



TESTING LABORATORY
CERTIFICATE #4820.01



FCC PART 15.249
RSS-GEN ISSUE 5, APRIL 2018
RSS-210 ISSUE 9, AUGUST 2016

TEST REPORT

For

NANOGRID LIMITED

ROOM 1405, 135 BONHAM STRAND TRADE CENTRE, 135 BONHAM STRAND, SHEUNG
WAN, HONG KONG

FCC ID: 2AEWY-NL29
IC: 20489-NL29

Report Type: Original Report	Product Name: Nanoleaf Canvas
Report Number: RDG180730066-00A	
Report Date: 2018-11-23	
Reviewed By: Dean Lau RF Supervisor	
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Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan). This report must not be used by the customer to claim product certification, approval, or endorsement by A2LA* or any agency of the Federal Government.

* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk “*”.

TABLE OF CONTENTS

GENERAL INFORMATION.....	3
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	3
OBJECTIVE	3
RELATED SUBMITTAL(S)/GRANT(S).....	3
TEST METHODOLOGY	3
MEASUREMENT UNCERTAINTY.....	4
TEST FACILITY	4
SYSTEM TEST CONFIGURATION.....	5
JUSTIFICATION	5
EUT EXERCISE SOFTWARE	5
EQUIPMENT MODIFICATIONS	5
SUPPORT EQUIPMENT LIST AND DETAILS	5
SUPPORT CABLE LIST AND DETAILS	5
BLOCK DIAGRAM OF TEST SETUP	6
SUMMARY OF TEST RESULTS	7
RSS-102 § 2.5.2 - EXEMPTION LIMITS FOR ROUTINE EVALUATION – RF EXPOSURE EVALUATION	8
APPLICABLE STANDARD	8
FCC §15.203 & RSS-GEN§6.8 - ANTENNA REQUIREMENT	9
APPLICABLE STANDARD	9
ANTENNA CONNECTOR CONSTRUCTION	10
FCC §15.207 (A) & RSS-GEN CLAUSE 8.8– AC LINE CONDUCTED EMISSIONS.....	11
APPLICABLE STANDARD	11
EUT SETUP	11
EMI TEST RECEIVER SETUP.....	11
TEST PROCEDURE	12
CORRECTED AMPLITUDE & MARGIN CALCULATION	12
TEST EQUIPMENT LIST AND DETAILS.....	12
TEST DATA	13
FCC§15.205, §15.209&§15.249&RSS-210§B10, RSS-GEN§8.10- RADIATED EMISSIONS.....	15
APPLICABLE STANDARD	15
EUT SETUP.....	16
TEST EQUIPMENT SETUP	16
TEST PROCEDURE	17
CORRECTED AMPLITUDE & MARGIN CALCULATION	17
TEST EQUIPMENT LIST AND DETAILS.....	18
TEST DATA	18
FCC §15.215(C) &RSS-GEN §6.7– 20 DB BANDWIDTH TESTING AND 99% OCCUPIED BANDWIDTH..	24
APPLICABLE STANDARD	24
TEST PROCEDURE	24
TEST EQUIPMENT LIST AND DETAILS.....	25
TEST DATA	25

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:		Nanoleaf Canvas
ISED EUT Model:		NL29-0003SW-9PK
FCC EUT Model:		NL29-0003SW-9PK
FCC Multiple Model:		NL29-XXXXSX-9PK
FCC ID:		2AEWY-NL29
IC:		20489-NL29
Adapter Information	Model:	DSL-24WF-42 420057
	Input:	100-120Vac,50/60Hz,0.8A
	Output:	42Vdc,0.57A,24W
External Dimension:		150mm(L)*150 mm(W)*150 mm(H)
Serial Number:		180730066
EUT Received Date:		2018.10.10

Note: About FCC, the series product, models are electrically identical, The difference between them please refer to the declaration letter for details. For marketing purpose, we selected NL29-0003SW-9PK for fully testing.

Objective

This type approval report is prepared on behalf of **NANOGRID LIMITED** in accordance with Part 2-Subpart J, and Part 15-Subparts A and C of the Federal Communication Commissions rules and RSS-210, Issue 9, August 2016, RSS-Gen Issue 5, April 2018 of the Innovation, Science and Economic Development Canada.

The tests were performed in order to determine compliance with FCC Rules Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.249 rules and RSS-210, Issue 9, August 2016, RSS-Gen Issue 5, April 2018 of the Innovation, Science and Economic Development Canada.

Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS submissions with FCC ID: 2AEWY-NL29.
Submitted with the part of a system with FCC ID: 2AEWY-NL26.
RSS-247 submissions with IC: 20489-NL29.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and RSS-210, Issue 9, AUGUST 2016, RSS-Gen Issue 5, April 2018

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

Measurement Uncertainty

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	$\pm 5\%$
Unwanted Emissions, radiated	30M~200MHz: 4.58 dB for Horizontal, 4.59 dB for Vertical 200M~1GHz: 4.83 dB for Horizontal, 5.85 dB for Vertical 1G~6GHz: 4.45 dB, 6G~26.5GHz: 5.23 dB
Temperature	$\pm 1^{\circ}\text{C}$
Humidity	$\pm 5\%$
DC and low frequency voltages	$\pm 0.4\%$
Duty Cycle	1%
AC Power Lines Conducted Emission	3.12 dB (150 kHz to 30 MHz)

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218, the FCC Designation No. : CN1220.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062D.

SYSTEM TEST CONFIGURATION

Justification

The EUT was configured for testing in an engineering mode which was provided by the manufacturer.

The device operates 2.4GHz band, the modulation is GFSK. Total 40 channels employs by the device:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404
...
...
..	...	38	2478
19	2440	39	2480

EUT was tested with channel 0, 19 and 39.

EUT Exercise Software

The software “SecureCRT.exe V8.0.0.1” was used for testing, which was provided by manufacturer. The maximum power was configured as below table, that provided by the manufacturer:

Channel	Frequency (MHz)	Power level
Low	2402	30
Middle	2440	40
High	2480	40

Equipment Modifications

No modifications were made to the EUT.

