FCC Part 15.247

TEST REPORT

For

Topeak, Inc

8F-4, No.20, Dalong Road, Taichung, Taiwan.

FCC ID: RS3-C02

Report Type:	**Product Type:**
Original Report	PANOCOMP X

Report Producer:	Kaylee Chiang
Report Number:	RTWA160921001-00A
Report Date:	2016-12-07
Reviewed By:	Jerry Chang

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REVISION HISTORY

Revision	Issue Date	Description
1.0	2016.12.07	Original

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1 General Information

1.1 Product Description for Equipment Under Test (EUT)

Applicant:	Topeak, Inc 8F-4, No.20, Dalong Road, Taichung, Taiwan.
Manufacturer:	Alatech Technology Limited 39F,No.758, JungMing S. Rd., South Dist., Taichung City 40255, Taiwan
Product:	PANOCOMP X
Model:	TPB-C02
Trade Name:	TOPEAK
Frequency Range:	2402-2480 MHz
Transmit Power:	BT BLE Mode: -0.11 dBm
Modulation Technique:	BT BLE Mode: GFSK
Transmit Data Rate:	BT BLE Mode: 1 Mbps
Number of Channels:	BT BLE Mode: 40 Channels
Antenna Specification:	Monopole Antenna/Gain: -1.96 dBi
Voltage Range:	3.7Vdc from Battery
Date of Test:	Oct 30, 2016~Dec 07, 2016

**All measurement and test data in this report was gathered from production sample serial number: 160921001 (Assigned by BACL, Taiwan) The EUT supplied by the applicant was received on 2016-09-21.*

Designation Number: TW1101

1.2 Objective

This report is prepared on behalf of *Topeak, Inc* in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communication Commission's rules.

The objective is to determine compliance with FCC Part 15.247 rules for Output Power, Antenna Requirements, 6 dB Bandwidth, and power spectral density, 100 kHz Bandwidth of Band Edges Measurement, Conducted and Radiated Spurious Emissions.

1.3 Related Submittal(s)/Grant(s)

N/A

1.4 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

1.5 Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Taiwan) to collect test data is located on the 70, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

Test site at Bay Area Compliance Laboratories Corp. (Taiwan) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on December 06, 2014. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.10.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 431084. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

2 System Test Configuration

2.1 Description of Test Configuration

For BT BLE mode, 40 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2402	21	2442
2	2404	--	--
3	2406	--	--
4	2408	38	2476
--	--	39	2478
20	2440	40	2480

2.2 Equipment Modifications

No modification was made to the EUT

2.3 EUT Exercise Software

N/A

2.4 Support Equipment List and Details

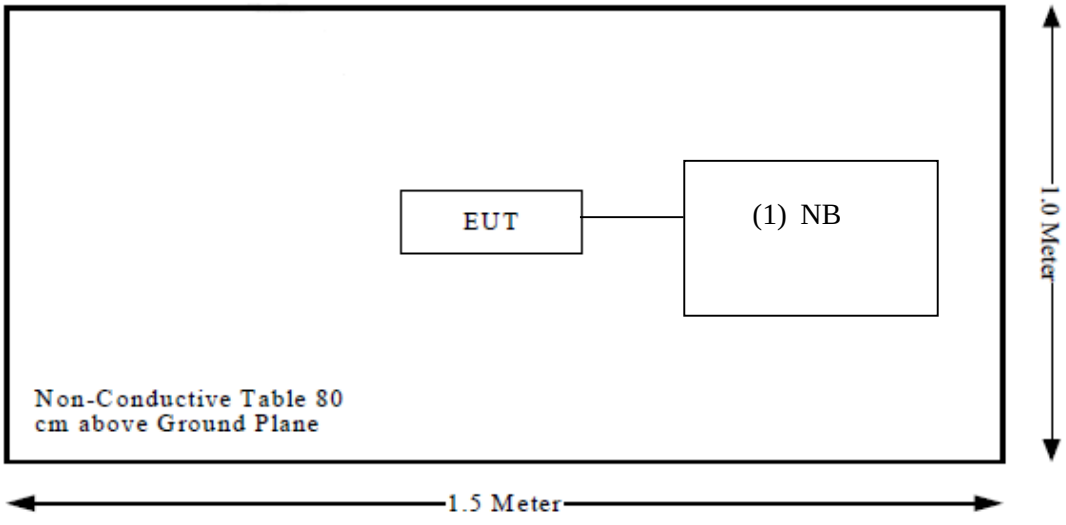
Description	Manufacturer	Model Number	BSMI	FCC ID	S/N
NB	DELL	E6410	N/A	N/A	10912240367

2.5 External Cable List and Details

Cable Description	Length (m)	From	To
N/A	N/A	N/A	N/A

2.6 Block Diagram of Test Setup

See test photographs attached in Exhibit A for the actual connections between EUT and support equipment.



3 Summary of Test Results

FCC Rules	Description of Test	Result
§15.247(i), §2.1091, §1.1310	Maximum Permissible Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.207(a)	AC Line Conducted Emissions	Not Applicable
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247(a)(2)	6 dB Emission Bandwidth	Compliance
§15.247(b)(3)	Maximum Peak Output Power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance
§15.247(e)	Power Spectral Density	Compliance

Note: It is battery operated equipment.

4 FCC §15.247(i) & 1.1310 &2.1091 - MAXIMUM PERMISSIBLE EXPOSURE (MPE)

4.1 Applicable Standard

According to subpart 15.247(i)and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:

Predication of MPE limit at a given distance
$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

4.2 Calculated Data:

FCC
Worse case:
MPE evaluation:

Frequency (MHz)	Tunp-up Power		Antenna Gain		Evaluation Distrance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
	(dBm)	(mW)	(dBi)	(numeric.)			
2402	-0.11	0.975	-1.96	0.637	20	0.0001	1

Result: MPE evaluation meet the requirement of standard.

5 FCC §15.203 – Antenna Requirements

5.1 Applicable Standard

According to § 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 user of a standard antenna jack or electrical connector is prohibited.

And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna does not exceed 6 dBi.

5.2 Antenna List and Details

Manufacturer	Type	Antenna Gain	Result
Alatech Technology Limited	Monopole Antenna	-1.96 dBi	Compliance

The EUT has one integral antenna arrangement, which was permanently attached; fulfill the requirement of this section. Please refer to the internal photos.

