 - 12.57725	2655 - 2900	
13.36 - 13.41	3260 - 3267	
16.42 - 16.423	3332 - 3339	
16.69475 - 16.69525	3345.8 - 3358	
16.80425 - 16.80475	3500 - 4400	
25.5 - 25.67	4500 - 5150	
37.5 - 38.25	5350 - 5460	
73 - 74.6	7250 - 7750	
74.8 - 75.2	8025 - 8500	
108 - 138	--	

* Certain frequency bands listed in table 7 and in bands above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of RSSs.

FCC Restricted Bands:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(2)
13.36-13.41			

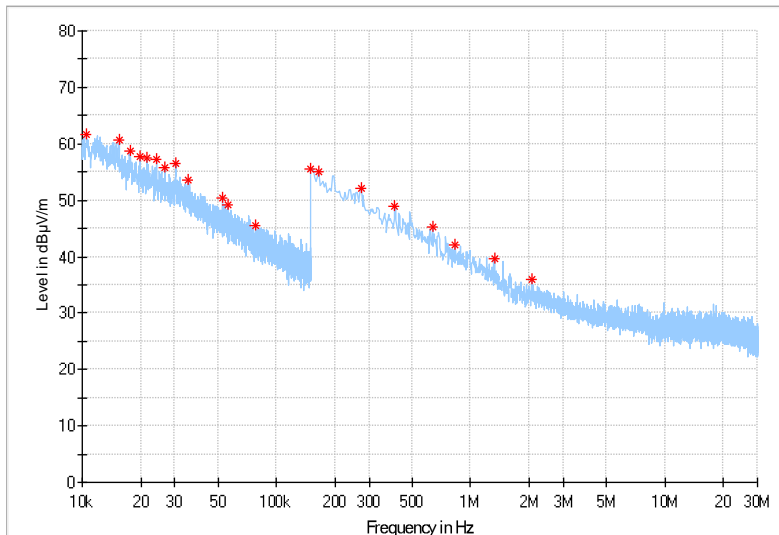
3) §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

Method of Measurement:

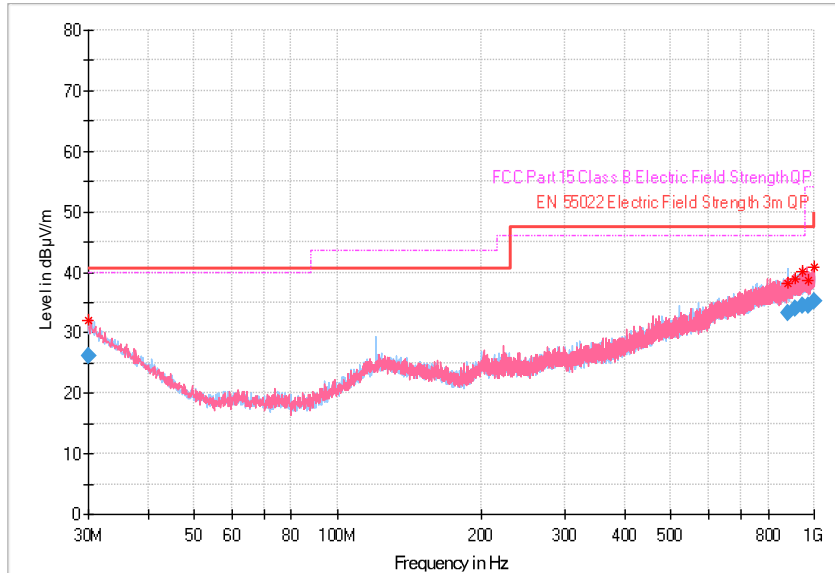
The EUT was tested in our 3 m SAC and was positioned on the center of the turntable. The transmitter was set for continuous transmission. The operating frequency of the device was measured for all radiated emissions 10 kHz to the 10th harmonic of the highest fundamental frequency. The EUT was pre-scanned in 3 different orthogonal orientations and was found to radiate highest when placed flat on the table top as indicated in the test photos.

Result: The EUT complies with the applicable standard.

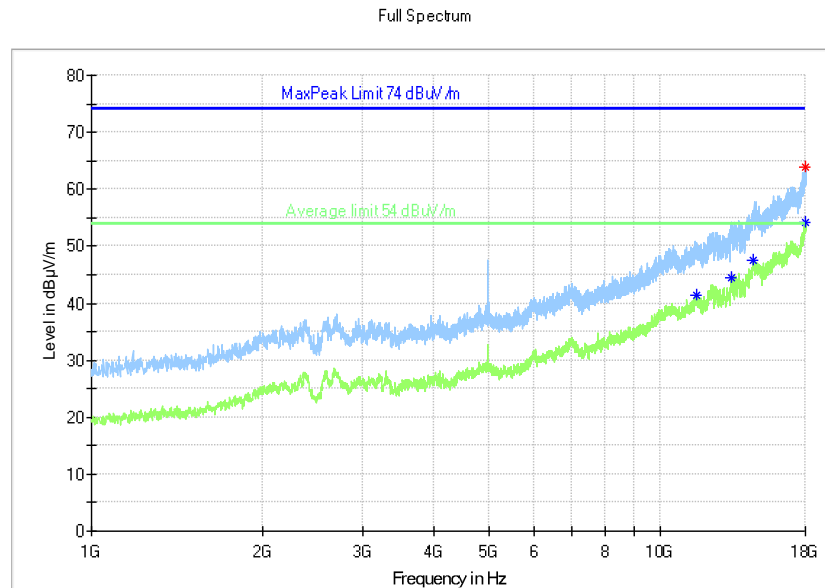
Measurement Data and Plot:



