



FCC Part 15.247

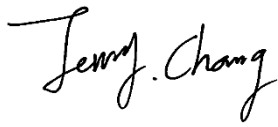
TEST REPORT

For

Topeak, Inc

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

FCC ID: R3S-HRM05

Report Type: Original Report	Product Type: Duoband Heart Rate Monitor
Report Producer: <u>Kaylee Chiang</u> 	
Report Number: <u>RTWA161118001-00A</u>	
Report Date: <u>2016-12-02</u>	
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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. (Taiwan)

REVISION HISTORY

Revision	Issue Date	Description
1.0	2016.12.02	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: Duoband Heart Rate Monitor

Model: TPB-HRM05

Trade Name: TOPEAK

Frequency Range: 2402-2480 MHz

Transmit Power: BT BLE Mode: -3.79 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: PCB Antenna/Gain: 4.21 dBi

Voltage Range: 3Vdc from Battery

Date of Test: Nov 28, 2016~Dec 02, 2016

**All measurement and test data in this report was gathered from production sample serial number: 161118001
(Assigned by BACL, Taiwan) The EUT supplied by the applicant was received on 2016-11-23.
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)

FCC Part 15.249 DXX submission with FCC ID: R3S-HRM05

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

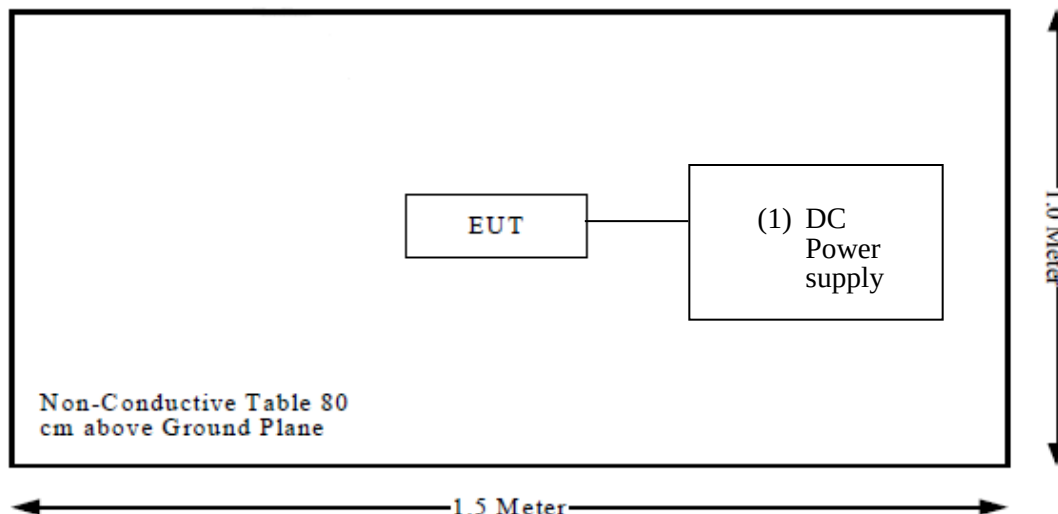
Description	Manufacturer	Model Number	BSMI	FCC ID	S/N
Power supply	Instek	GPC-3030BQ	N/A	N/A	B843809

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), §2.1093	RF 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) & 2.1093 - RF Exposure

4.1 Applicable Standard

According to FCC §15.247(i)

Systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB 447498 D01 General RF Exposure Guidance, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$$\left[\frac{(\text{max. power of channel, including tune-up tolerance, mW})}{(\text{min. test separation distance, mm})} \right] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR, where}$$

1. $f(\text{GHz})$ is the RF channel transmit frequency in GHz.
2. Power and distance are rounded to the nearest mW and mm before calculation.
3. The result is rounded to one decimal place for comparison.
4. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test Exclusion.

4.2 RF Exposure Evaluation Result

FCC

Worse case:

Frequency (MHz)	Tune-up Power		Evaluation Distance (mm)	SAR Exclusion Result	SAR Exclusion Limit (1g SAR)
	(dBm)	(mW)			
2480	-3.79	0.418	5	0.133	3

Result: SAR test is exempted.

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 exceed 6 dBi.

5.2 Antenna List and Details

Manufacturer	Type	Antenna Gain	Result
Alatech Technology Limited	PCB Antenna	4.21 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

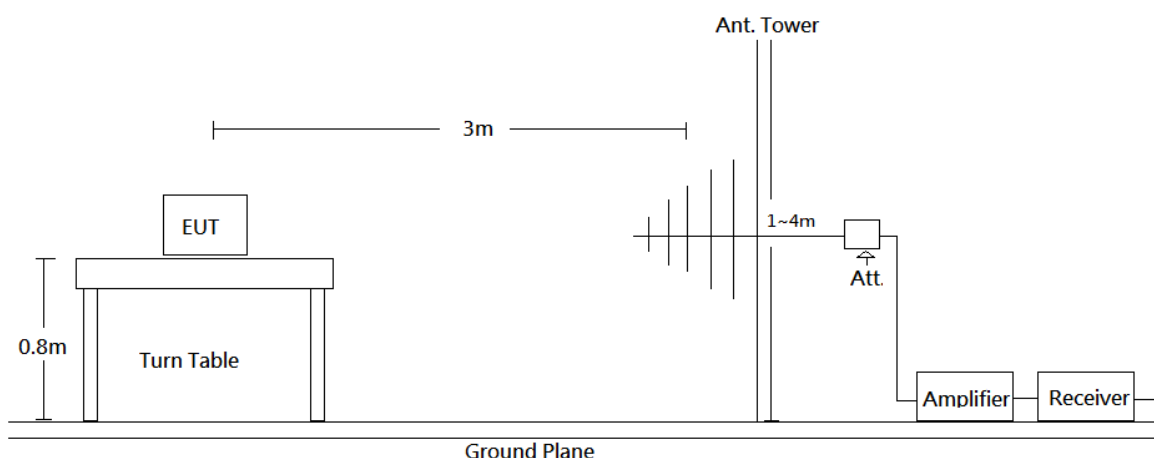
All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency 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.