6 FCC §15.209, §15.205 , §15.247(d) – Spurious Emissions

6.1 Applicable Standard

FCC§15.247 (d); §15.209; §15.205

6.2 Measurement Uncertainty

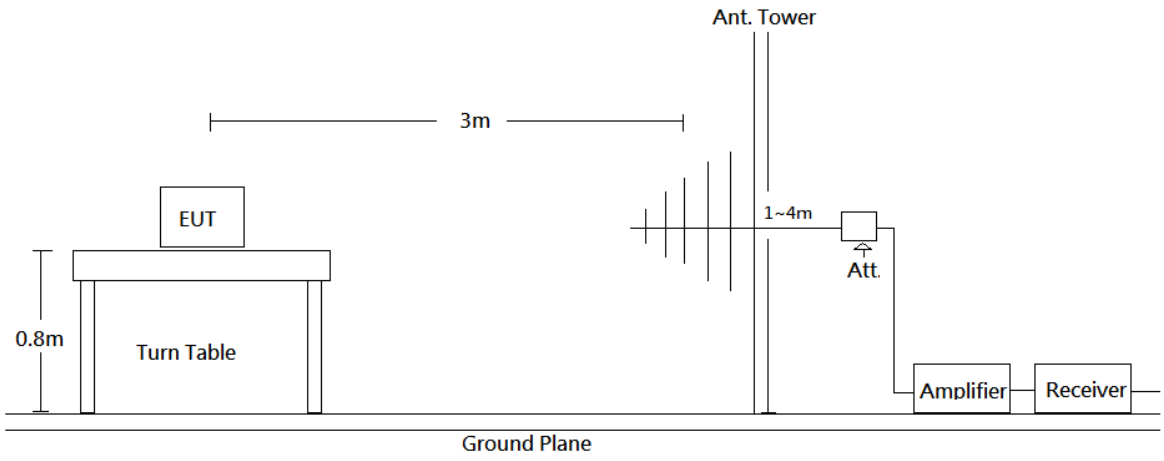
All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of radiation emissions at Bay Area Compliance Laboratories Corp. (Taiwan) is shown in below table. And the uncertainty will not be taken into consideration for the test data recorded in the report.

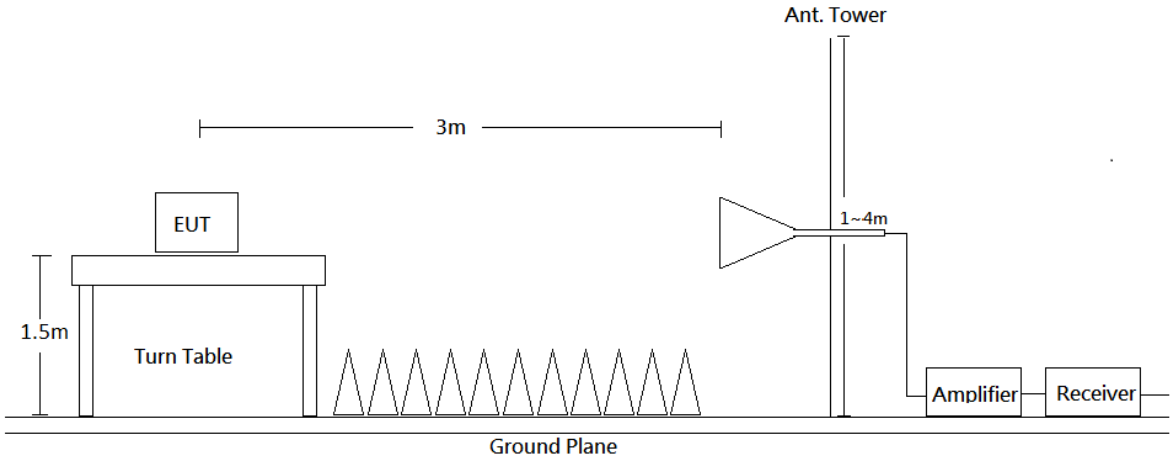
Frequency	Measurement uncertainty
30 MHz~200 MHz	4.21 dB (k=2, 95% level of confidence)
200 MHz~1 GHz	4.41 dB (k=2, 95% level of confidence)
1 GHz~6 GHz	4.51 dB (k=2, 95% level of confidence)
6 GHz~18 GHz	4.88 dB (k=2, 95% level of confidence)
18 GHz~26 GHz	4.30 dB (k=2, 95% level of confidence)
26 GHz~40 GHz	4.30 dB (k=2, 95% level of confidence)

6.3 EUT Setup

Blow 1 GHz:



Above 1 GHz:



Radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC Part 15.209 and FCC 15.247 Limits.

6.4 EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 26.5 GHz. During the radiated emission test, the EMI test receiver was set with the following configurations measurement method 6.3 in ANSI C63.10.

Set RBW = 1 MHz, VBW= 3MHz for f > 1 GHz for peak measurement. For average measurement: VBW = 10 Hz, when duty cycle is no less than 98 percent. VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

Frequency Range	RBW	VBW	IF BW	Detector
30-1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1 MHz	3 MHz	/	PK
	1 MHz	10 Hz	/	Ave

6.5 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 detector mode from 30 MHz to 1 GHz and PK and average detector modes for frequencies above 1 GHz.

6.6 Corrected Factor & Margin Calculation

The Correct Factor 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:

Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain

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

Margin = Result –Limit

6.7 Test Results Summary

According to the data in the following table, the EUT complied with the FCC §15.209 Limit. Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$Lm + U(Lm) \leq Llim + Ucispr$

In BACL, U(Lm) is less than Ucispr, if Lm is less than Llim, it implies that the EUT complies with the limit.