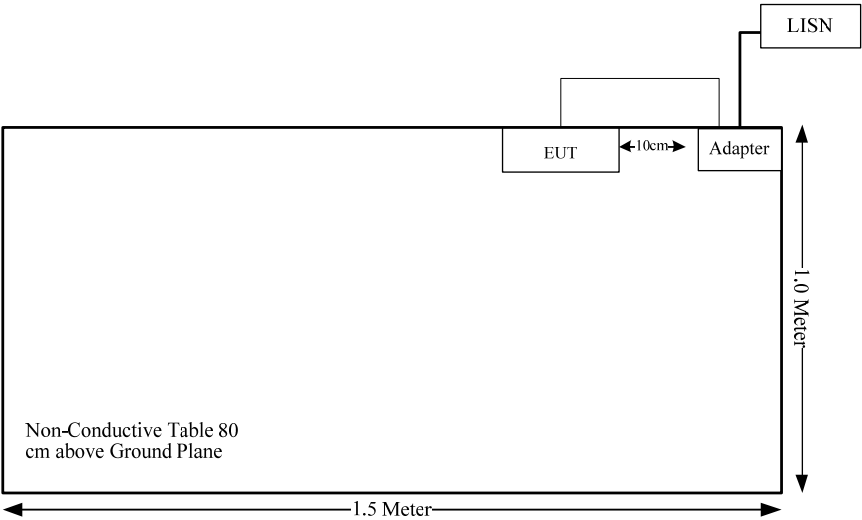
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Lenovo	Notebook	G510	CB04060626
nanoleaf	AC/DC Adapter	DSL-24WF-42 420057	/

Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
Undetachable Cable	No	No	2.5	Adapter	EUT

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
RSS-102 §2.5.2	Exemption limits for Routine Evaluation – RF EXPOSURE Evaluation	Compliance
§15.203 RSS-Gen Clause 6.8	Antenna Requirement	Compliance
§15.207(a) RSS-Gen Clause 8.8	Conduction Emissions	Compliance
15.205, §15.209, §15.249 RSS-210 Clause B10, RSS-Gen Clause 8.10	Radiated Emissions	Compliance
§15.215 (c) RSS-Gen Clause 6.7	20 dB Bandwidth 99% Occupied Bandwidth	Compliance

RSS-102 § 2.5.2 - EXEMPTION LIMITS FOR ROUTINE EVALUATION – RF EXPOSURE EVALUATION

Applicable Standard

According to RSS-102 § (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:

- below 20 MHz⁶ and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- 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;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

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.

Result:

The EUT is a low power device, exemption from Routine Evaluation Limits –RF exposure Evaluation.

FCC §15.203 & RSS-GEN§6.8 - ANTENNA REQUIREMENT

Applicable Standard

According to FCC § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

According to RSS-Gen §6.8, The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

For licence-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

This radio transmitter [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

Antenna Connector Construction

The device has 2 internal antennas, fulfill the requirement of this section. Please refer to the EUT photos and below information.

Unit	Antenna	Antenna Type	Connector Type	input impedance (Ohm)	Antenna Gain
Controller	2.4G	FPC	PCB	50	2.15 dBi
	WIFI	FPC	PCB	50	2.15 dBi

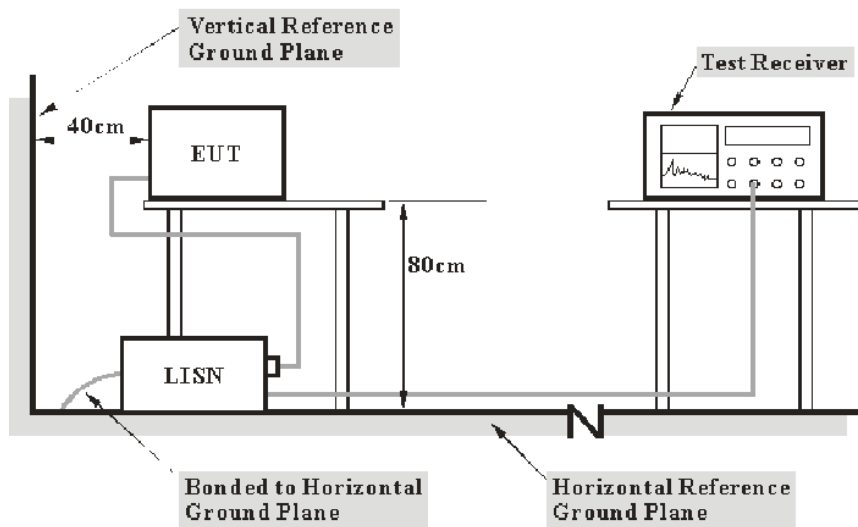
Result: Compliance.

FCC §15.207 (a) & RSS-GEN CLAUSE 8.8– AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207(a), RSS-Gen§8.8.

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 and the RSS-Gen limits.

The spacing between the peripherals was 10 cm.

The adapter was connected to the main lisn with a 120 V/60 Hz AC power source.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the adapter was connected to the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$$V_C = V_R + A_C + VDF$$

$$C_f = A_C + VDF$$

Herein,

V_C (cord. Reading): corrected voltage amplitude

V_R : reading voltage amplitude

A_C : attenuation caused by cable loss

VDF: voltage division factor of AMN

C_f : Correction Factor

The “**Margin**” column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Equipment List and Details

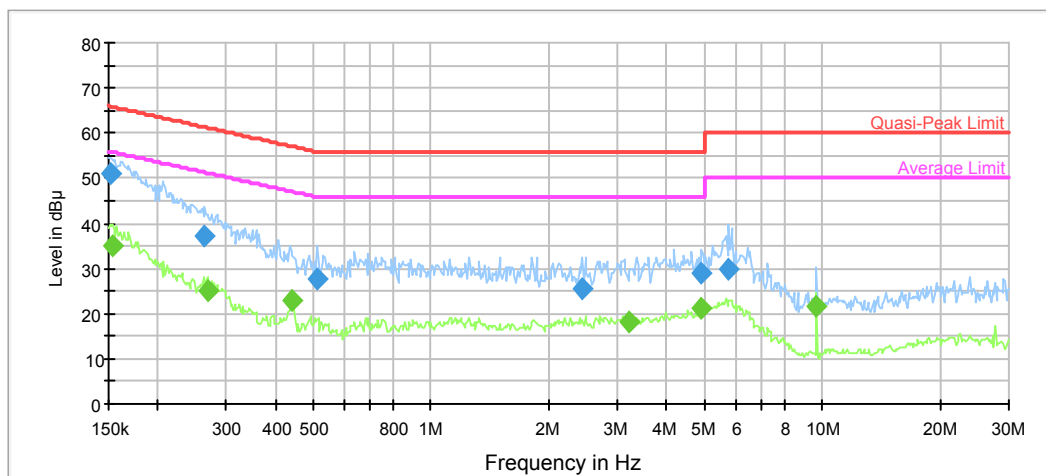
Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCS 30	830245/006	2017-12-11	2018-12-11
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-01	2018-09-05	2019-09-05
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A
R&S	Two-line V-network	ENV 216	101614	2017-12-08	2018-12-08

