



FCC Part 15.225

TEST REPORT

For

Latchable, Inc.

450 West 33rd Street, New York, New York, 10001, United States

FCC ID: 2AK5B-C1

Report Type: Original Report	Product Type: Smart access control product with WiFi and BLE
Report Producer:	<u>Kaylee Chiang</u>
Report Number:	<u>RLK1801005-00B</u>
Report Date:	<u>2018-01-29</u>
Reviewed By:	<u>Jerry Chang</u>
Bay Area Compliance Laboratories Corp.(Taiwan) 70, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C. Tel: +886 (2) 2647 6898 Fax: +886 (2) 2647 6895 www.bacl.com.tw	

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	No.	Report Number	Issue Date	Description	Author/ Revised by
1.0	RLK1801005	RLK1801005-00B	2018.01.29	Original Report	Kaylee

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1 General Information

1.1 Product Description for Equipment under Test (EUT)

Applicant	Latchable, Inc. 450 West 33rd Street. New York, New York, 10001, United States
Manufacturer	Goldtek Technology CO., LTD. 16F, No166, Jian 1st Rd., Zhonghe Dist., New Taipei City 235, Taiwan (R.O.C.)
Brand(Trade) Name	Latch
Product (Equipment)	Smart access control product with WiFi and BLE
Model Name	C1
Series Model	N/A
EUT Function	NFC
Frequency Range	13.56 MHz
Number of Channels	1 Channel
Field strength (dBuV)	47 dBuV
Received Date	Jan 08, 2018.
Date of Test	Jan 09, 2018 ~ Jan 29, 2018
Related Submittal(s)/Grant(s)	FCC Part 15.247 DTS with FCC ID : 2AK5B-C1

*All measurement and test data in this report was gathered from production sample serial number: 1801005

(Assigned by BACL, Taiwan).

1.2 Operation Condition of EUT

Power Operation (Voltage Range)	<input type="checkbox"/> AC 120V/60Hz
	<input type="checkbox"/> Adapter : (Not for sale)
	<input type="checkbox"/> By Power Core
	<input checked="" type="checkbox"/> DC Type
	<input type="checkbox"/> DC Power Supply
	<input checked="" type="checkbox"/> Battery : 9V
	<input type="checkbox"/> External from USB Cable
	<input type="checkbox"/> External DC Adapter
	<input type="checkbox"/> Host System

1.3 Objective

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

The objective is to determine compliance with FCC Part 15.225 rules.

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
 70, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.
 68-3, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

Bay Area Compliance Laboratories Corp. (Taiwan) Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 3180) and the FCC designation No.TW3180 under the Mutual Recognition Agreement (MRA) in FCC Test. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.10-2013.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 974454. 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

The EUT was configured for testing according to ANSI C63.10: 2013

2.2 Equipment Modifications

No modification was made to the EUT

2.3 Support Equipment List and Details

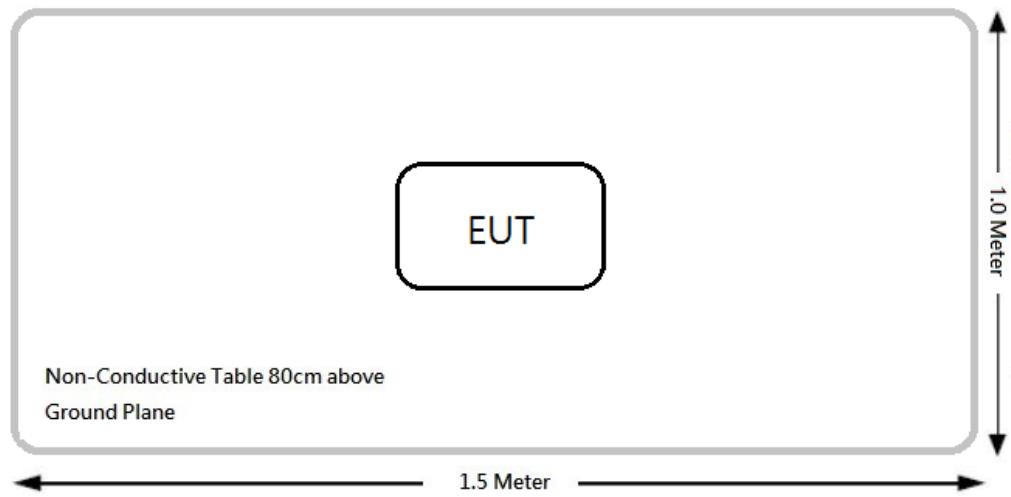
Description	Manufacturer	Model	BSMI	FCC ID / DoC
Notebook	Dell	P62G	N/A	PD98260NGU