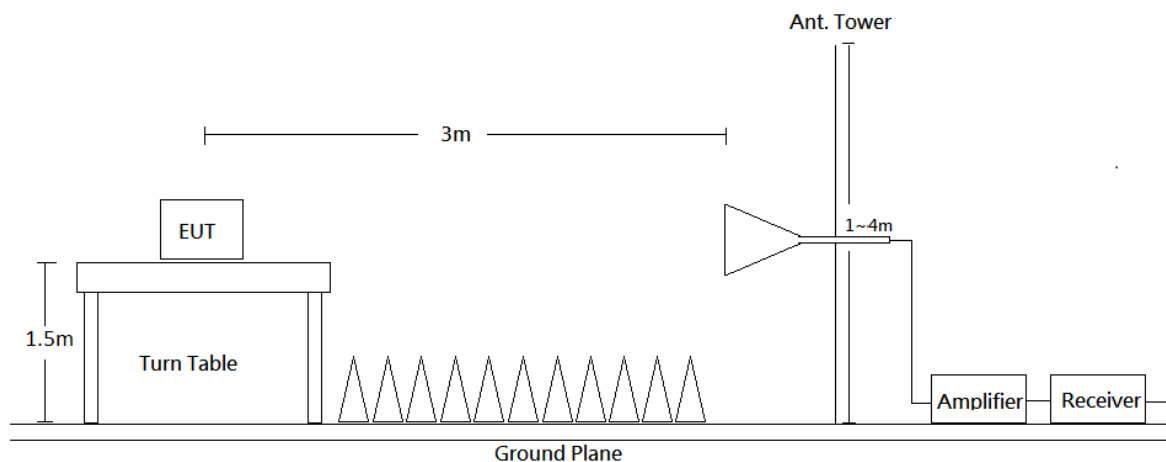
Frequency	Measurement uncertainty
30 MHz~200 MHz	4.21 dB (k=2, 95% level of confidence)
200 MHz~1 GHz	4.41 dB (k=2, 95% level of confidence)
1 GHz~6 GHz	4.51 dB (k=2, 95% level of confidence)
6 GHz~18 GHz	4.88 dB (k=2, 95% level of confidence)
18 GHz~26 GHz	4.30 dB (k=2, 95% level of confidence)
26 GHz~40 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. $\text{VBW} \geq 1/T$, 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:

$$\text{Correct Factor} = \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

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

$$\text{Margin} = \text{Result} - \text{Limit}$$

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

$$L_m + U(L_m) \leq L_{lim} + U_{cispr}$$

In BACL, $U(L_m)$ is less than U_{cispr} , if L_m is less than L_{lim} , 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
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
Preamplifier	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	2015/12/2	2016/12/1
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
Spectrum Analyzer	Rohde & Schwarz	FSU26	200268	2016/5/7	2017/5/6
Cable	WOKEN	SFL402	00100A1F6A1 92S	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:	25.2° C
Relative Humidity:	58 %
ATM Pressure:	101.0 kPa

The testing was performed by David Hsu on 2016-11-28 to 2016-11-29.

6.10 Test Results

Mode: Test Mode

Below 1 GHz, 2402 MHz

Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	30.9700	26.55	-4.33	22.22	40.00	-17.78	100	341	QP
2	137.6700	26.68	-10.96	15.72	43.50	-27.78	100	304	QP
3	372.4100	27.25	-8.52	18.73	46.00	-27.27	100	302	QP
4	599.3900	27.82	-4.32	23.50	46.00	-22.50	100	311	QP
5	839.9500	27.16	-0.26	26.90	46.00	-19.10	100	13	QP
6	956.3500	26.60	2.61	29.21	46.00	-16.79	100	237	QP

Note: Result = Reading + Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	119.2400	34.05	-11.10	22.95	43.50	-20.55	100	240	QP
2	325.8500	30.00	-9.48	20.52	46.00	-25.48	100	336	QP
3	489.7800	27.85	-6.10	21.75	46.00	-24.25	100	37	QP
4	714.8200	27.94	-2.83	25.11	46.00	-20.89	100	330	QP
5	855.4700	26.50	0.07	26.57	46.00	-19.43	100	65	QP
6	940.8300	25.95	2.21	28.16	46.00	-17.84	100	39	QP

Note: Result = Reading + Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

2442MHz**Horizontal**

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	115.3600	27.12	-11.58	15.54	43.50	-27.96	100	25	QP
2	292.8700	27.36	-10.11	17.25	46.00	-28.75	100	218	QP
3	434.4900	28.06	-7.12	20.94	46.00	-25.06	100	275	QP
4	600.3600	28.11	-4.31	23.80	46.00	-22.20	100	94	QP
5	802.1200	28.82	-1.01	27.81	46.00	-18.19	100	267	QP
6	950.5300	26.43	2.46	28.89	46.00	-17.11	100	20	QP