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data**Environmental Conditions**

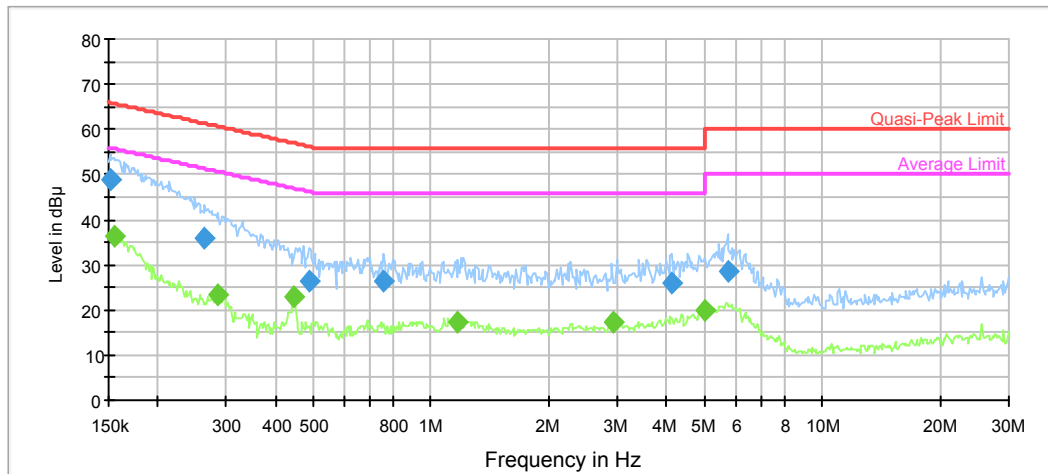
Temperature:	27.1 °C
Relative Humidity:	41 %
ATM Pressure:	100.8 kPa

The testing was performed by Ade Xiao on 2018-11-19.

AC120 V, 60 Hz, Line:

Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.152410	51.1	9.000	L1	11.1	14.8	65.9
0.264113	37.0	9.000	L1	10.3	24.3	61.3
0.511698	27.8	9.000	L1	9.9	28.2	56.0
2.439371	25.6	9.000	L1	9.8	30.4	56.0
4.918182	29.0	9.000	L1	9.8	27.0	56.0
5.767867	30.0	9.000	L1	9.8	30.0	60.0

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.153629	35.2	9.000	L1	11.1	20.6	55.8
0.268355	25.0	9.000	L1	10.2	26.2	51.2
0.443327	22.9	9.000	L1	9.9	24.1	47.0
3.224010	18.3	9.000	L1	9.8	27.7	46.0
4.918182	21.1	9.000	L1	9.8	24.9	46.0
9.681660	21.5	9.000	L1	9.8	28.5	50.0

AC120 V, 60 Hz, Neutral:

Frequency (MHz)	QuasiPeak (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.151200	49.0	9.000	N	11.1	16.9	65.9
0.264113	36.1	9.000	N	10.3	25.2	61.3
0.487810	26.6	9.000	N	9.9	29.6	56.2
0.756101	26.2	9.000	N	9.8	29.8	56.0
4.127365	26.1	9.000	N	9.8	29.9	56.0
5.722091	28.6	9.000	N	9.8	31.4	60.0

Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.156097	36.2	9.000	N	11.1	19.5	55.7
0.283749	23.1	9.000	N	10.2	27.6	50.7
0.446873	23.1	9.000	N	9.9	23.9	46.9
1.171949	17.3	9.000	N	9.8	28.7	46.0
2.930016	17.3	9.000	N	9.8	28.7	46.0
4.997188	19.8	9.000	N	9.8	26.2	46.0

FCC§15.205, §15.209&§15.249&RSS-210§B10, RSS-Gen§8.10- RADIATED EMISSIONS

Applicable Standard

As per FCC§15.249 (a), except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

As per FCC§15.249 (c), Field strength limits are specified at a distance of 3 meters.

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

According to RSS-210 §B10

Devices shall comply with the following requirements:

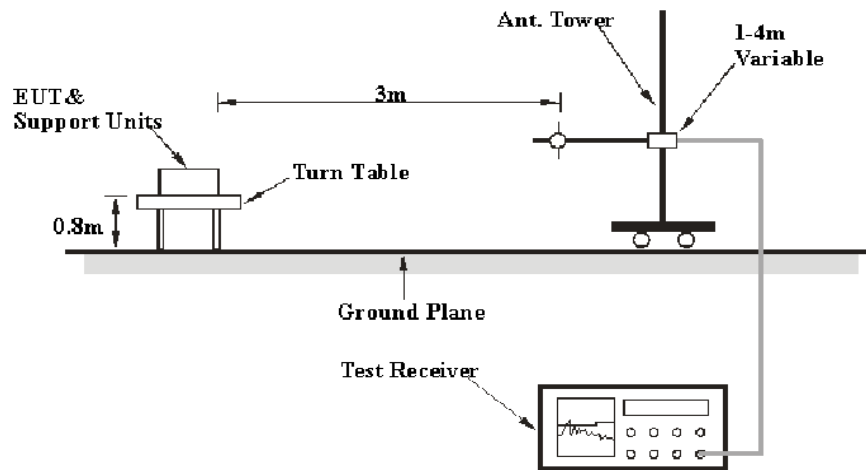
The field strength of fundamental and harmonic emissions, measured at 3 m, shall not (a)exceed 50 mV/m and 0.5 mV/m respectively.

The field strength limits shall be measured using an average detector, except for the fundamental emission in the frequency band 902-928 MHz, which is based on measurements using an International Special Committee on Radio Interference (CISPR) quasi-peak detector.