2.4 External Cable List and Details

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

2.5 Block Diagram of Test Setup

Radiation 150 kHz to 1 GHz



3 Summary of Test Results

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207(a)	AC Line Conducted Emissions	*Not Applicable
§15.205, §15.209, §15.225	Spurious Emissions	Compliance
§15.225(e)	Frequency Stability	Compliance
§15.215(c)	20 dB Emission Bandwidth	Compliance

* Not Applicable: EUT use DC 9V by battery.

4 FCC §15.203 – Antenna Requirements

4.1 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

4.2 Antenna List and Details

Manufacturer	Model	Antenna Type	Antenna Gain	Result
Latchable Inc.	Latchable-NFC.	PCB Antenna	0 dBi	Compliance

5 FCC §15.209, §15.205, §15.225 – Spurious Emissions

5.1 Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As Per FCC §15.205(a) and RSS-Gen except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	960 – 1240	4. 5 – 5. 15
0.495 – 0.505	16.69475 – 16.69525	1300 – 1427	5. 35 – 5. 46
2.1735 – 2.1905	25.5 – 25.67	1435 – 1626.5	7.25 – 7.75
4.125 – 4.128	37.5 – 38.25	1645.5 – 1646.5	8.025 – 8.5
4.17725 – 4.17775	73 – 74.6	1660 – 1710	9.0 – 9.2
4.20725 – 4.20775	74.8 – 75.2	1718.8 – 1722.2	9.3 – 9.5
6.215 – 6.218	108 – 121.94	2200 – 2300	10.6 – 12.7
6.26775 – 6.26825	123 – 138	2310 – 2390	13.25 – 13.4
6.31175 – 6.31225	149.9 – 150.05	2483.5 – 2500	14.47 – 14.5
8.291 – 8.294	156.52475 – 156.52525	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.7 – 156.9	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	162.0125 – 167.17	3.332 – 3.339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	3.3458 – 3.358	23.6 – 24.0
12.29 – 12.293	240 – 285	3.600 – 4.400	31.2 – 31.8
12.51975 – 12.52025	322 – 335.4		36.43 – 36.5
12.57675 – 12.57725	399.9 – 410		Above 38.6
13.36 – 13.41	608 – 614		

As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As per FCC §15.225,

- (a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
- (b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
- (c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.
- (d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

5.2 Measurement Uncertainty

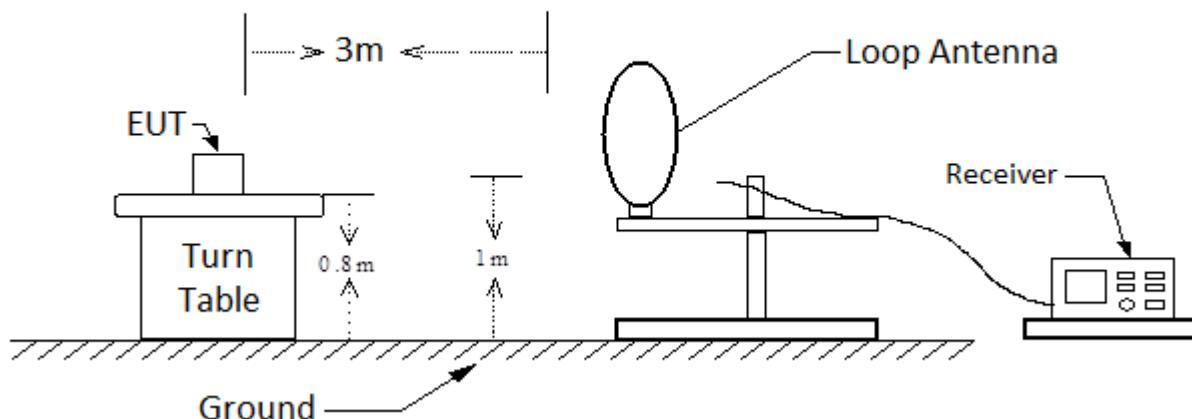
All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency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