Note: Result = Reading + Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	30.9700	26.79	-4.33	22.46	40.00	-17.54	100	225	QP
2	119.2400	33.90	-11.10	22.80	43.50	-20.70	100	57	QP
3	166.7700	29.97	-12.13	17.84	43.50	-25.66	100	26	QP
4	388.9000	27.81	-8.18	19.63	46.00	-26.37	100	171	QP
5	686.6900	28.80	-3.27	25.53	46.00	-20.47	100	4	QP
6	981.5700	25.49	3.24	28.73	54.00	-25.27	100	23	QP

Note: Result = Reading + Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

2480 MHz**Horizontal**

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	30.0000	26.32	-3.62	22.70	40.00	-17.30	100	345	QP
2	127.0000	27.52	-10.78	16.74	43.50	-26.76	100	81	QP
3	286.0800	27.13	-10.23	16.90	46.00	-29.10	100	99	QP
4	468.4400	27.68	-6.44	21.24	46.00	-24.76	100	150	QP
5	663.4100	27.82	-3.56	24.26	46.00	-21.74	100	144	QP
6	810.8500	27.09	-0.84	26.25	46.00	-19.75	100	268	QP

Note: Result = Reading + Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	119.2400	33.24	-11.10	22.14	43.50	-21.36	100	351	QP
2	166.7700	31.41	-12.13	19.28	43.50	-24.22	100	344	QP
3	266.6800	28.05	-10.89	17.16	46.00	-28.84	100	228	QP
4	450.0100	28.11	-6.74	21.37	46.00	-24.63	100	176	QP
5	786.6000	27.90	-1.35	26.55	46.00	-19.45	100	50	QP
6	967.9900	26.44	2.89	29.33	54.00	-24.67	100	101	QP

Note: Result = Reading + Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Above 1 GHz, 2402 MHz**Horizontal**

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	2318.740	60.55	-5.46	55.09	74.00	-18.91	100	73	peak
2	2318.740	46.25	-5.46	40.79	54.00	-13.21	100	73	AVG
3	2375.455	61.34	-5.31	56.03	74.00	-17.97	100	1	peak
4	2375.455	46.18	-5.31	40.87	54.00	-13.13	100	1	AVG
5	2402.000	92.57	-5.25	87.32	N/A	N/A	100	68	peak
6	2402.000	91.89	-5.25	86.64	N/A	N/A	100	68	AVG
7	4804.000	60.58	0.63	61.21	74.00	-12.79	100	350	peak
8	4804.000	51.92	0.63	52.55	54.00	-1.45	100	350	AVG

Note: Result = Reading + Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	2318.645	64.02	-5.46	58.56	74.00	-15.44	100	136	peak
2	2318.645	47.38	-5.46	41.92	54.00	-12.08	100	136	AVG
3	2375.075	62.84	-5.31	57.53	74.00	-16.47	100	160	peak
4	2375.075	47.10	-5.31	41.79	54.00	-12.21	100	160	AVG
5	2402.000	96.64	-5.25	91.39	N/A	N/A	100	135	peak
6	2402.000	95.79	-5.25	90.54	N/A	N/A	100	135	AVG
7	4804.000	58.58	0.63	59.21	74.00	-14.79	100	145	peak
8	4804.000	49.05	0.63	49.68	54.00	-4.32	100	145	AVG

Note: Result = Reading + Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

2442 MHz**Horizontal**

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	2442.000	94.83	-5.14	89.69	N/A	N/A	100	354	peak
2	2442.000	93.87	-5.14	88.73	N/A	N/A	100	354	AVG
3	4884.000	60.13	0.94	61.07	74.00	-12.93	100	167	peak
4	4884.000	51.24	0.94	52.18	54.00	-1.82	100	167	AVG

Note: Result = Reading + Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	2442.000	94.73	-5.14	89.59	N/A	N/A	100	352	peak
2	2442.000	94.10	-5.14	88.96	N/A	N/A	100	352	AVG
3	4884.000	59.56	0.94	60.50	74.00	-13.50	100	153	peak
4	4884.000	50.93	0.94	51.87	54.00	-2.13	100	153	AVG

Note: Result = Reading + Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

2480 MHz**Horizontal**

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	2480.000	92.75	-5.06	87.69	N/A	N/A	100	123	peak
2	2480.000	91.57	-5.06	86.51	N/A	N/A	100	123	AVG
3	2497.960	63.50	-5.00	58.50	74.00	-15.50	100	169	peak
4	2497.960	45.95	-5.00	40.95	54.00	-13.05	100	169	AVG
5	4960.000	58.40	1.23	59.63	74.00	-14.37	100	196	peak
6	4960.000	49.51	1.23	50.74	54.00	-3.26	100	196	AVG

Note: Result = Reading + Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	2480.000	96.58	-5.06	91.52	N/A	N/A	100	346	peak
2	2480.000	95.48	-5.06	90.42	N/A	N/A	100	346	AVG
3	2498.080	66.15	-5.00	61.15	74.00	-12.85	100	96	peak
4	2498.080	49.36	-5.00	44.36	54.00	-9.64	100	96	AVG
5	4960.000	60.21	1.23	61.44	74.00	-12.56	100	100	peak
6	4960.000	51.16	1.23	52.39	54.00	-1.61	100	100	AVG