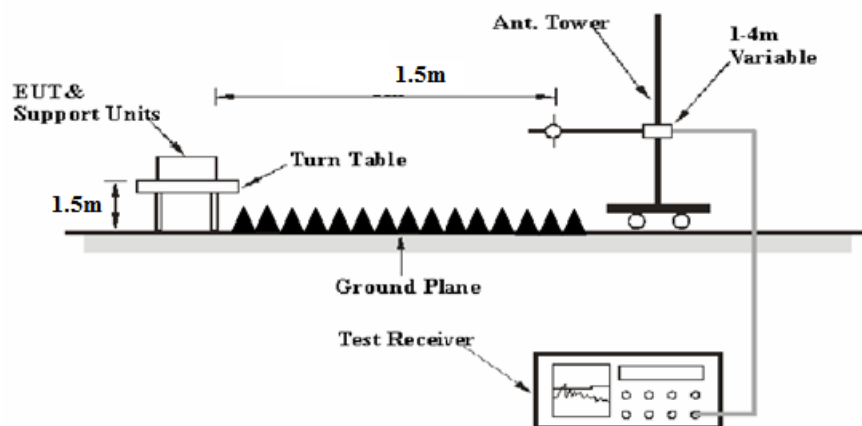
Emissions radiated outside of the specified frequency bands, except for harmonic emissions, (b)shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission tests were performed in the 10 meters chamber for the range 30MHz to 1GHz and the 3 meters chamber B test site for above 1GHz, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, FCC 15.249 and RSS-210, RSS-Gen limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

Test Equipment Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	AV

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All data was recorded in the Quasi-peak detection mode from 30 MHz to 1GHz, peak and average detection mode above 1 GHz.

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Equipment List and Details

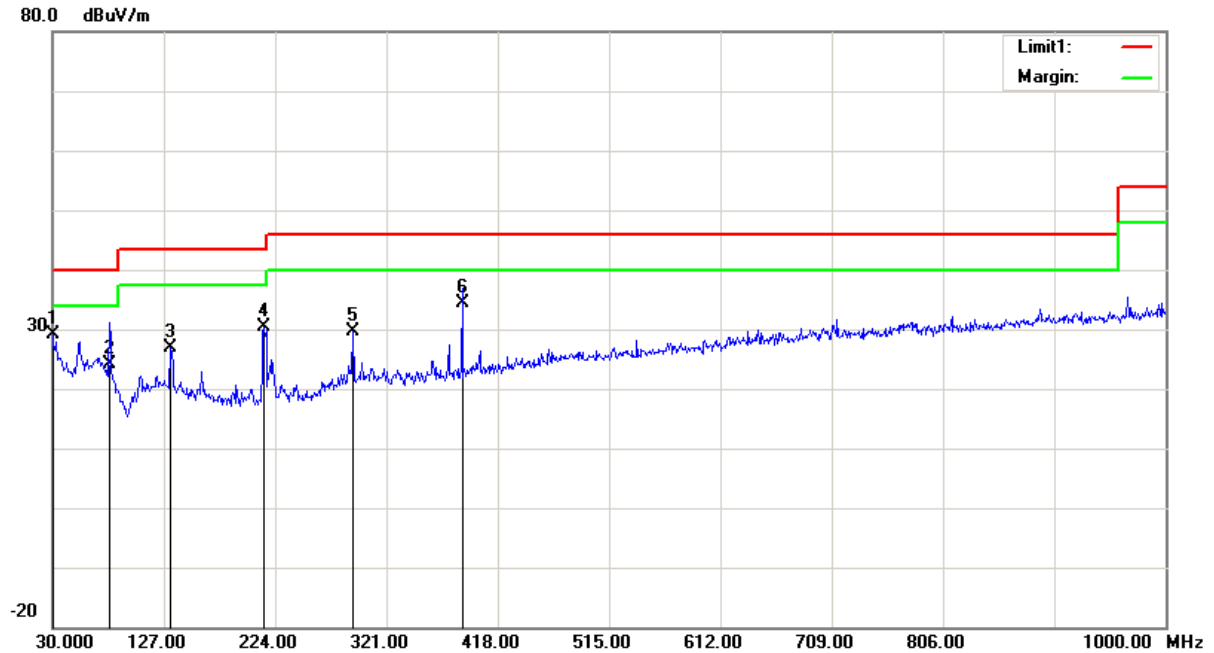
Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2017-12-11	2018-12-11
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2020-11-10
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-1000-01	2018-09-05	2019-09-05
HP	Amplifier	8447D	2727A05902	2018-09-05	2019-09-05
Agilent	Spectrum Analyzer	E4440A	SG43360054	2018-01-04	2019-01-04
R&S	Spectrum Analyzer	FSP 38	100478	2017-12-08	2018-12-08
ETS-Lindgren	Horn Antenna	3115	000 527 35	2016-01-05	2019-01-04
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-01 1304	2016-11-18	2019-11-18
Unknown	Coaxial Cable	C-2.4J2.4J-50	C-0700-02	2018-06-27	2019-06-27
MITEQ	Amplifier	AFS42-00101800- 25-S-42	2001271	2018-09-05	2019-09-05
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2018-06-27	2019-06-27
E-Microwave	Band-stop Filters	OBSF-2400-2483.5- S	OE01601525	2018-06-16	2019-06-16
Micro-tronics	High Pass Filter	HPM50111	S/N-G217	2018-06-16	2019-06-16