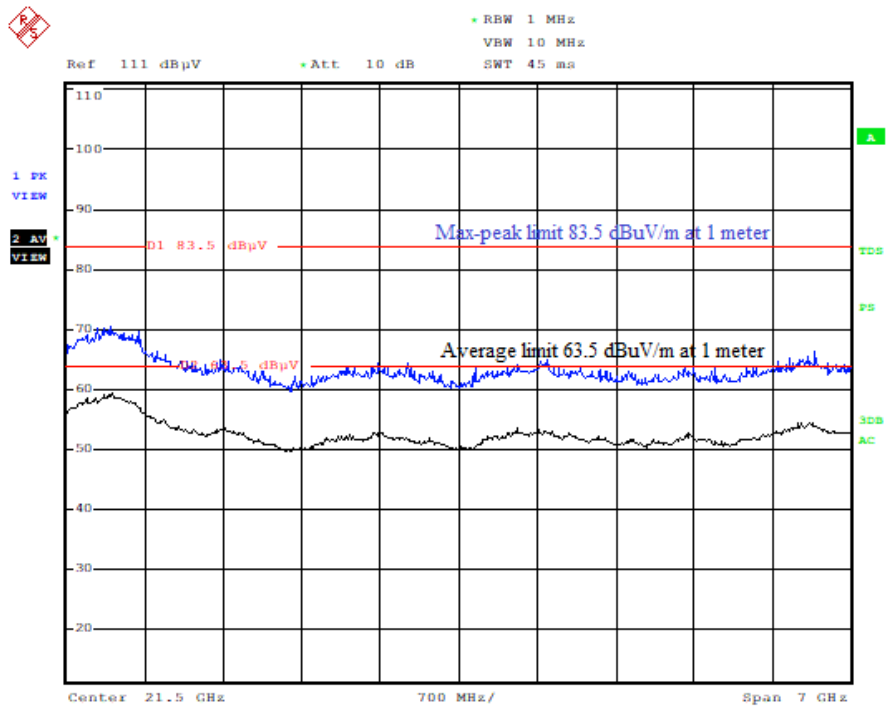
Radiated Spurious Emissions at 3m, 10k -30M Hz



Radiated Spurious Emissions at 3m, 30M – 1G Hz



Radiated Spurious Emissions at 3m, 1G – 18G Hz



Radiated Spurious Emissions at 1m, 18G– 25G Hz

Data, Spurious Emissions of Harmonics

Modulation	Freq.	Peak Raw	Avg. Raw	Sys Gain	Anten. factor	Peak Corr	Avg. Corr.	Peak Limit	Avg. Limit
	MHz	dBuV	dBuV	dB	dB/m	dBuV/m	dBuV/m	dBuV/m	dBuV/m
Low channel	4804	57	35	27.9	34.1	63.2	41.2	74	54
	7206	60.2	34.5	25.1	35.6	70.7	45	74	54
Mid channel	4852	56.8	34.5	28.3	34.1	62.6	40.3	74	54
	7278	59	35	25.2	35.6	69.4	45.4	74	54
High channel	4960	58	35	28.5	34.1	63.6	40.6	74	54
	7440	59	34.5	25.4	35.6	69.2	44.7	74	54

Note: Measurements were performed from 9 kHz to 25G Hz, only the signal within 10dB of the limit line was measured and reported.