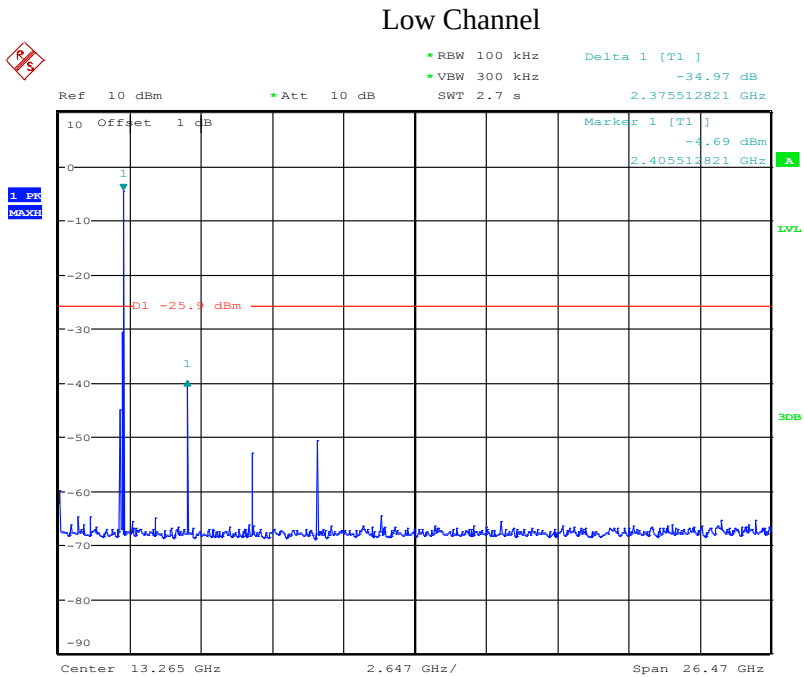
Note: Result = Reading + Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

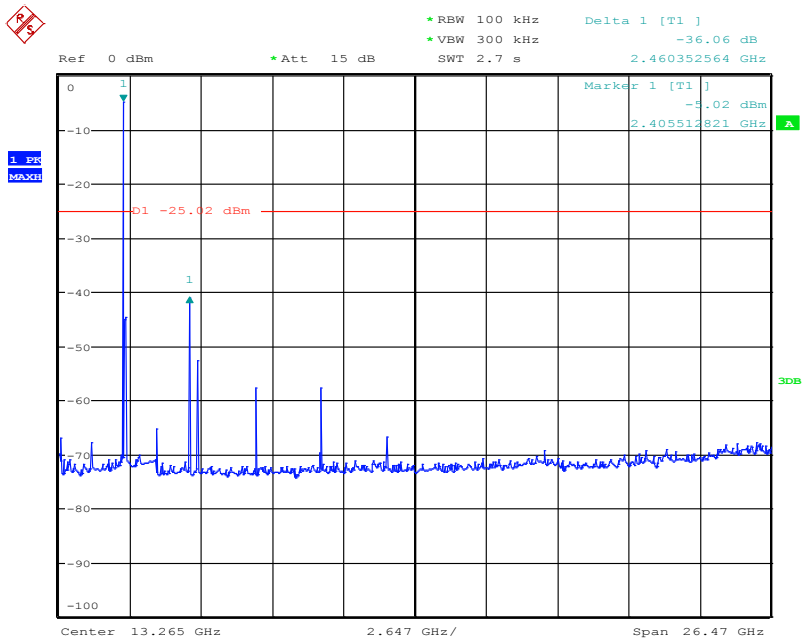
Conducted Spurious Emissions:

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	RESULT
Low	2402	34.97	≥ 20	PASS
Mid	2442	36.06	≥ 20	PASS
High	2480	35.5	≥ 20	PASS