6.8 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Spurious emission test					
Broadband Antenna	Sunol Sciences	JB6	A050115	2016/11/16	2017/11/15
Attenuator	Mini-Circuits	UNAT-6+	15542_01	2016/11/16	2017/11/15
Amplifier	Sonoma	310N	130602	2016/7/15	2017/7/14
Horn Antenna	EMCO	3115	9311-4158	2016/5/10	2017/5/9
Horn Antenna	ETS-Lindgren	3116	00062638	2016/9/5	2017/9/4
Preamplifier	EMEC	EM01G18G	060657	2015/12/21	2016/12/20
Preamplifier	EMEC	EM18G40G	060656	2015/12/21	2016/12/20
Active Loop Antenna	ETS-Lindgren	6502	00035796	2015/7/23	2018/7/22
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2016/11/3	2017/11/2
Mircoflex Cable	UTIFLEX	UFB311A-Q-1440-300300	220490-006	2016/11/2	2017/11/1
Mircoflex Cable	UTIFLEX	UFB197C-1-2362-70U-70U	225757-001	2016/7/15	2017/7/14
Mircoflex Cable	UTIFLEX	UFA210A-1-3149-300300	MFR64639 226389-001	2016/12/1	2017/11/30
Spectrum Analyzer	Rohde & Schwarz	FSEK30	825084/006	2015/12/24	2016/12/23
Mircoflex Cable	ROSNAL	K1K50-UP0264-K1K50-80CM	160309-2	2016/3/24	2017/3/23
Mircoflex Cable	ROSNAL	K1K50-UP0264-K1K50-450CM	160309-1	2016/3/24	2017/3/23
Turn Table	Champro	TT-2000	060772-T	N.C.R	N.C.R
Antenna Tower	Champro	AM-BS-4500-B	060772-A	N.C.R	N.C.R
Controller	Champro	EM1000	060772	N.C.R	N.C.R
software	Rohde & Schwarz	EMC32	BACL-03A1	N.C.R	N.C.R
Conducted Spurious Emissions test					
Spectrum Analyzer	Rohde & Schwarz	FSU26	200268	2016/5/7	2017/5/6
Cable	WOKEN	SFL402	00100A1F6A192S	2015/12/18	2016/12/17

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

6.9 Test Environmental Conditions

Temperature:	26° C
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

The Conducted Spurious Emissions testing was performed by David Hsu on 2016-10-30.
The Radiated Spurious emission testing was performed by David Hsu on 2016-12-05.

6.10 Test Results

Mode: Test Mode

2402 MHz

Horizontal

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (˚)	Remark
107.6000	32.76	-12.84	19.92	43.50	-23.58	150	305	QP
231.7600	35.04	-12.61	22.43	46.00	-23.57	150	109	QP
310.3300	30.05	-9.80	20.25	46.00	-25.75	150	163	QP
558.6500	28.70	-5.16	23.54	46.00	-22.46	150	84	QP
745.8600	29.34	-2.26	27.08	46.00	-18.92	150	288	QP
935.0100	28.12	2.05	30.17	46.00	-15.83	150	150	QP
2366.905	58.78	-5.34	53.44	74.00	-20.56	100	34	peak
2366.905	45.88	-5.34	40.54	54.00	-13.46	100	34	AVG
2401.770	97.20	-5.25	91.95	NA	NA	100	185	peak
2401.770	94.08	-5.25	88.83	NA	NA	100	185	AVG
4804.000	56.73	0.63	57.36	74.00	-16.64	100	150	peak
4804.000	48.60	0.63	49.23	54.00	-4.77	100	150	AVG
7206.000	49.16	6.41	55.57	74.00	-18.43	100	128	peak
7206.000	41.56	6.41	47.97	54.00	-6.03	100	128	AVG

Note: Result = Reading + Factor
Margin = Result – Limit
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain
The other emission levels were very low against the limit.

Vertical

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (˚)	Remark
65.8900	42.00	-17.23	24.77	40.00	-15.23	150	9	QP
99.8400	39.99	-14.72	25.27	43.50	-18.23	150	95	QP
165.8000	33.89	-12.04	21.85	43.50	-21.65	150	30	QP
224.0000	34.29	-12.86	21.43	46.00	-24.57	150	283	QP
299.6600	31.26	-10.02	21.24	46.00	-24.76	150	132	QP
455.8300	29.96	-6.65	23.31	46.00	-22.69	150	49	QP
2349.045	58.81	-5.37	53.44	74.00	-20.56	100	66	peak
2349.045	45.83	-5.37	40.46	54.00	-13.54	100	66	AVG
2402.055	92.93	-5.25	87.68	NA	NA	100	205	peak
2402.055	90.14	-5.25	84.89	NA	NA	100	205	AVG
4808.000	45.71	0.63	46.38	74.00	-27.62	100	108	peak
4808.000	37.36	0.63	38.03	54.00	-15.97	100	108	AVG

Note: Result = Reading + Factor
Margin = Result – Limit
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain
The other emission levels were very low against the limit.

2442MHz

Horizontal

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (˚)	Remark
224.9700	32.33	-12.83	19.50	46.00	-26.50	150	179	QP
355.9200	29.41	-8.86	20.55	46.00	-25.45	150	56	QP
441.2800	27.70	-6.96	20.74	46.00	-25.26	150	5	QP
651.7700	29.23	-3.70	25.53	46.00	-20.47	150	263	QP
735.1900	28.29	-2.46	25.83	46.00	-20.17	150	82	QP
906.8800	27.28	1.29	28.57	46.00	-17.43	150	84	QP
2442.000	96.57	-5.14	91.43	NA	NA	100	183	peak
2442.000	93.82	-5.14	88.68	NA	NA	100	183	AVG
4884.000	52.51	0.94	53.45	74.00	-20.55	100	165	peak
4884.000	44.70	0.94	45.64	54.00	-8.36	100	165	AVG
7326.000	46.73	6.86	53.59	74.00	-20.41	100	155	peak
7326.000	38.26	6.86	45.12	54.00	-8.88	100	155	AVG

Note: Result = Reading + Factor
Margin = Result – Limit
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain
The other emission levels were very low against the limit.

Vertical

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (˚)	Remark
65.8900	41.66	-17.23	24.43	40.00	-15.57	150	9	QP
108.5700	40.05	-12.60	27.45	43.50	-16.05	150	91	QP
119.2400	34.25	-11.10	23.15	43.50	-20.35	150	267	QP
166.7700	33.65	-12.13	21.52	43.50	-21.98	150	59	QP
217.2100	33.38	-13.06	20.32	46.00	-25.68	150	355	QP
486.8700	30.73	-6.15	24.58	46.00	-21.42	150	63	QP
2441.800	91.75	-5.14	86.61	NA	NA	100	327	peak
2441.800	89.05	-5.14	83.91	NA	NA	100	327	AVG
4884.000	46.96	0.94	47.90	74.00	-26.10	100	255	peak
4884.000	39.40	0.94	40.34	54.00	-13.66	100	255	AVG

Note: Result = Reading + Factor
Margin = Result – Limit
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain
The other emission levels were very low against the limit.