3.5 6dB Bandwidth

Date Performed: September 12, 2018

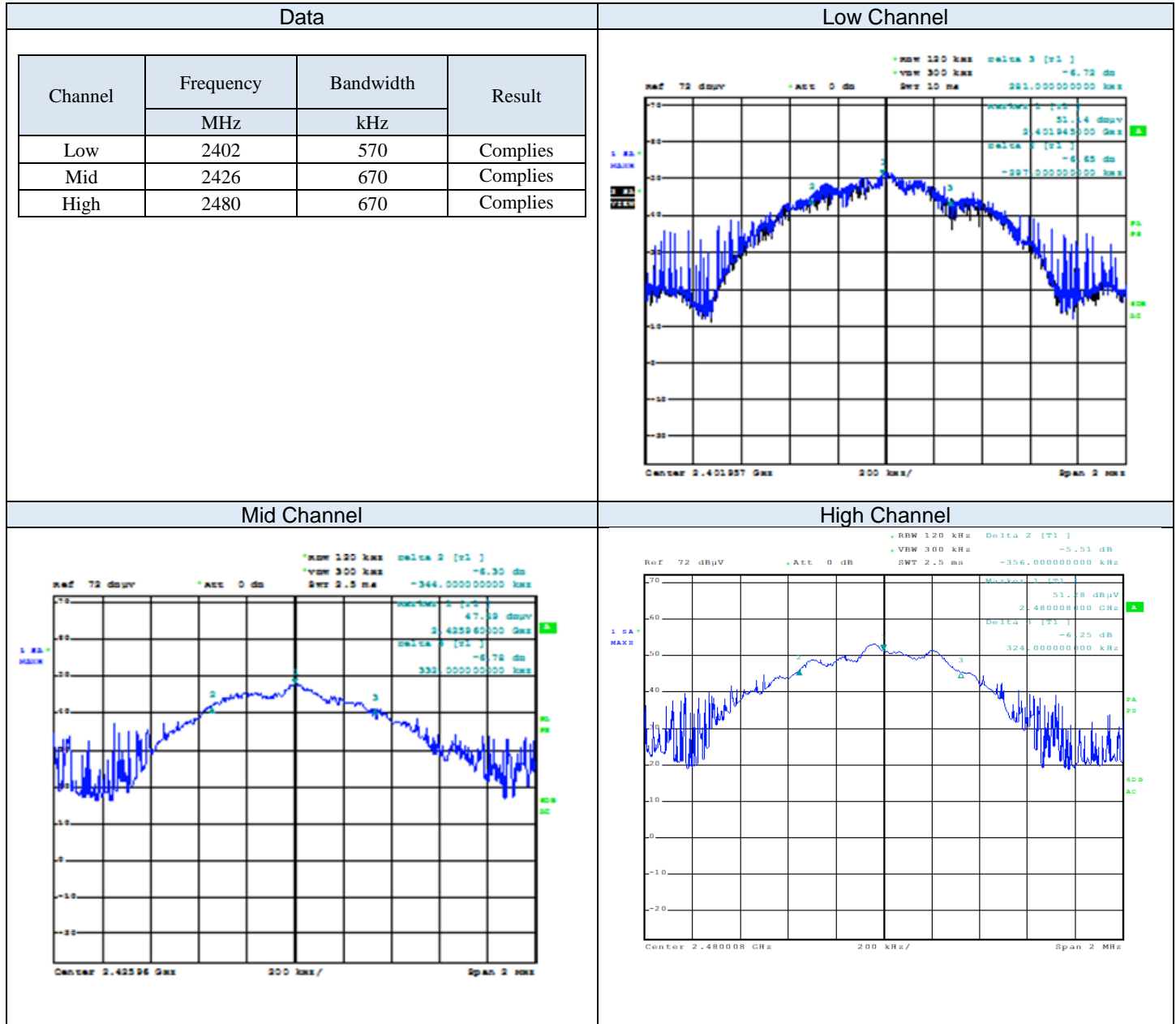
Test Standard: FCC Subpart C §15.247 (a) (2), RSS-247 Issue 2 §5.2

Test Method: ANSI C63.10:2013

Test Requirement: Systems using digital modulation techniques may operate in the 902–928MHz, 2400–2483.5 MHz, and 5725–5850MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Result: The EUT performed as expected.

Measurement Data and Plot:



3.6 99% Bandwidth

Date Performed: August 24, 2018

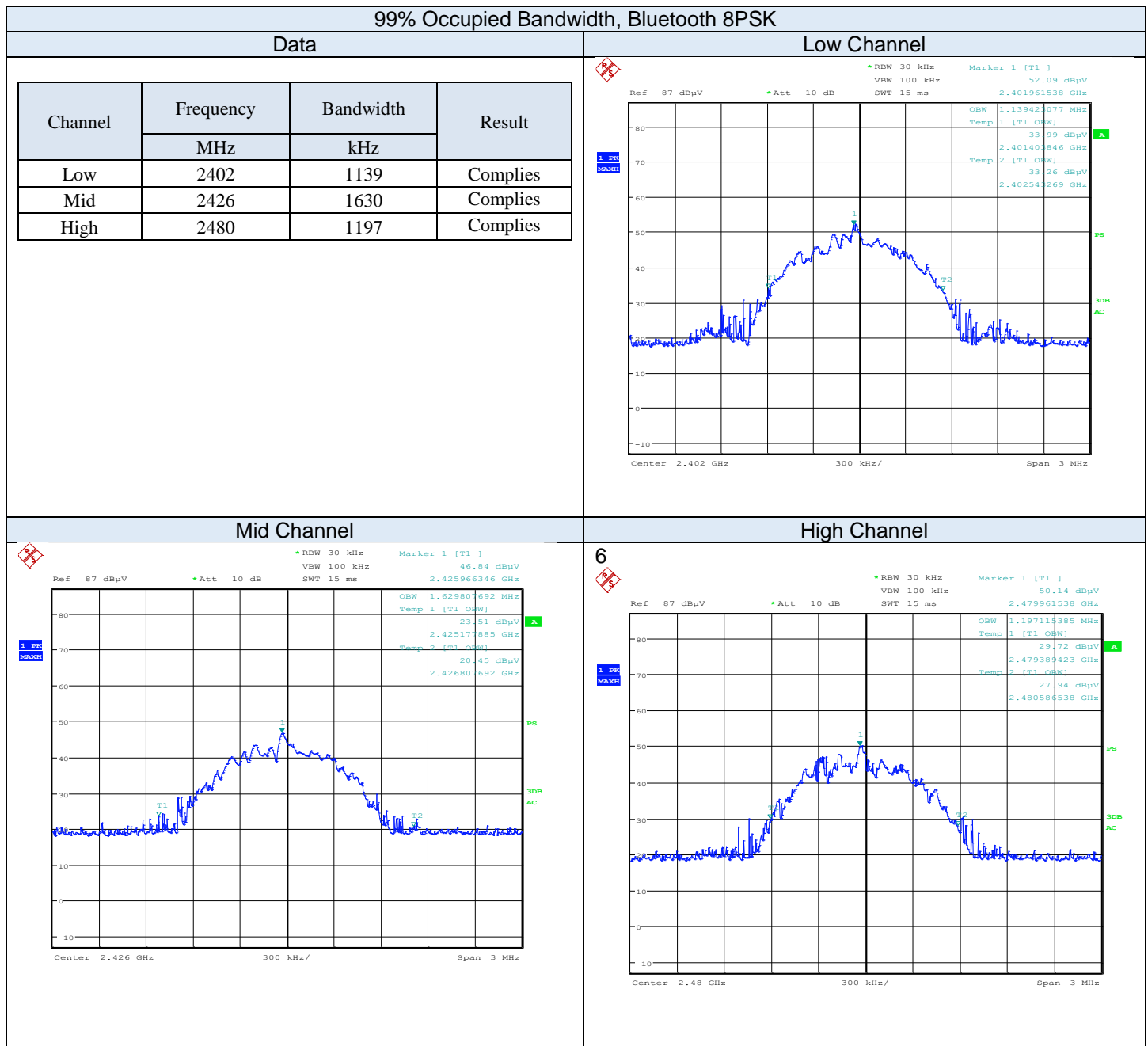
Test Standard: RSS-247 Issue 2, RSS-Gen Issue 5

Minimum Requirement: The Occupied Channel Bandwidth is the bandwidth that contains 99 % of the power of the signal. The bandwidth shall fall completely within the frequency range specified by the standard.

Measurement Method: As called in ANSI C63.10-2013.

Result: The EUT complies with the applicable standard.

Measurement Data and Plot:



3.7 Out of Band Emissions (Band Edge)

Date Performed: August 24, 2018

Test Standard: FCC Title 47 CFR Part 15: Subpart C - §15.247 (d), RSS-247-Issue 2 §5.5