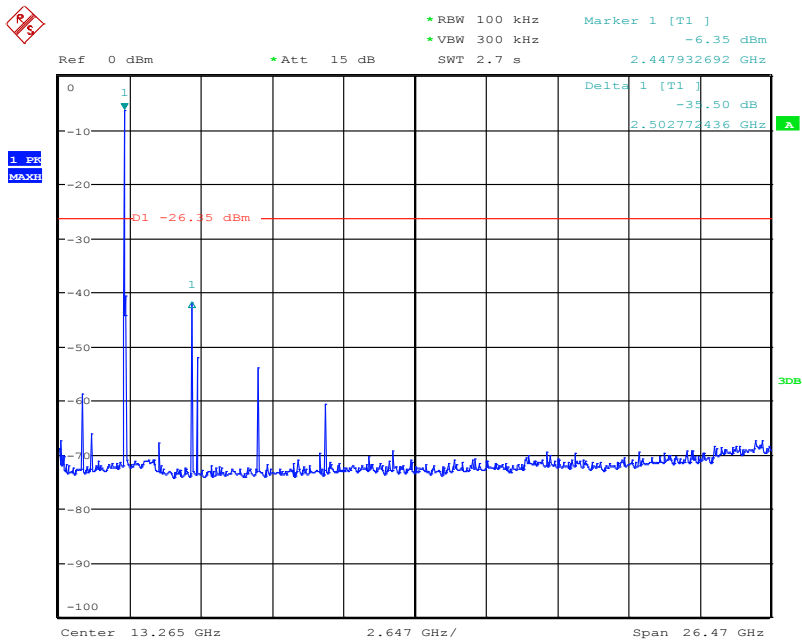
Date: 28.NOV.2016 16:22:09

Middle Channel



Date: 29.NOV.2016 14:06:01

High Channel



Date: 29.NOV.2016 15:23:18

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

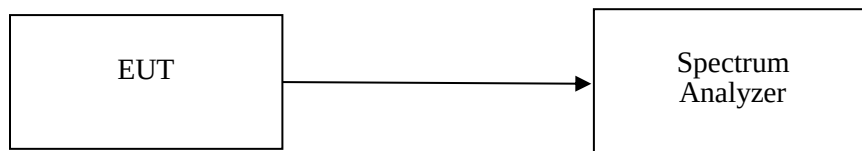
7.1 Applicable Standard

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:	101.0 kPa

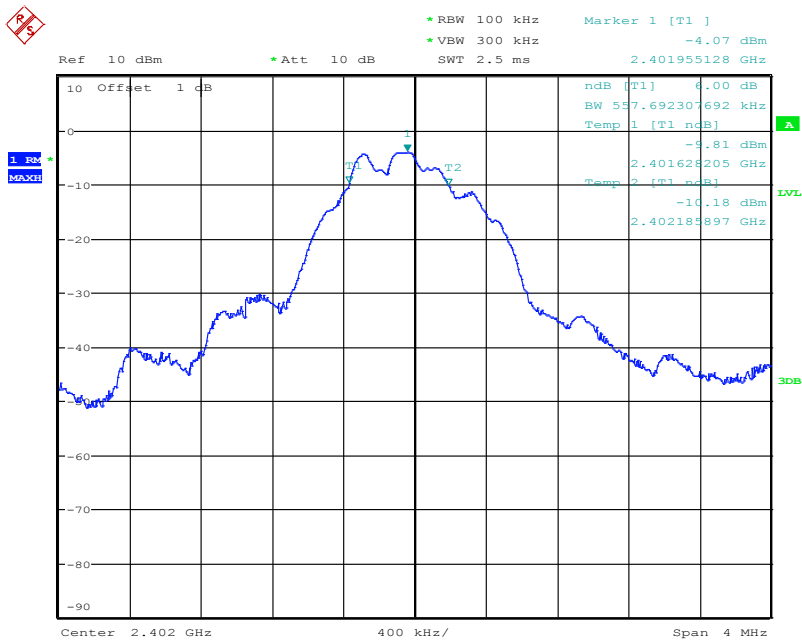
The testing was performed by David Hsu on 2016-11-28 to 2016-11-29.

7.5 Test Results

Channel	Frequency (MHz)	6 dB OBW (MHz)	Limit (MHz)	Result
Low	2402	0.55	> 0.5	Compliance
Middle	2442	0.57	> 0.5	Compliance
High	2480	0.57	> 0.5	Compliance