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

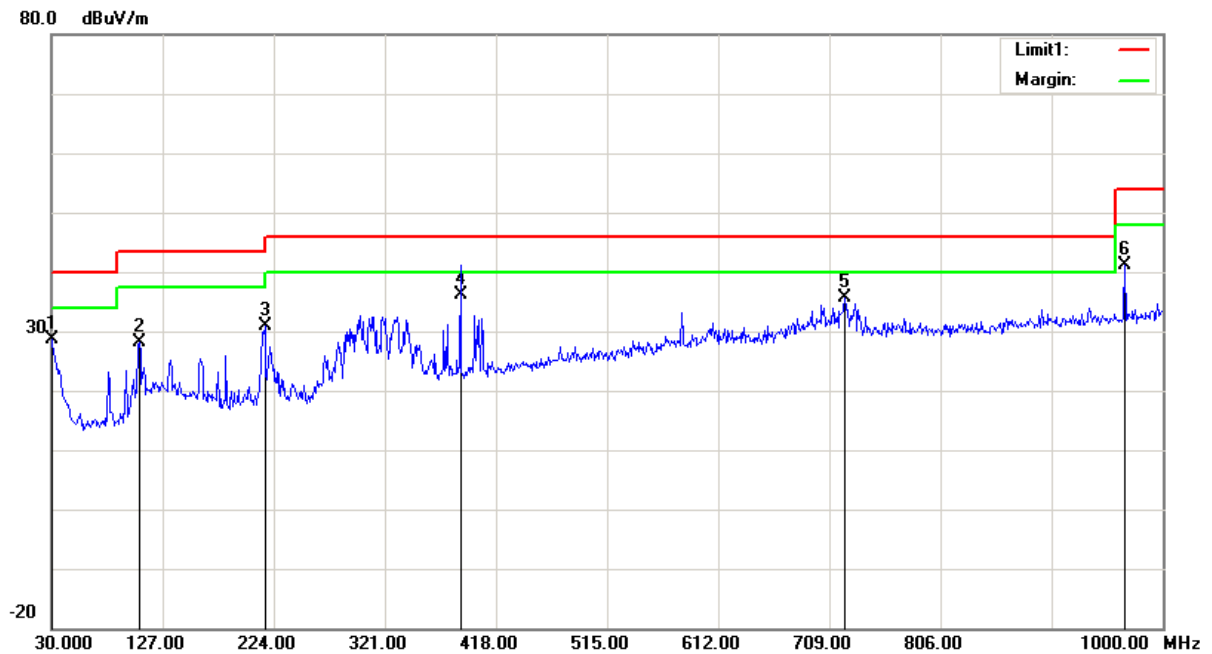
Test Data**Environmental Conditions**

Temperature:	25.3 ~ 26.8 °C
Relative Humidity:	35 ~ 36%
ATM Pressure:	99.7 kPa

The testing was performed by Tyler Pan & Neil Liao on 2018-11-14.

1) 30MHz-1GHz:**Horizontal:**

Frequency (MHz)	Receiver Reading (dBuV)	Remark	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.0000	27.25	peak	1.76	29.01	40.00	10.99
79.4700	35.28	QP	-11.18	24.10	40.00	15.90
132.8200	31.75	peak	-4.95	26.80	43.50	16.70
214.3000	37.44	peak	-7.16	30.28	43.50	13.22
291.9000	33.65	peak	-4.02	29.63	46.00	16.37
386.9600	36.64	QP	-2.37	34.27	46.00	11.73

Vertical:

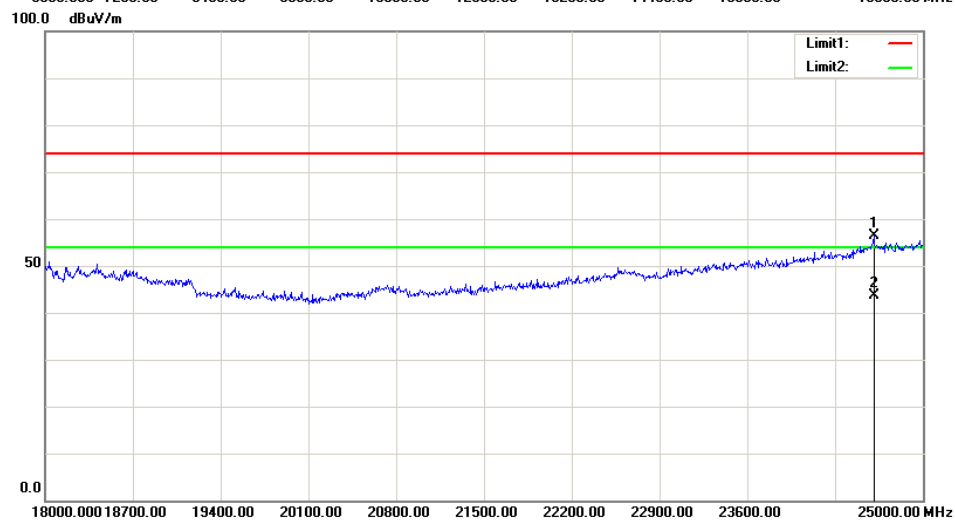
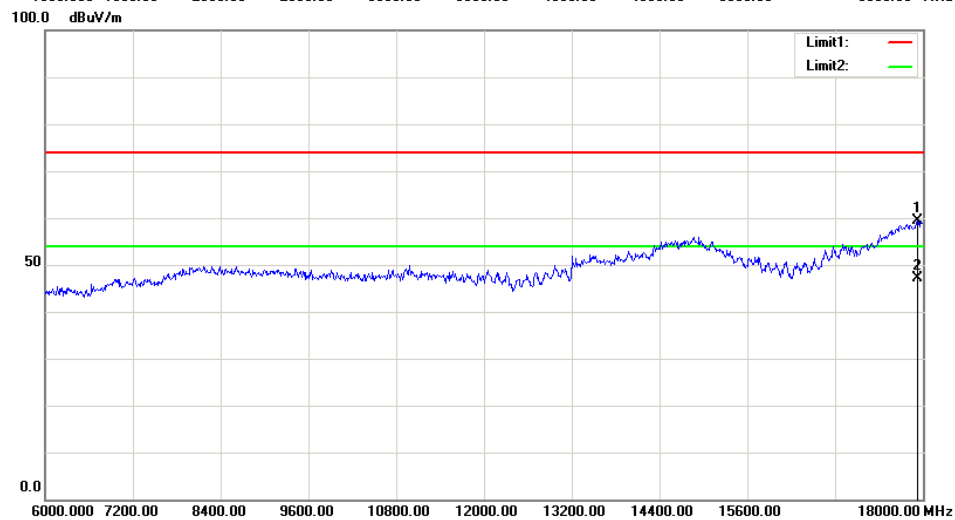
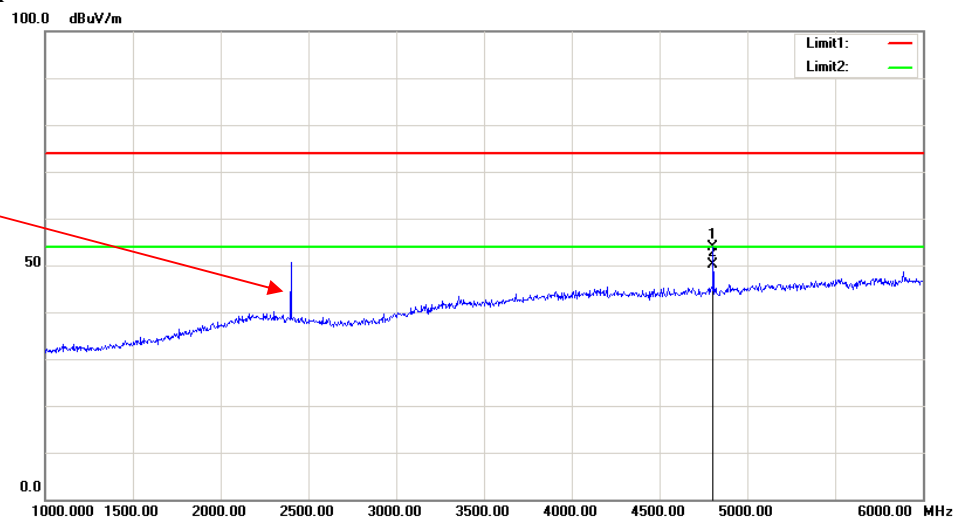
Frequency (MHz)	Receiver Reading (dBuV)	Remark	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.0000	26.76	peak	1.76	28.52	40.00	11.48
106.6300	35.19	peak	-7.06	28.13	43.50	15.37
216.2400	38.16	peak	-7.20	30.96	46.00	15.04
386.9600	38.54	QP	-2.37	36.17	46.00	9.83
722.5800	32.24	peak	3.32	35.56	46.00	10.44
967.0200	18.29	peak	22.94	41.23	54.00	12.77