2480 MHz

Horizontal

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (˚)	Remark
128.9400	27.94	-10.72	17.22	43.50	-26.28	150	60	QP
310.3300	30.61	-9.80	20.81	46.00	-25.19	150	163	QP
471.3500	28.45	-6.40	22.05	46.00	-23.95	150	269	QP
652.7400	28.14	-3.68	24.46	46.00	-21.54	150	68	QP
790.4800	27.68	-1.26	26.42	46.00	-19.58	150	139	QP
951.5000	27.21	2.49	29.70	46.00	-16.30	150	263	QP
2479.750	96.89	-5.06	91.83	NA	NA	100	164	peak
2479.750	93.98	-5.06	88.92	NA	NA	100	164	AVG
2493.040	59.30	-5.02	54.28	74.00	-19.72	100	301	peak
2493.040	46.58	-5.02	41.56	54.00	-12.44	100	301	AVG
4960.000	46.67	1.23	47.90	74.00	-26.10	100	181	peak
4960.000	39.63	1.23	40.86	54.00	-13.14	100	181	AVG
7440.000	43.58	7.28	50.86	74.00	-23.14	100	165	peak
7440.000	35.37	7.28	42.65	54.00	-11.35	100	165	AVG

Note: Result = Reading + Factor
Margin = Result – Limit
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain
The other emission levels were very low against the limit.

Vertical

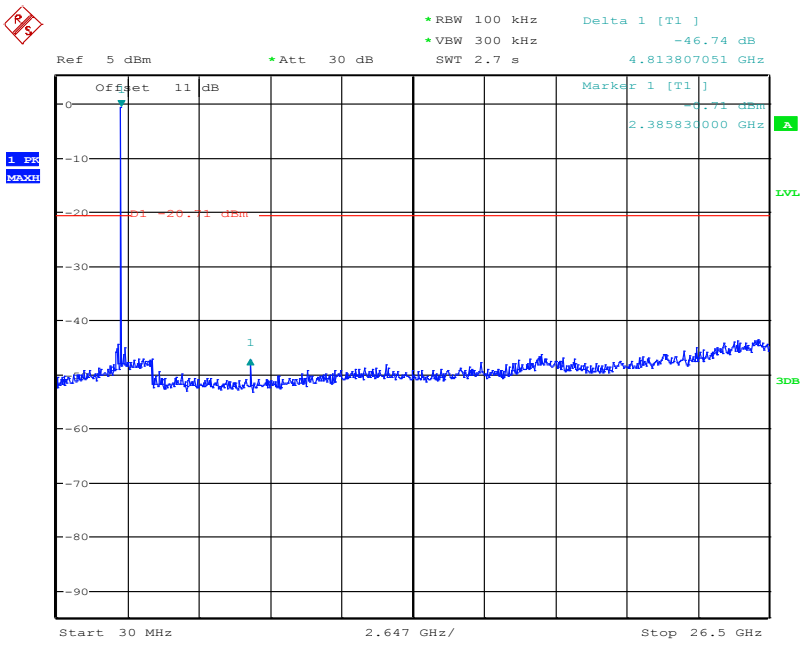
Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (˚)	Remark
65.8900	41.48	-17.23	24.25	40.00	-15.75	150	9	QP
119.2400	34.22	-11.10	23.12	43.50	-20.38	150	267	QP
167.7400	35.90	-12.22	23.68	43.50	-19.82	150	75	QP
219.1500	32.78	-13.02	19.76	46.00	-26.24	150	22	QP
497.5400	29.52	-5.98	23.54	46.00	-22.46	150	128	QP
682.8100	30.86	-3.31	27.55	46.00	-18.45	150	349	QP
2480.050	91.89	-5.06	86.83	NA	NA	100	247	peak
2480.050	89.19	-5.06	84.13	NA	NA	100	247	AVG
2486.710	58.96	-5.03	53.93	74.00	-20.07	100	92	peak
2486.710	46.25	-5.03	41.22	54.00	-12.78	100	92	AVG
4960.000	47.10	1.23	48.33	74.00	-25.67	100	252	peak
4960.000	41.38	1.23	42.61	54.00	-11.39	100	252	AVG
7440.000	44.08	7.28	51.36	74.00	-22.64	100	188	peak
7440.000	37.51	7.28	44.79	54.00	-9.21	100	188	AVG

Note: Result = Reading + Factor
Margin = Result – Limit
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain
The other emission levels were very low against the limit.

Conducted Spurious Emissions:

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	RESULT
Low	2402	46.74	≥ 20	PASS
Mid	2442	44.41	≥ 20	PASS
High	2480	47.57	≥ 20	PASS

Low Channel



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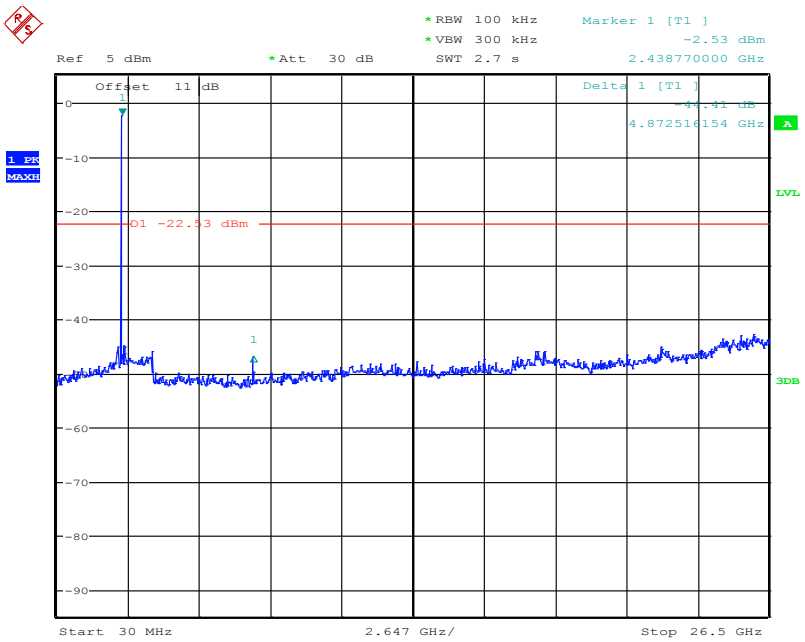
Middle Channel