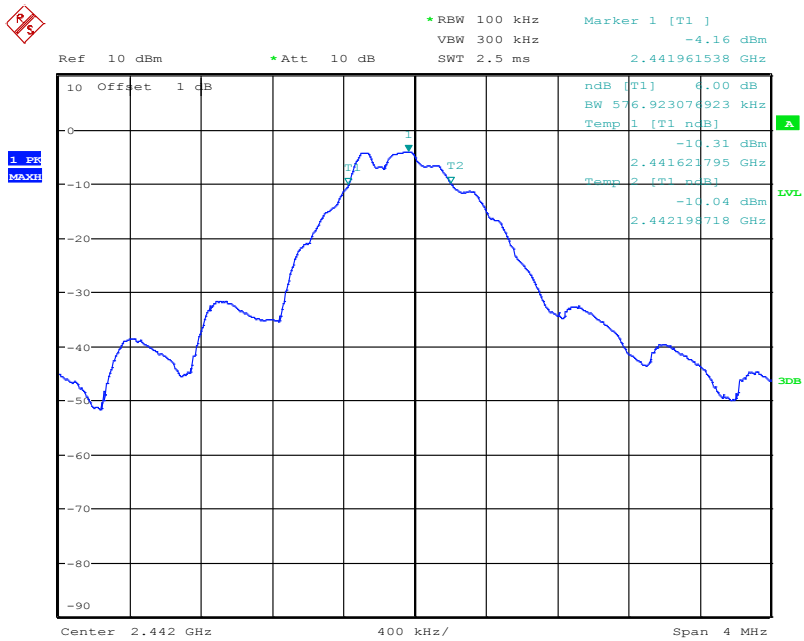
Please refer to the following plots

Low Channel



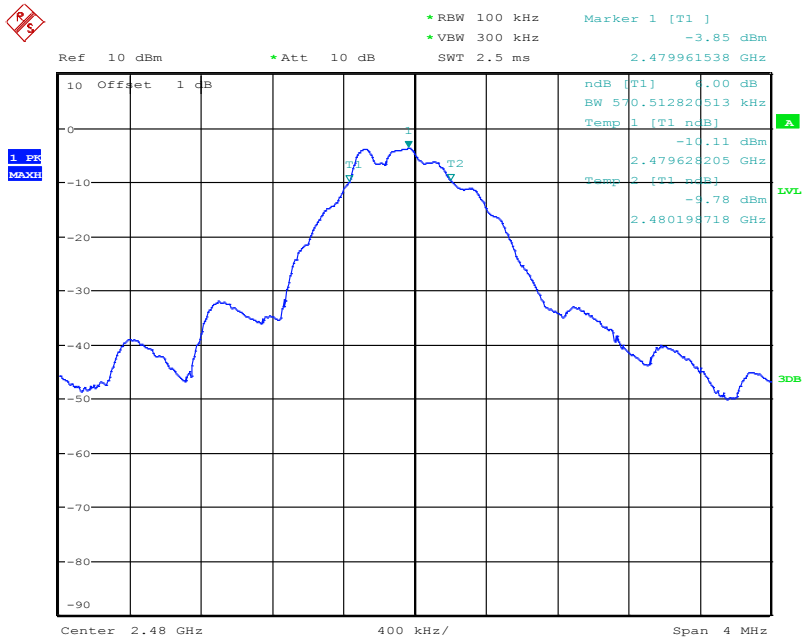
Date: 28.NOV.2016 16:08:54

Middle Channel



Date: 29.NOV.2016 13:53:01

High Channel



Date: 29.NOV.2016 15:09:55

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

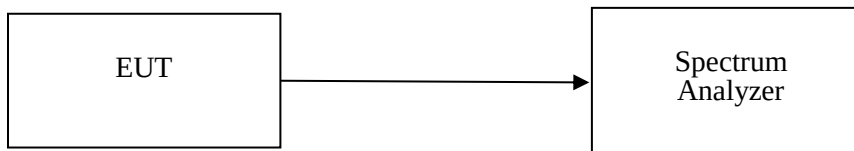
8.1 Applicable Standard

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:	101.0 kPa

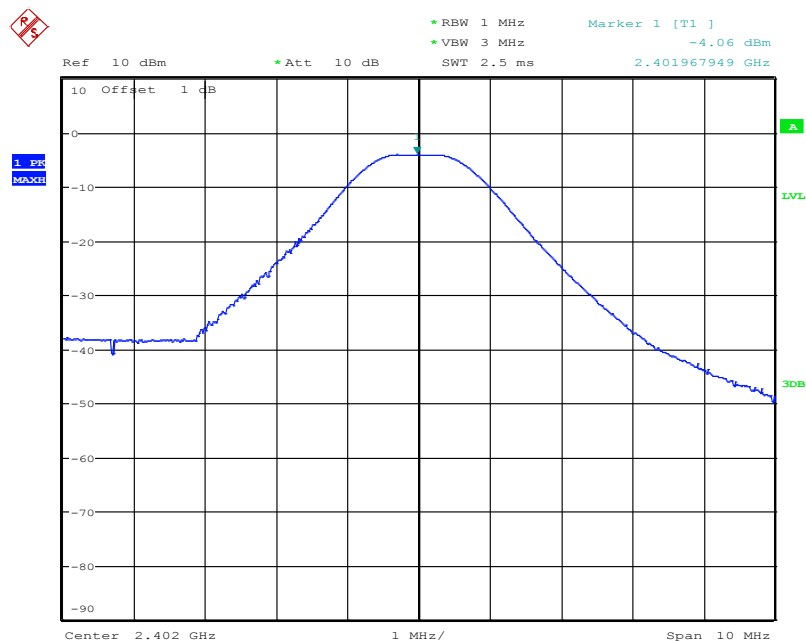
The testing was performed by David Hsu on 2016-11-28 to 2016-11-29.

8.5 Test Results

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)	Result
Low	2402	-4.06	30	Compliance
Middle	2442	-4.12	30	Compliance
High	2480	-3.79	30	Compliance