2) 1GHz-25GHz

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Remark	Polar (H/V)	Factor (dB(1/m))					
Test Frequency: 2402 MHz									
2402.00	61.88	PK	H	28.10	1.80	0.00	91.78	113.98	22.20
2402.00	60.93	AV	H	28.10	1.80	0.00	90.83	93.98	3.15
2402.00	63.77	PK	V	28.10	1.80	0.00	93.67	113.98	20.31
2402.00	63.13	AV	V	28.10	1.80	0.00	93.03	93.98	0.95
2400.00	34.88	PK	V	28.10	1.80	0.00	64.78	74.00	9.22
2400.00	21.91	AV	V	28.10	1.80	0.00	51.81	54.00	2.19
4804.00	58.10	PK	V	32.91	3.17	37.20	56.98	74.00	17.02
4804.00	53.72	AV	V	32.91	3.17	37.20	52.60	54.00	1.40
7206.00	45.88	PK	V	35.74	4.82	37.23	49.21	74.00	24.79
7206.00	33.34	AV	V	35.74	4.82	37.23	36.67	54.00	17.33
Test Frequency: 2440 MHz									
2440.00	62.01	PK	H	28.18	1.82	0.00	92.01	113.98	21.97
2440.00	61.10	AV	H	28.18	1.82	0.00	91.10	93.98	2.88
2440.00	63.36	PK	V	28.18	1.82	0.00	93.36	113.98	20.62
2440.00	62.58	AV	V	28.18	1.82	0.00	92.58	93.98	1.40
4880.00	56.98	PK	V	33.06	3.27	37.21	56.10	74.00	17.90
4880.00	52.25	AV	V	33.06	3.27	37.21	51.37	54.00	2.63
7320.00	45.80	PK	V	36.03	4.62	37.37	49.08	74.00	24.92
7320.00	33.41	AV	V	36.03	4.62	37.37	36.69	54.00	17.31
Test Frequency: 2480 MHz									
2480.00	61.54	PK	H	28.26	1.84	0.00	91.64	113.98	22.34
2480.00	60.67	AV	H	28.26	1.84	0.00	90.77	93.98	3.21
2480.00	63.32	PK	V	28.26	1.84	0.00	93.42	113.98	20.56
2480.00	62.55	AV	V	28.26	1.84	0.00	92.65	93.98	1.33
2483.50	28.27	PK	V	28.27	1.84	0.00	58.38	74.00	15.62
2483.50	16.10	AV	V	28.27	1.84	0.00	46.21	54.00	7.79
4960.00	57.43	PK	V	33.22	3.23	37.25	56.63	74.00	17.37
4960.00	53.24	AV	V	33.22	3.23	37.25	52.44	54.00	1.56
7440.00	45.78	PK	V	36.34	4.41	37.52	49.01	74.00	24.99
7440.00	33.34	AV	V	36.34	4.41	37.52	36.57	54.00	17.43

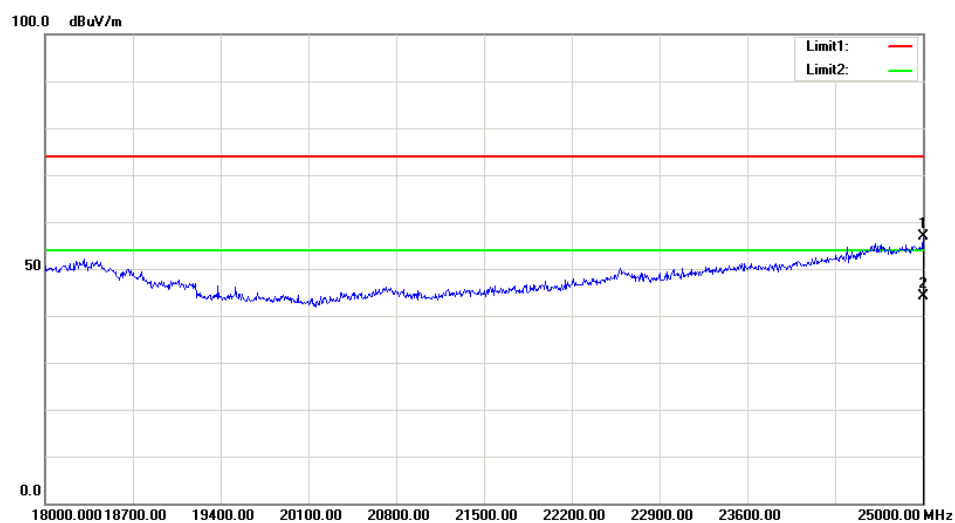
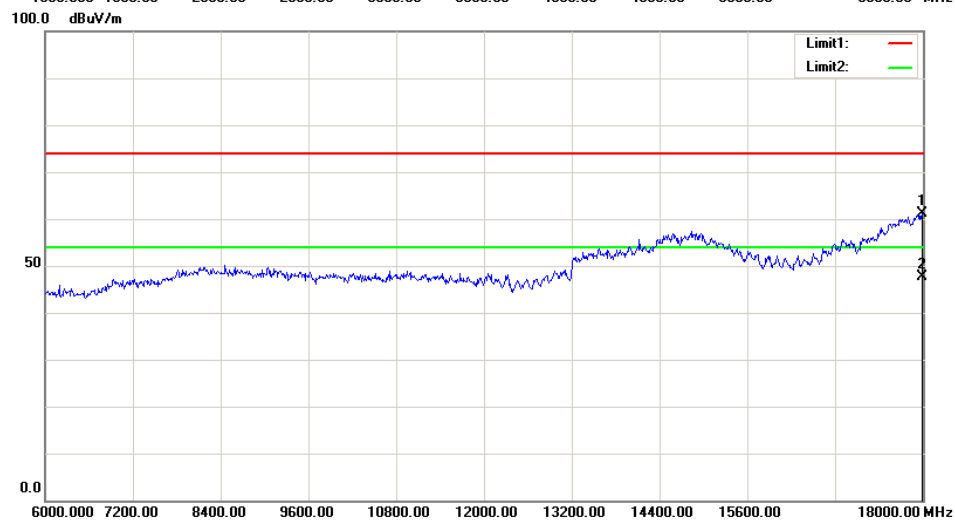
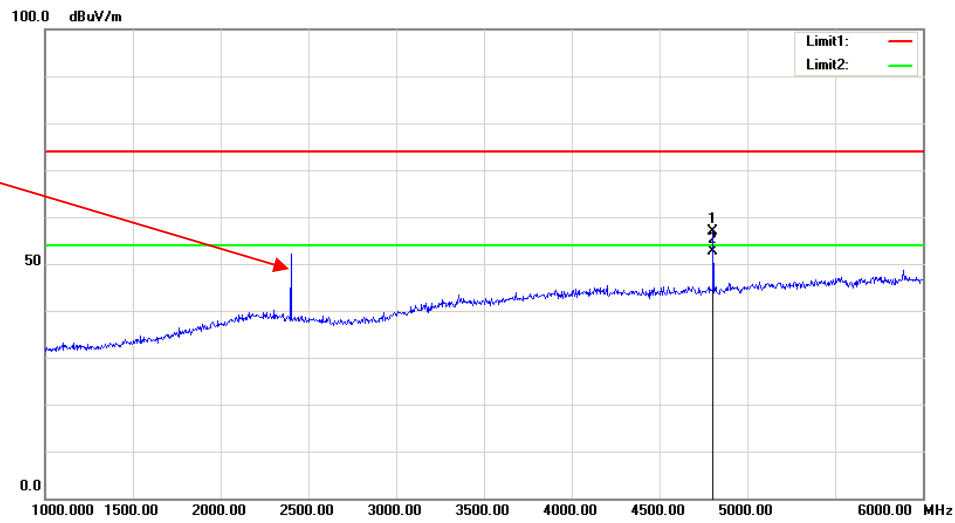
Test plots (Low channel was the worst case)
Horizontal