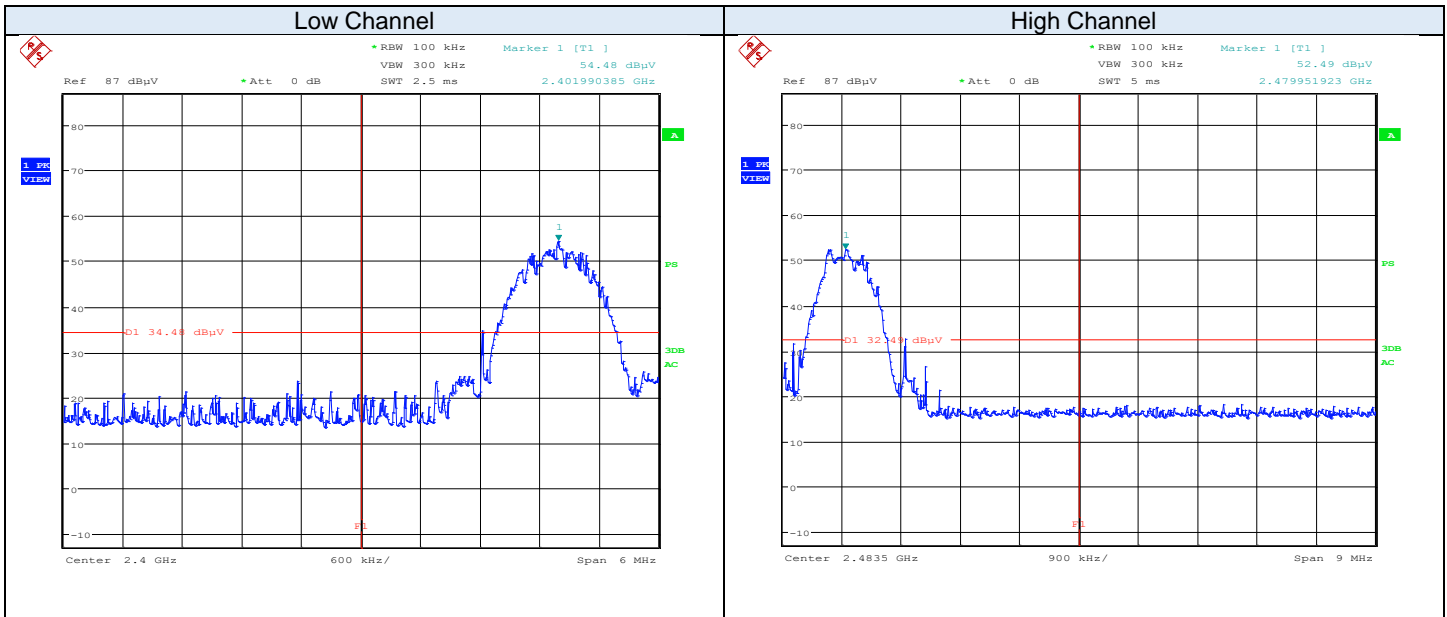
Test Method: ANSI C63.10:2013

Test Requirement: In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section A8.4 (4), the attenuation required shall be 30 dB instead of 20dB.

Result:

The EUT complies with the applicable standard.

Measurement Data and Plot:



3.8 Unintentional Radiated Emissions

Date Performed:

August 17, 2018

Test Standard:

- FCC Title 47 CFR Part 15: Subpart B - §15.109
- ICES-003 Issue 6

Test Method:

- ANSI C63.4-2014

Required Limit:

The field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency, <i>f</i> (MHz)	Field strength (dB μ V/m)
30 – 88	40.0
88 – 216	43.5
216 – 960	46.0
above 960	54.0

Note 1: The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

Note 2: The emissions limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector.

Method of Measurement:

The EUT was positioned in the center of the turntable in the SAC. The EUT was then measured for all the radiated emissions in the frequency range of 30MHz – 1GHz. Measurements were made using the spectrum analyzer and receiver using the appropriate antennas, amplifiers, attenuators, and filters.

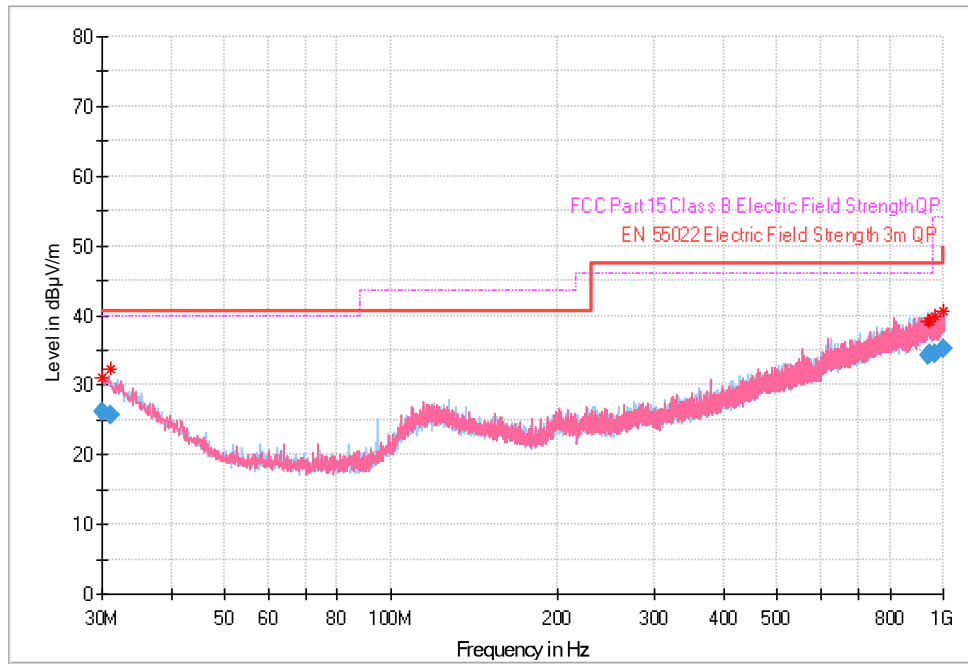
Emissions in both horizontal and vertical polarizations were measured while rotating the Equipment Under Test (EUT) on the turntable to maximize signal strength. In the case of high ambient noises, the measurements are performed at a closer distance and the limit is adjusted per the equation below. The result is added or subtracted to the required emission level to ensure compliance at the new distance.

$$20 \log \left(\frac{D1}{D2} \right); \quad \text{Where } \begin{array}{l} D1 = \text{Current Distance} \\ D2 = \text{Required Distance} \end{array}$$

Result:

The EUT complies with the applicable standard.

Measurement Data and Plot:



30MHz – 1GHz Unintentional Radiated Emissions scanned at 3m SAC, Class B limit

Note: There is no signal found in the frequency range from 150kHz – 25GHz when the transmitter is off.