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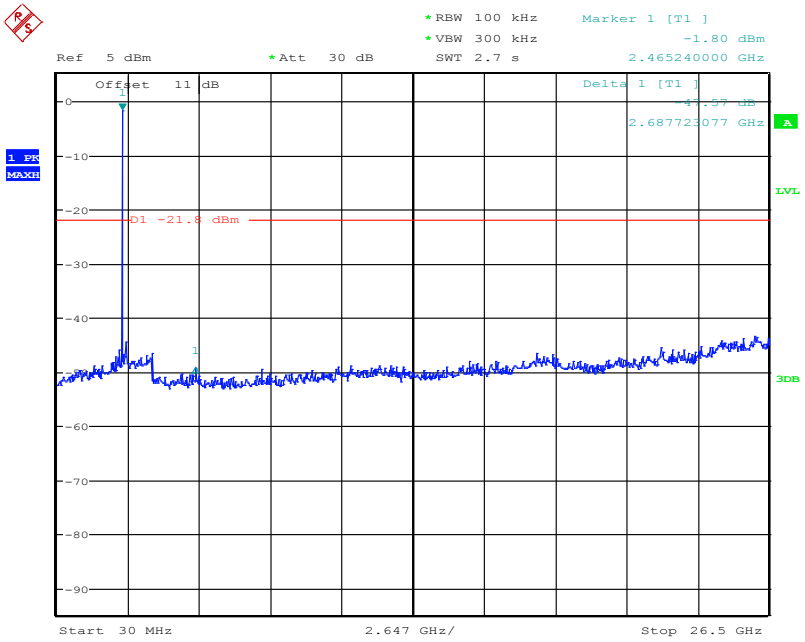
High Channel



Date: 30.OCT.2016 11:21:44

7 FCC §15.247(a)(2) – 6 dB Emission Bandwidth

7.1 Applicable Standard

According to FCC §15.247(a) (2).

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

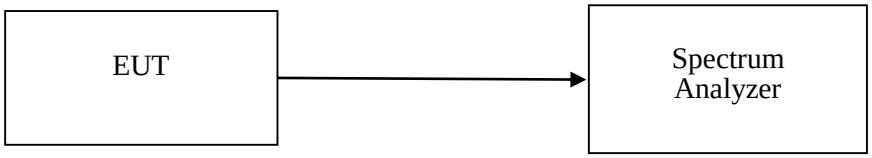
7.2 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.

4. Repeat above procedures until all frequencies measured were complete.



7.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSU26	200268	2016/5/7	2017/5/6
Cable	WOKEN	SFL402	00100A1F6A192S	2015/12/18	2016/12/17

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

7.4 Test Environmental Conditions

Temperature:	26° C
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

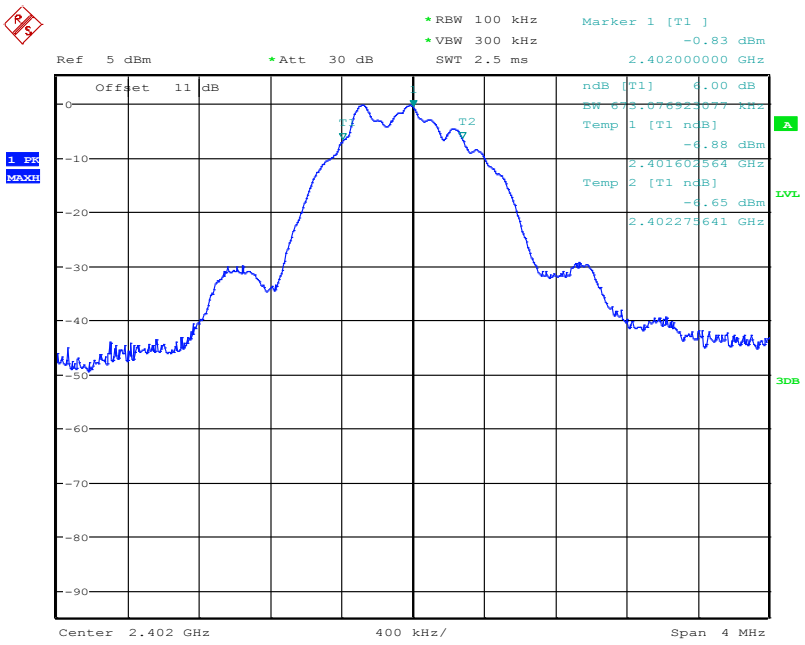
The testing was performed by David Hsu on 2016-10-30 to 2016-12-07

7.5 Test Results

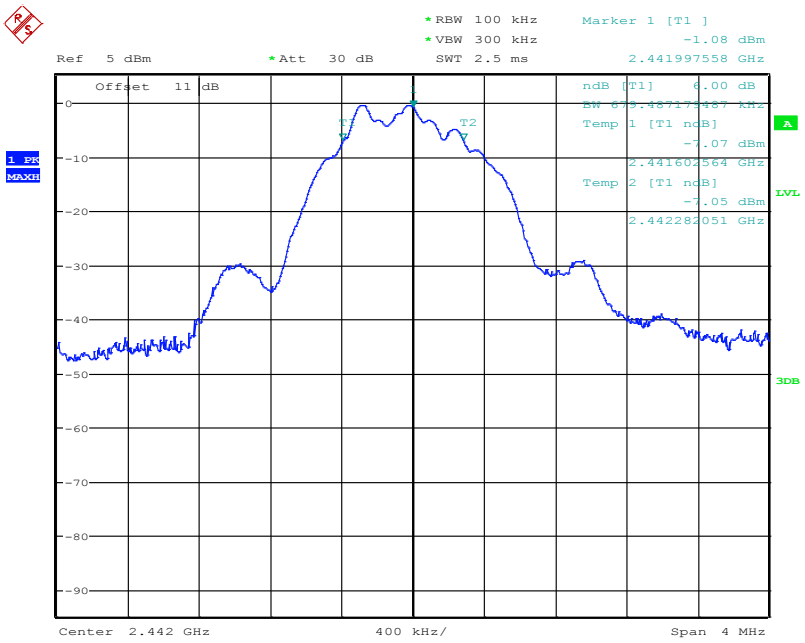
Channel	Frequency (MHz)	6 dB OBW (MHz)	Limit (MHz)	Result
Low	2402	0.67	> 0.5	Compliance
Middle	2442	0.67	> 0.5	Compliance
High	2480	0.67	> 0.5	Compliance