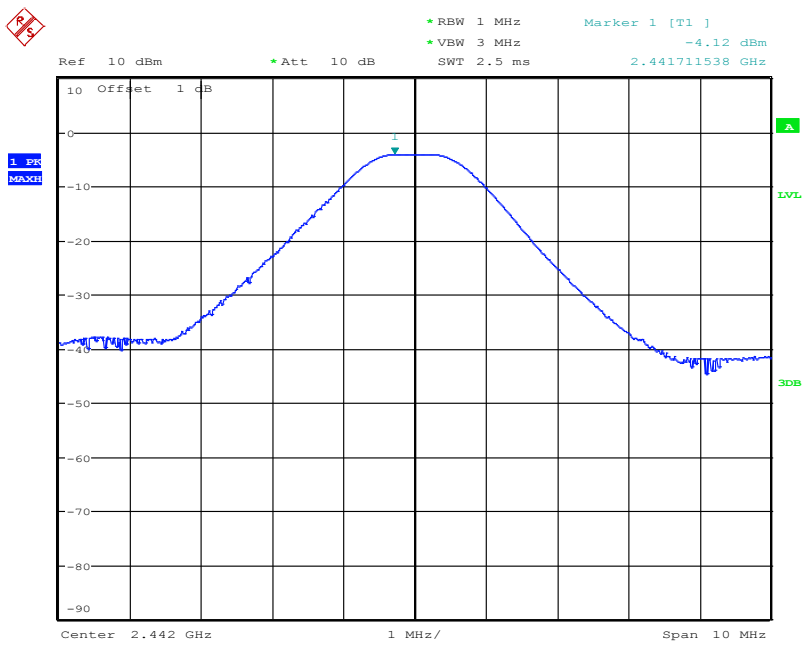
Please refer to the following plots

Low Channel



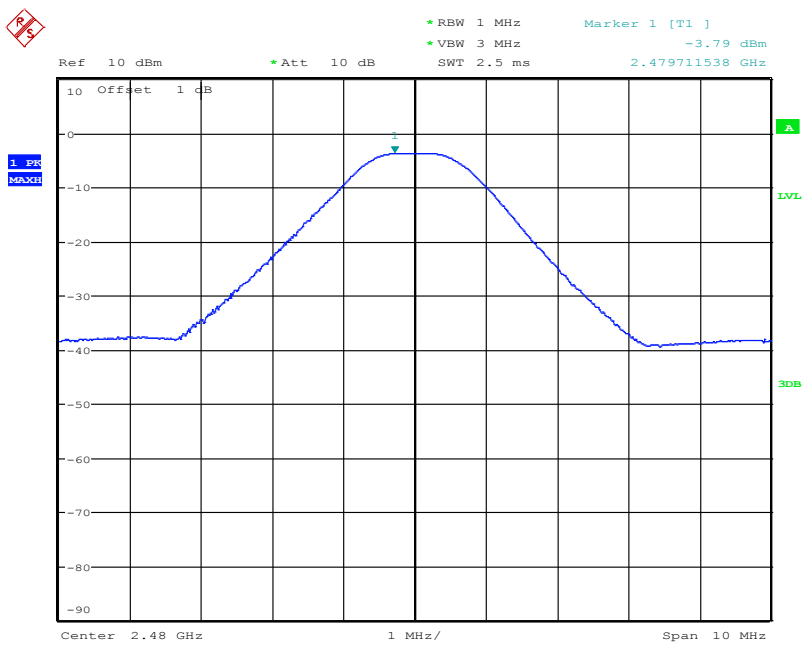
Date: 28.NOV.2016 16:02:25

Middle Channel



Date: 29.NOV.2016 13:57:55

High Channel



Date: 29.NOV.2016 15:18:20

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:	101.0 kPa

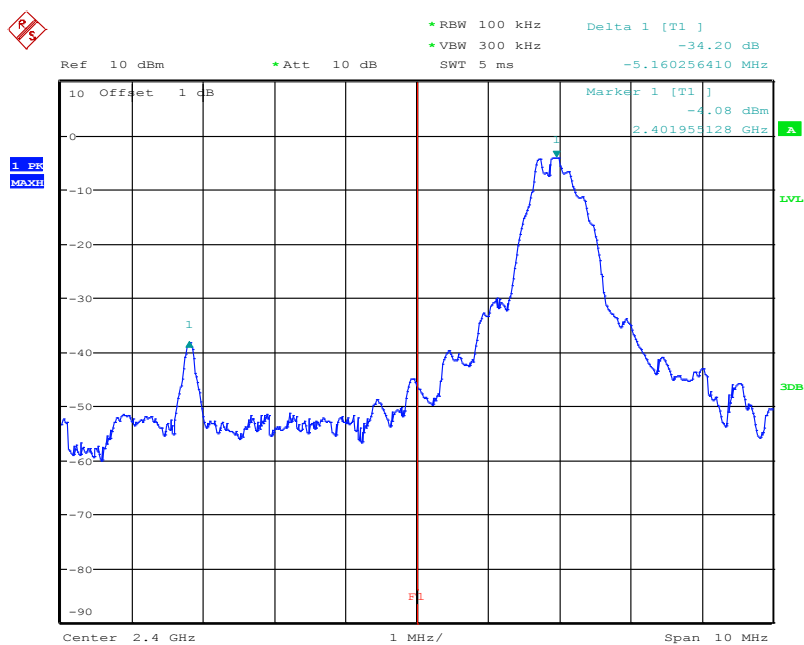
The testing was performed by David Hsu on 2016-11-28 to 2016-11-29

9.5 Test Results

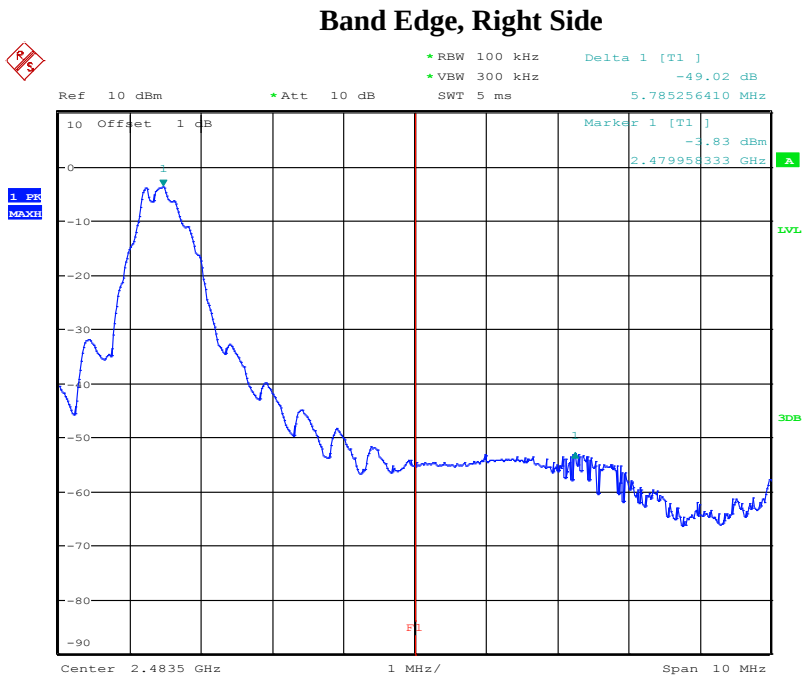
Please refer to the following plots

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	RESULT
Low	2402	34.20	≥ 20	PASS
High	2480	49.02	≥ 20	PASS

Band Edge, Left Side



Date: 28.NOV.2016 16:18:51



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10 FCC §15.247(e) – Power Spectral Density