3.9 AC Mains Conducted Emissions

Date Performed:

August 17, 2018

Test Standard:

- FCC Title 47 CFR Part 15: Subpart B - §15.109
- ICES-003 Issue 6

Test Method:

- ANSI C63.10-2013

Required Limit:

The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the following limits

Frequency (MHz)	Conducted Limit (dBµV)	
	Quasi-Peak	Average
0.15 – 0.50	66 to 56	56 to 46
0.50 – 5	56	46
5.0 – 30.0	60	50

Note 1: The lower limit shall apply at the transition frequencies.

Method of Measurement:

Measurements were made using a test receiver with 9kHz bandwidth, CISPR Quasi-Peak and Average detector.

EUT Configuration:

EUT was configured per ANSI C63.10, Section 6.2.

Worst-case Modulation:

Per ANSI C63.10, Section 6.2, worst-case emissions was identified using Bluetooth modulation on Channel 11 (2413 MHz).

Modifications:

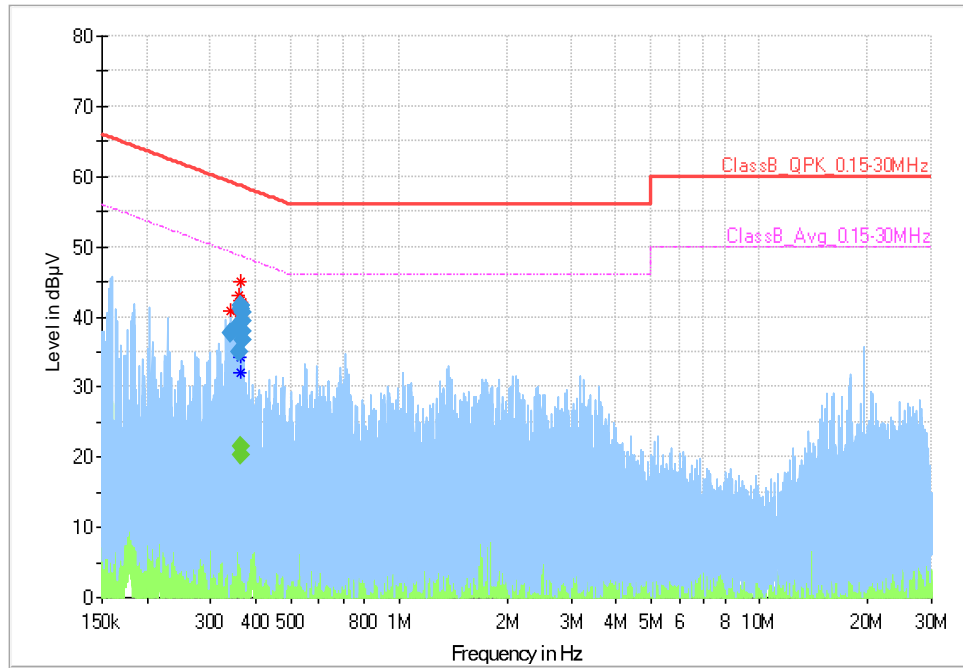
No modification was required to comply for this test.

Result:

The EUT complies with the applicable standard.

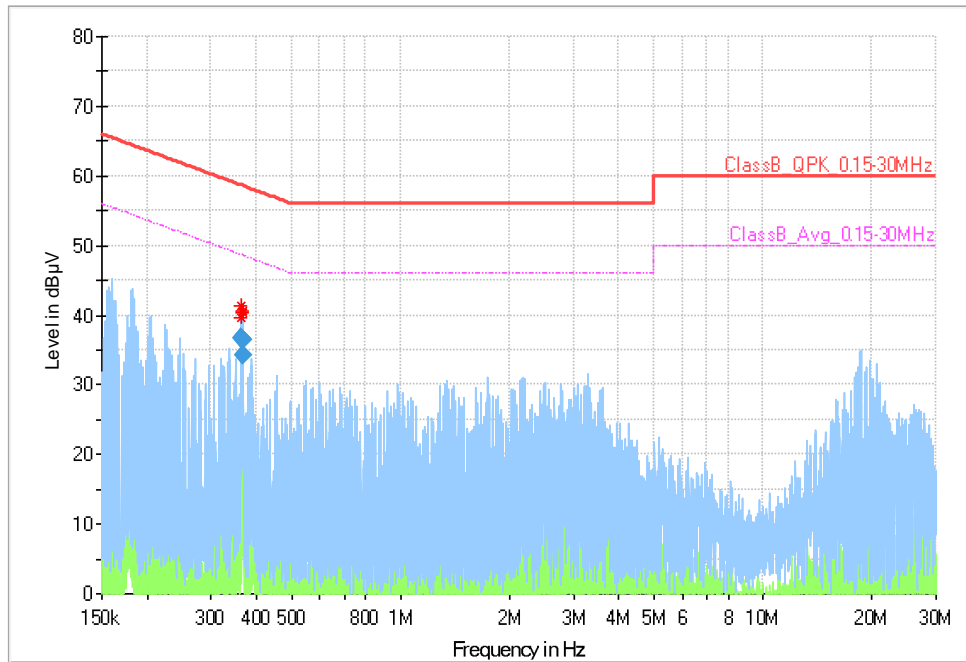
Measurement Data and Plot:

Conducted Emissions – AC main power, Line 1, 120Vac/60Hz



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)
0.341117	37.74	---	59.18	21.44	1000.0	9.000	10.7
0.358597	34.95	---	58.76	23.81	1000.0	9.000	10.7
0.361115	38.85	---	58.70	19.85	1000.0	9.000	10.7
0.362561	---	20.36	48.67	28.31	1000.0	9.000	10.7
0.362561	41.07	---	58.67	17.60	1000.0	9.000	10.7
0.363650	---	21.43	48.65	27.22	1000.0	9.000	10.7
0.363650	41.71	---	58.65	16.94	1000.0	9.000	10.7
0.365107	41.65	---	58.61	16.96	1000.0	9.000	10.7
0.366203	40.73	---	58.59	17.85	1000.0	9.000	10.7
0.367303	39.48	---	58.56	19.08	1000.0	9.000	10.7
0.368406	37.84	---	58.54	20.69	1000.0	9.000	10.7
0.369143	36.64	---	58.52	21.88	1000.0	9.000	10.7

Conducted Emissions – AC main power, Line 2, 120Vac/60Hz



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)
0.363287	36.59	---	58.65	22.07	1000.0	9.000	10.7
0.364742	36.75	---	58.62	21.87	1000.0	9.000	10.7
0.365838	36.45	---	58.60	22.14	1000.0	9.000	10.7
0.367303	34.32	---	58.56	24.24	1000.0	9.000	10.7

3.10 RF Exposure Evaluation

Date Performed: November 9, 2018

Test Standard: FCC 47 CFR §1.1310: RSS-102 Section 2.5.2:

CC CFR 47 §1.1310:

“Radiofrequency radiation exposure limits for General Population/Uncontrolled Exposure at Frequency range 1500 - 100000 MHz: 1.0 mW/cm²”

RSS-102 Section 2.5.2:

“RF exposure evaluation is required if the separation distance between the user and/or bystander and the device’s radiating element is greater than 20 cm, except when the device operates as follows:

-at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834} W$ (adjusted for tune-up tolerance), where f is in MHz

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.”

MPE Results:

The calculation below is used to consider situations in which simultaneous exposure to fields of different frequencies occur. The calculation is performed by the sum of each relative exposure for each equipment according to the following criteria

$$\text{Power Density} = \frac{\text{EIRP}}{4\pi r^2} \text{ mW/cm}^2$$

Max EIRP measured: 8.94 dBm or 7.83mW

Power Density at 20 cm: 0.0016 mW/cm*cm

Limit: 1.0 mW/cm*cm

This device is compliant with the requirement MPE limit for uncontrolled exposure.

RF exposure evaluation exemption for IC:

Max EIRP measured: 8.94 dBm or 7.83mW or 0.00783 W

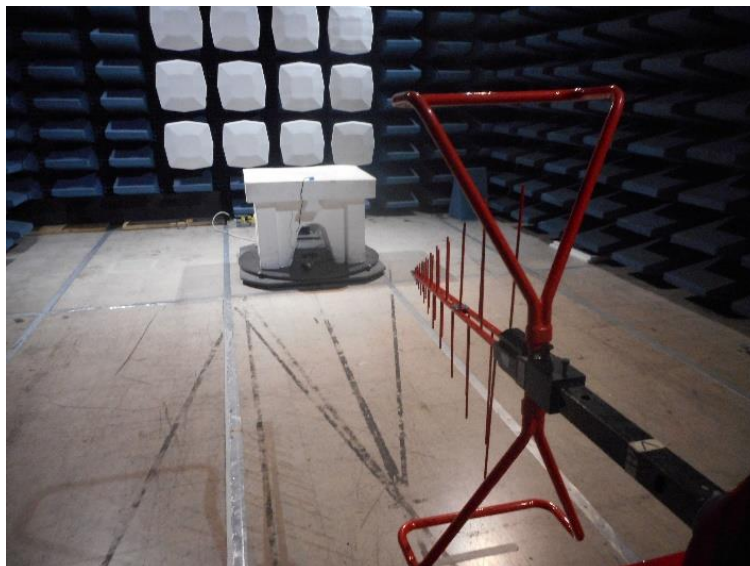
Limit: $1.31 \times 10^{-2} f^{0.6834} W = 2.68 W$ ($f = 2426 \text{ MHz}$)

Therefore, RF exposure is not required.