Please refer to the following plots

Low Channel

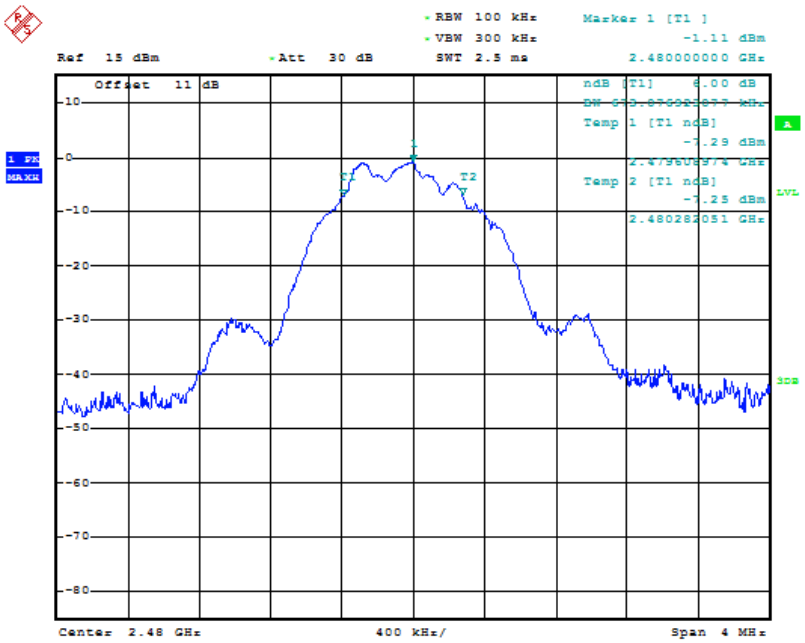


Middle Channel



Date: 30.OCT.2016 09:31:15

High Channel



Date: 7.DEC.2016 10:48:26

8 FCC §15.247(b)(3) – Maximum Output Power

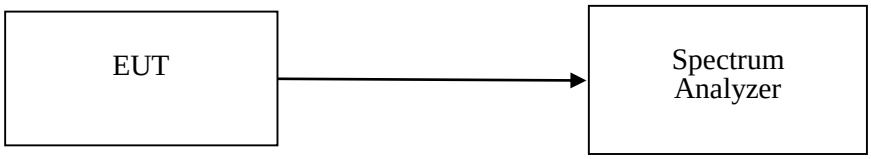
8.1 Applicable Standard

According to FCC §15.247(b) (3).

Systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

8.2 Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to an EMI Test Receiver.
3. Add a correction factor to the display.



8.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSU26	200268	2016/5/7	2017/5/6
Cable	WOKEN	SFL402	00100A1F6A192S	2015/12/18	2016/12/17

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

8.4 Test Environmental Conditions

Temperature:	26° C
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

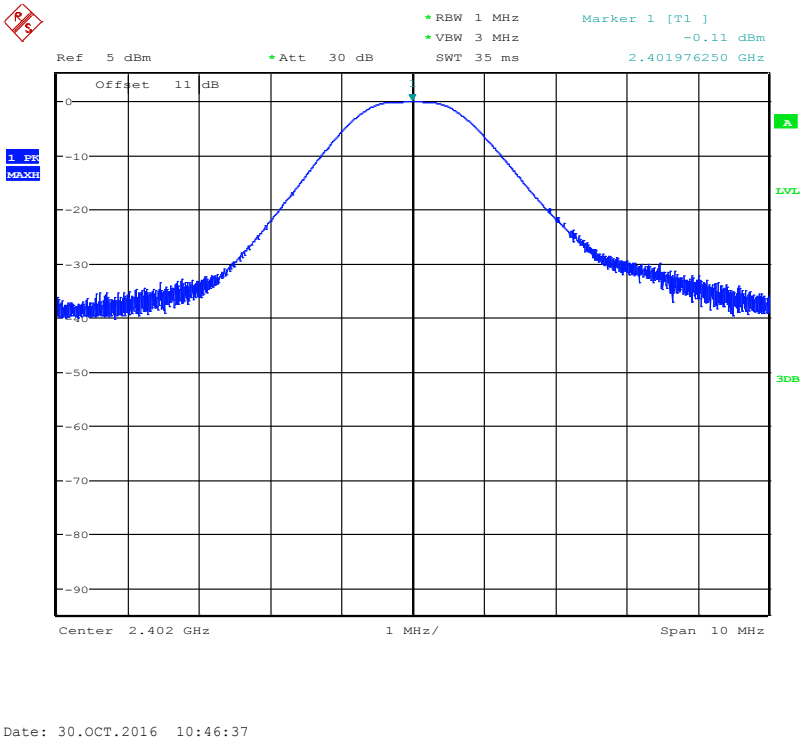
The testing was performed by David Hsu on 2016-10-30.

8.5 Test Results

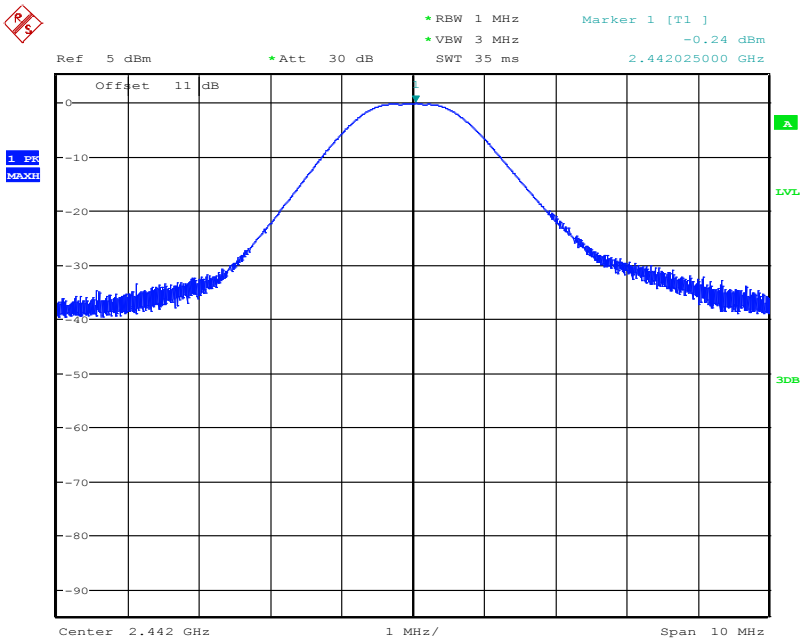
Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)	Result
Low	2402	-0.11	30	Compliance
Middle	2442	-0.24	30	Compliance
High	2480	-0.40	30	Compliance