Fundamental
Test with Band
Rejection Filter



Vertical

Fundamental
Test with Band
Rejection Filter



FCC §15.215(c) & RSS-GEN §6.7– 20 dB BANDWIDTH TESTING AND 99% OCCUPIED BANDWIDTH

Applicable Standard

As per FCC§15.215 (c)

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

As per RSS-Gen§6.6

The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth.

When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

Note: Video averaging is not permitted.

A peak, or peak hold, may be used in place of the sampling detector as this may produce a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold may be necessary to determine the occupied bandwidth if the device is not transmitting continuously.

The trace data points are recovered and are directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.

The difference between the two recorded frequencies is the 99% occupied bandwidth.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
3. Repeat above procedures until all frequencies measured were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2017-12-08	2018-12-08
ETS-Lindgren	Horn Antenna	3115	000 527 35	2016-01-05	2019-01-04
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2018-09-05	2019-09-05
MITEQ	Amplifier	AFS42-00101800-25-S-42	2001271	2018-09-05	2019-09-05

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data**Environmental Conditions**

Temperature:	25.3 °C
Relative Humidity:	36 %
ATM Pressure:	99.7 kPa

The testing was performed by Tyler Pan on 2018-11-14 and 2018-11-15.

Test Result: Compliant.

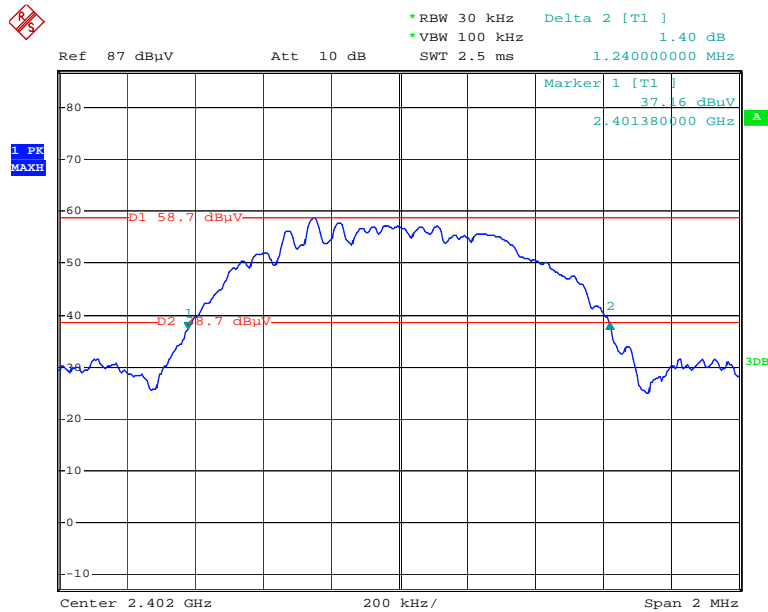
Please refer to following tables and plots

Test Mode: Transmitting

Frequency (MHz)	20 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
2402	1.240	1.084
2440	1.244	1.076
2480	1.240	1.076

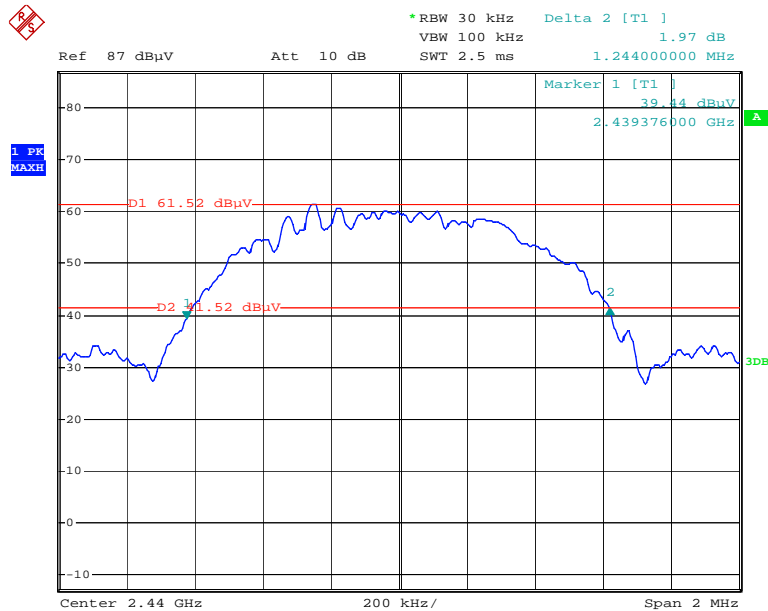
20 dB Bandwidth:

Low Channel



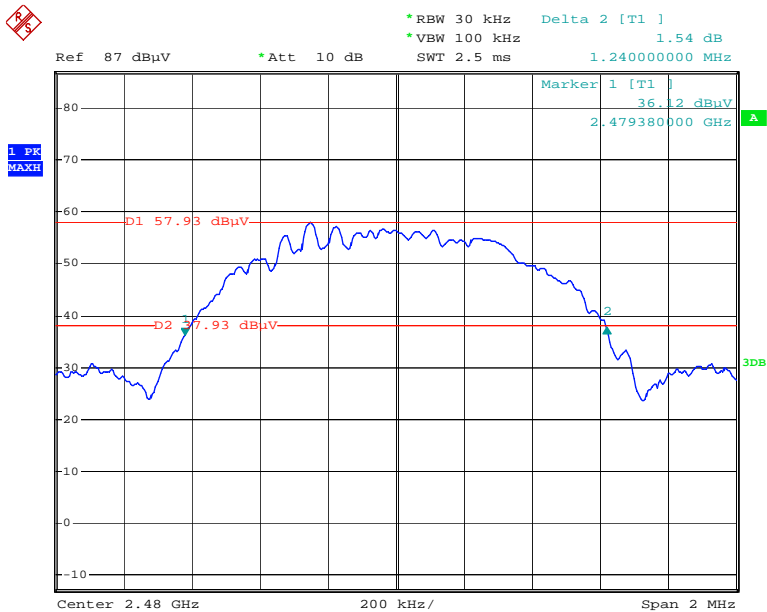
Date: 14.NOV.2018 23:38:22

Middle Channel



Date: 14.NOV.2018 22:42:09

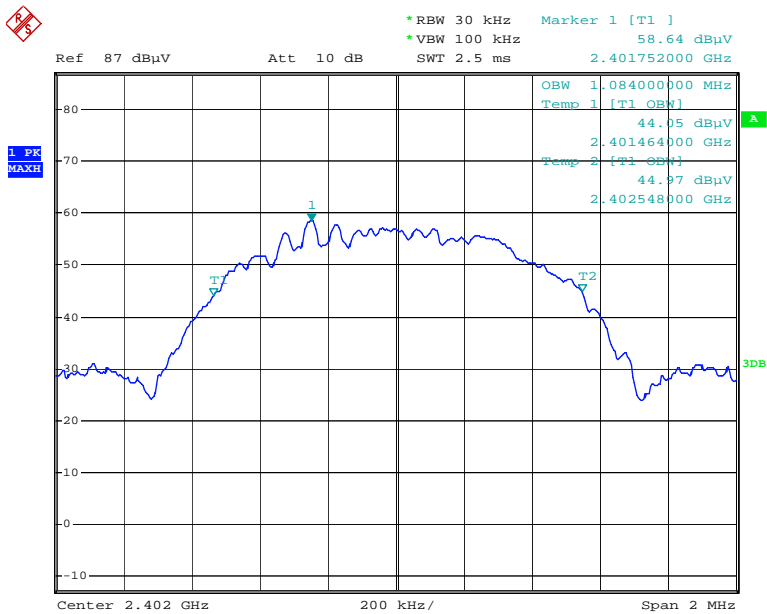
High Channel



Date: 14.NOV.2018 23:12:45

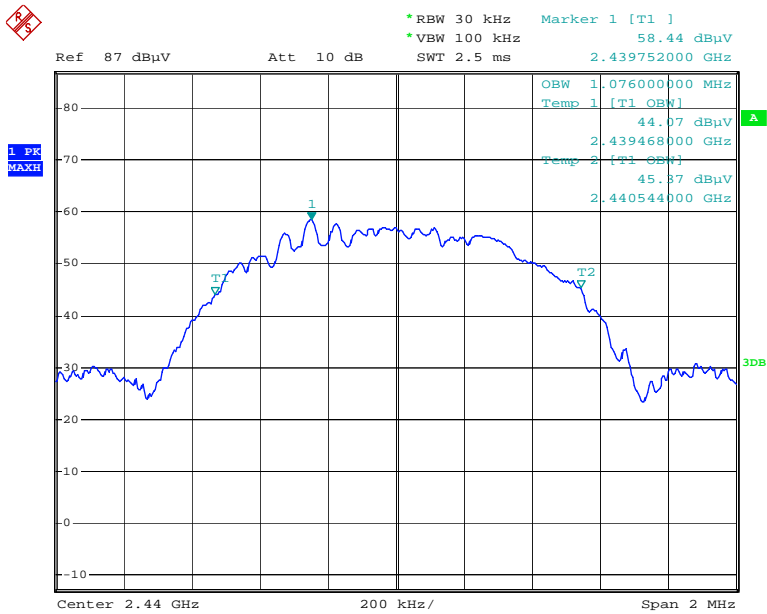
Occupied Bandwidth:

Low Channel



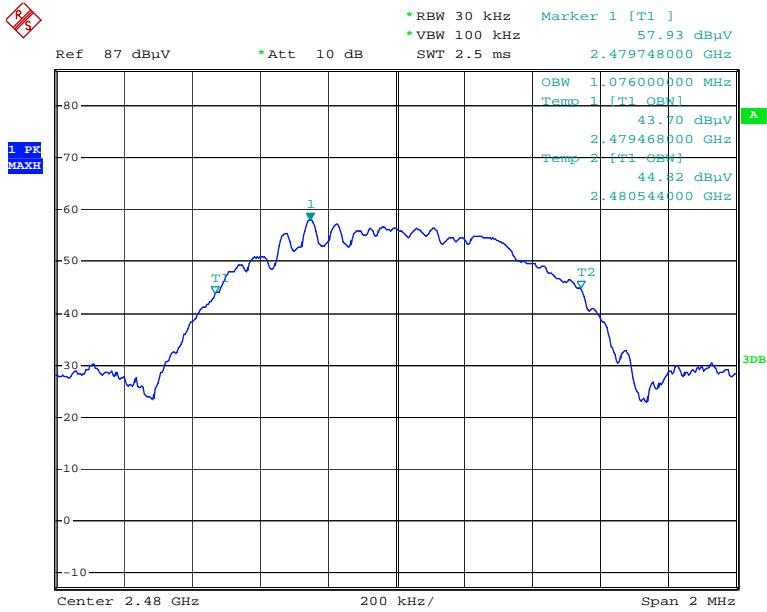
Date: 14.NOV.2018 23:36:16

Middle Channel



Date: 15.NOV.2018 00:09:39

High Channel



Date: 14.NOV.2018 23:09:56

***** END OF REPORT *****