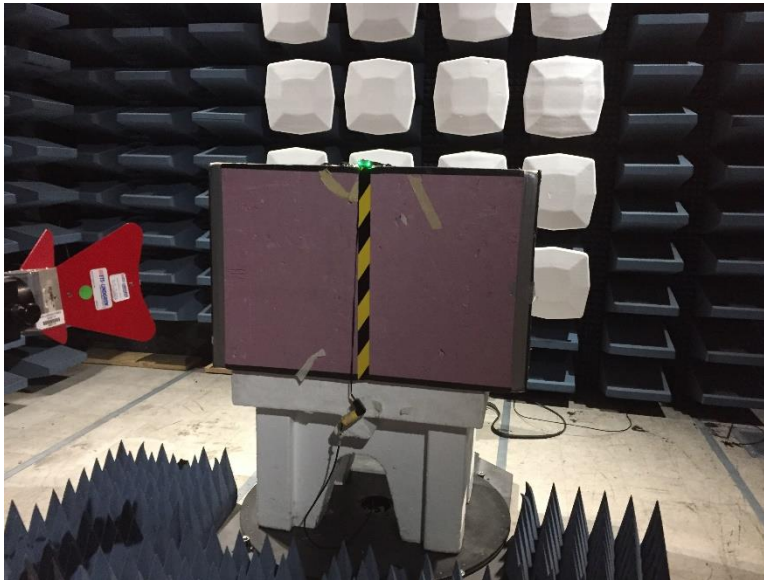
Appendix A: TEST SETUP PHOTOS



Radiated Emissions performed at the 3m SAC, 150kHz – 30MHz



Radiated Emissions performed at the 3m SAC, 30MHz – 1GHz



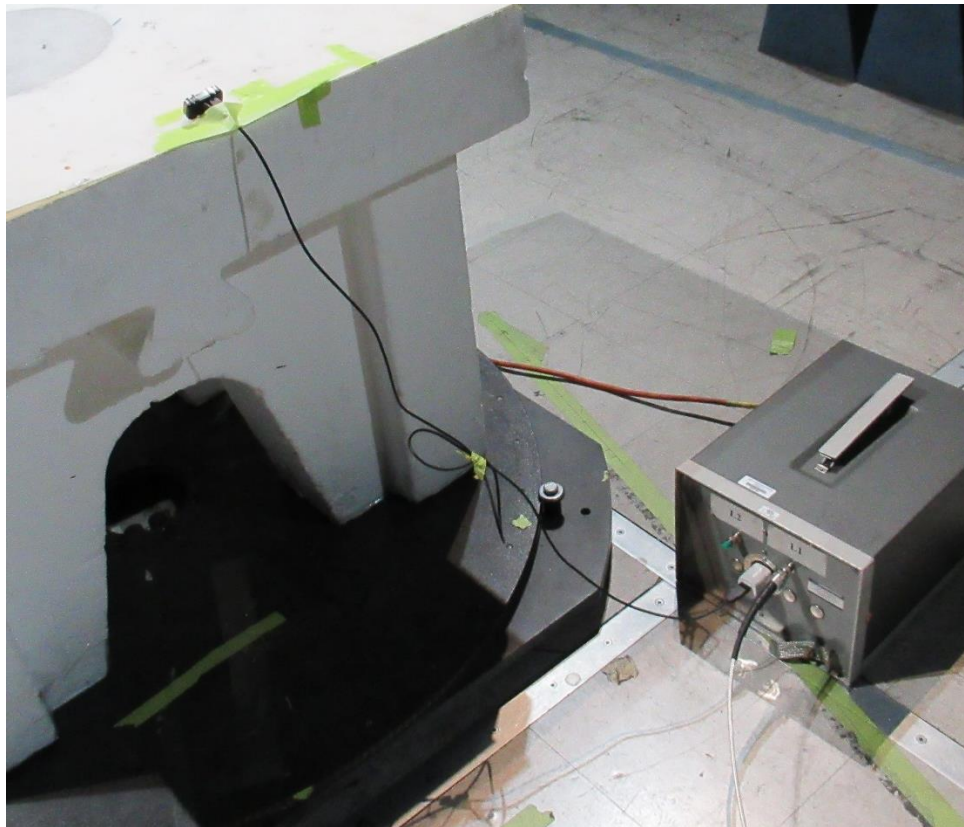
Radiated Emissions performed at the 3m, 1 -18 GHz



Radiated Emissions performed at the 1m, above 18 -25 GHz



The setup of the EUT at the 3m SAC, above 1 GHz



Conducted Emissions performed at the 3m SAC



Conducted Emissions (close-up) performed at the 3m SAC

Appendix B: ABBREVIATIONS

Abbreviation	Definition
AC	Alternating Current
AM	Amplitude Modulation
CISPR	Comité International Spécial des Perturbations Radioélectriques
DC	Direct Current
EMC	ElectroMagnetic Compatibility
EMI	ElectroMagnetic Interference
EUT	Equipment Under Test
FCC	Federal Communications Commission
IC	Industry Canada
ICES	Interference Causing Equipment Standard
IEC	International Electrotechnical Commission
LISN	Line Impedance Stabilizing Network
OATS	Open Area Test Site
RF	Radio Frequency
RMS	Root-Mean-Square
SAC	Semi-Anechoic Chamber

END OF REPORT