Please refer to the following plots

Low Channel

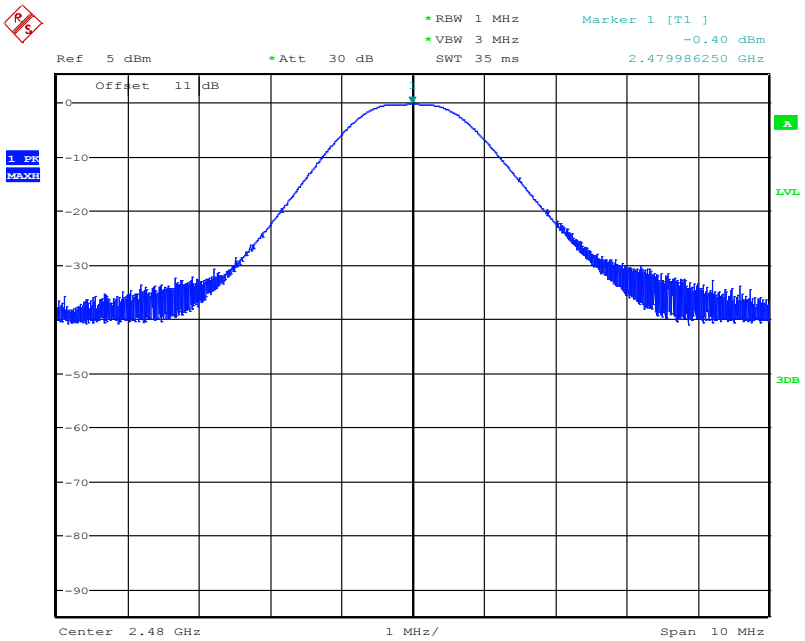


Middle Channel



Date: 30.OCT.2016 10:50:03

High Channel



Date: 30.OCT.2016 10:35:39

9 FCC §15.247(d) – 100 kHz Bandwidth of Frequency Band Edge

9.1 Applicable Standard

According to FCC §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)).

9.2 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

9.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSU26	200268	2016/5/7	2017/5/6
Cable	WOKEN	SFL402	00100A1F6A192S	2015/12/18	2016/12/17

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

9.4 Test Environmental Conditions

Temperature:	26° C
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

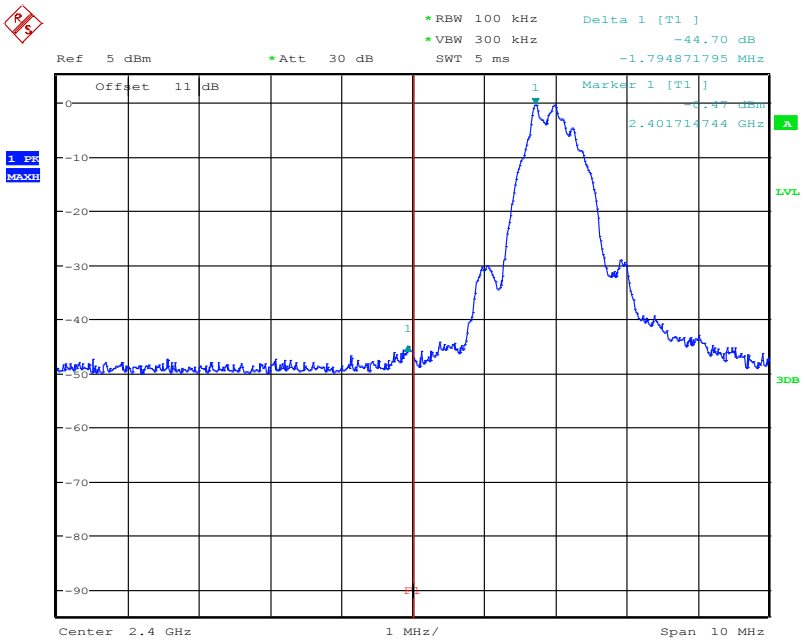
The testing was performed by David Hsu on 2016-10-30.

9.5 Test Results

Please refer to the following plots

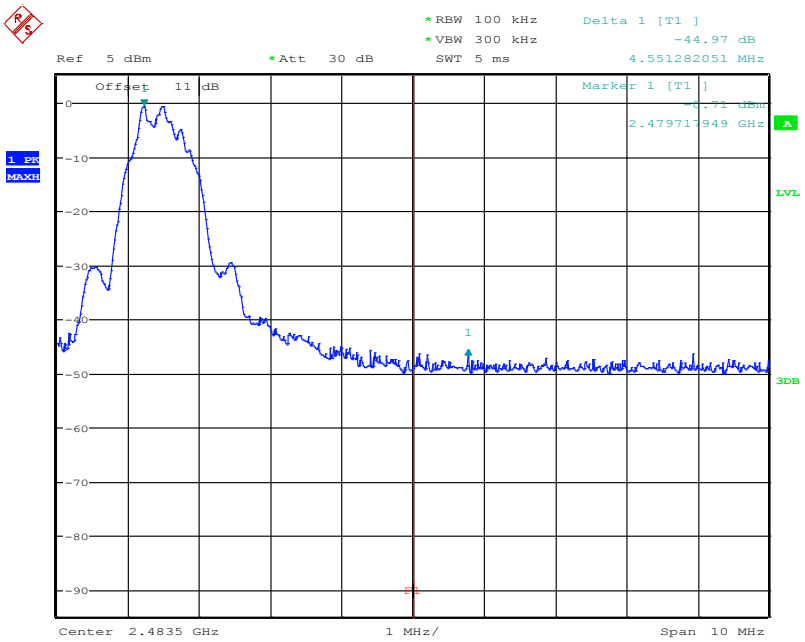
Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	RESULT
Low	2402	44.7	≥ 20	PASS
High	2480	44.9	≥ 20	PASS

Band Edge, Left Side



Date: 30.OCT.2016 09:52:06

Band Edge, Right Side



Date: 30.OCT.2016 09:58:09

10 FCC §15.247(e) – Power Spectral Density

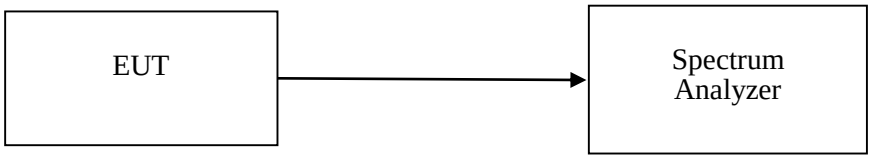
10.1 Applicable Standard

According to FCC §15.247(e).