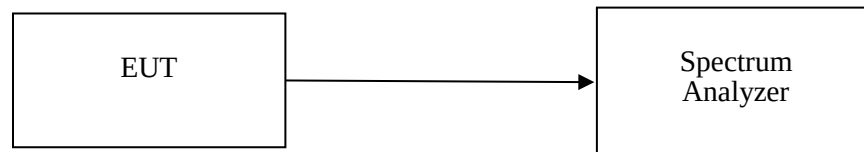
10.1 Applicable Standard

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

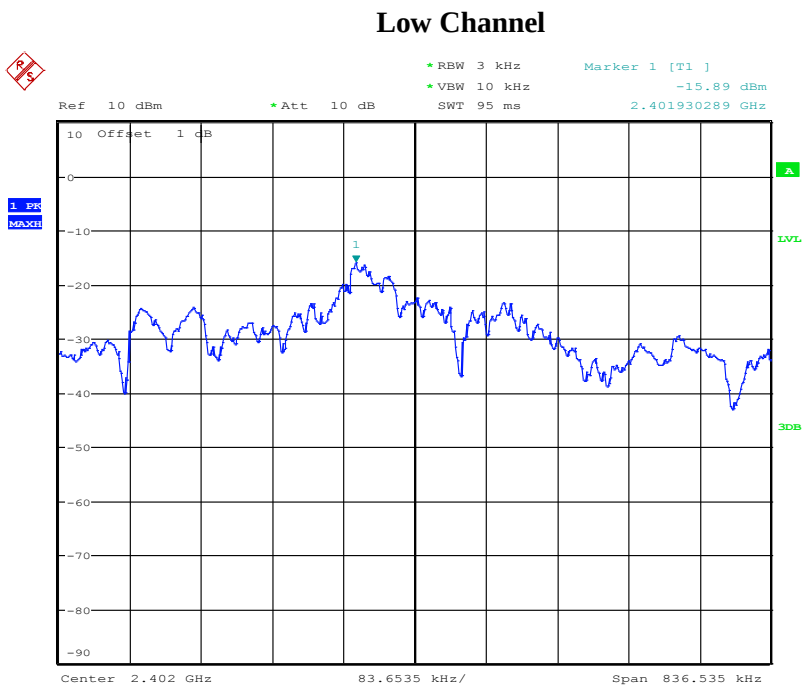
Temperature:	26° C
Relative Humidity:	58 %
ATM Pressure:	101.0 kPa

The testing was performed by David Hsu on 2016-11-28 to 2016-11-29

10.4 Test Results

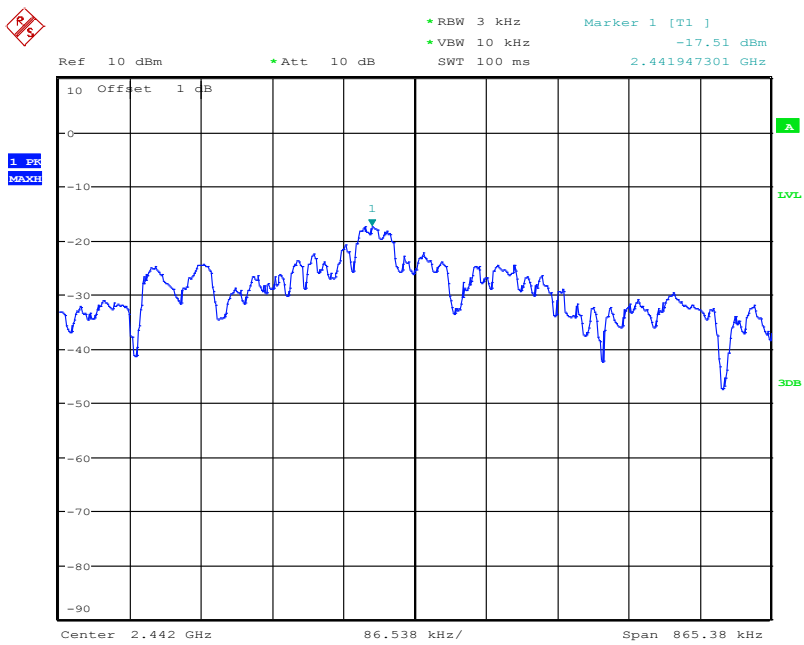
Channel	Frequency (MHz)	PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Result
Low	2402	-15.89	8	Compliance
Middle	2442	-17.51	8	Compliance
High	2480	-17.00	8	Compliance

Please refer to the following plots



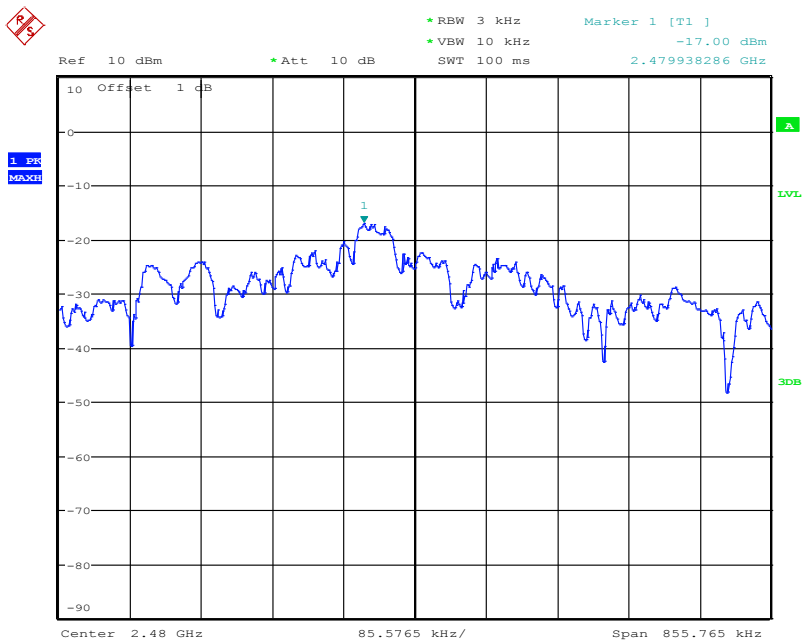
Date: 28.NOV.2016 16:16:34

Middle Channel



Date: 29.NOV.2016 13:55:53

High Channel



Date: 29.NOV.2016 15:15:15

----- END OF REPORT -----