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

10.2 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of SA on any frequency be measured and set SA to 1.5MHz span mode. And then, set RBW and VBW of spectrum analyzer to proper value. (DTS)
4. Repeat above procedures until all frequencies measured were complete.



Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSU26	200268	2016/5/7	2017/5/6
Cable	WOKEN	SFL402	00100A1F6A192S	2015/12/18	2016/12/17

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

10.3 Test Environmental Conditions

Temperature:	26° C
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

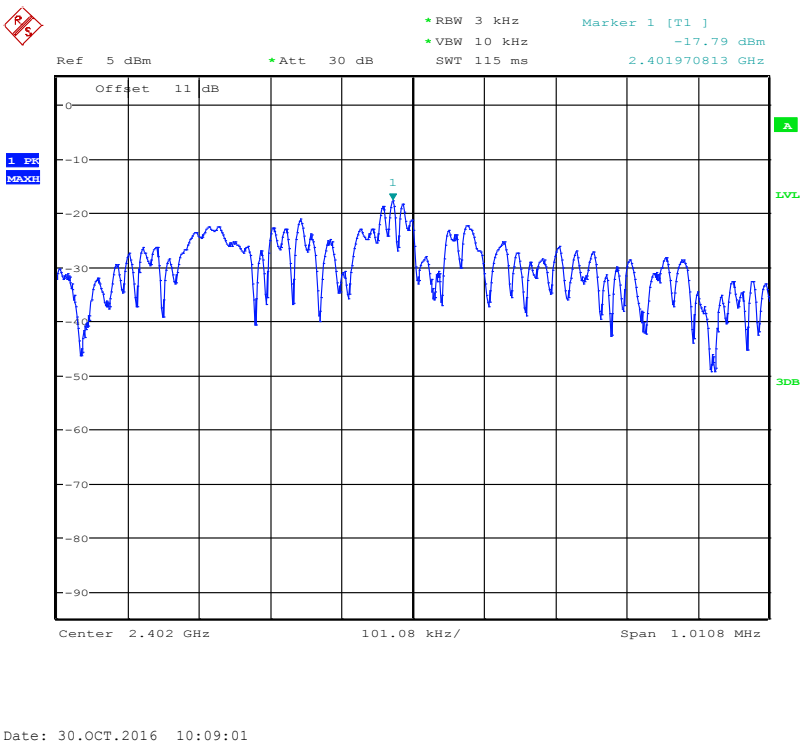
The testing was performed by David Hsu on 2016-10-30.

10.4 Test Results

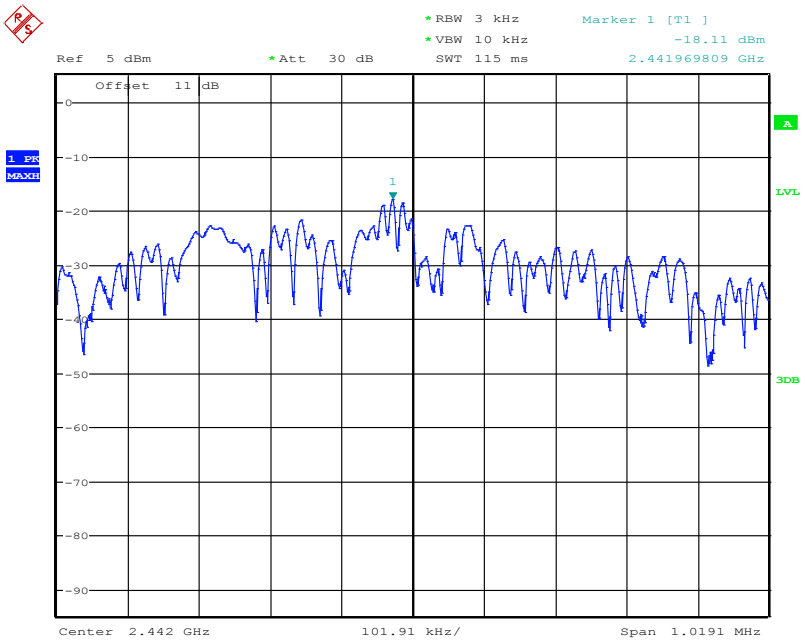
Channel	Frequency (MHz)	PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Result
Low	2402	-17.79	8	Compliance
Middle	2442	-18.11	8	Compliance
High	2480	-18.02	8	Compliance

Please refer to the following plots

Low Channel



Middle Channel



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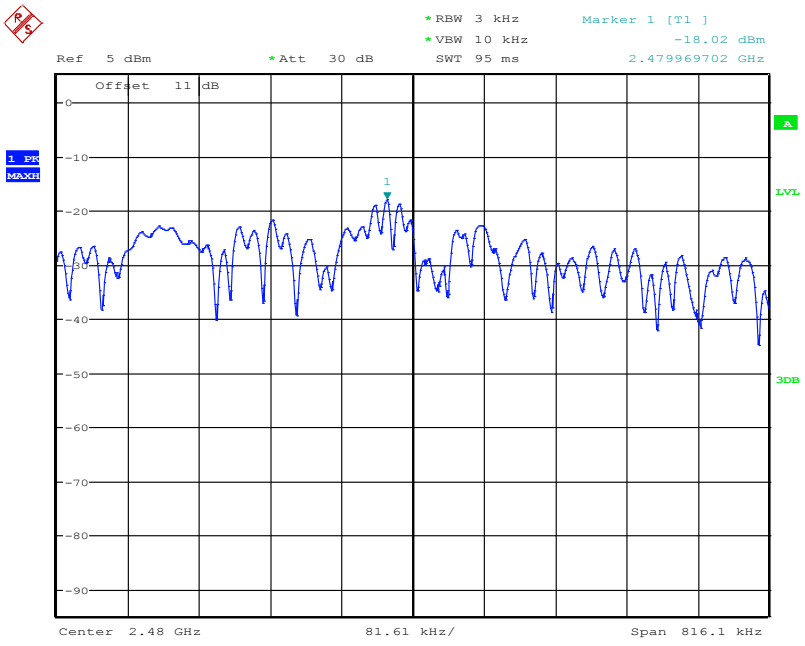
High Channel



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