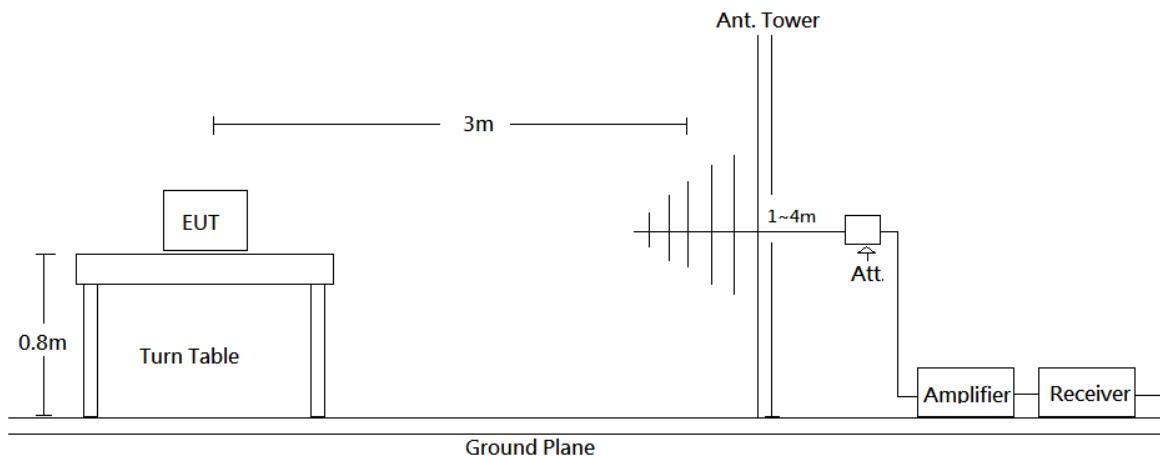
Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of radiation emissions at Bay Area Compliance Laboratories Corp. (Taiwan) is shown in below table. And the uncertainty will not be taken into consideration for the test data recorded in the report.

Frequency	Measurement uncertainty
30 MHz~200 MHz	3.76 dB (k=2, 95% level of confidence)
200 MHz~1 GHz	4.12 dB (k=2, 95% level of confidence)
1 GHz~6 GHz	4.84 dB (k=2, 95% level of confidence)
6 GHz~18 GHz	5.16 dB (k=2, 95% level of confidence)
18 GHz~26 GHz	4.84 dB (k=2, 95% level of confidence)
26 GHz~40 GHz	4.30 dB (k=2, 95% level of confidence)

5.3 EUT Setup

150 kHz to 30 MHz



30 MHz to 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 15.225 Limits.

5.4 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.

Frequency Range	RBW	VBW	Detector	Measurement method
Below 150 kHz	200 Hz	1 kHz	QP	QP
150 kHz-30 MHz	9 kHz	30 kHz	QP	QP
30-1000 MHz	120 kHz	/	QP	QP

5.5 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 9 kHz to 1 GHz.

5.6 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

5.7 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

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

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

5.8 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Bilog Antenna	Sunol & Mini-Circuits	JB6/UNAT-6+	A050115 / 15542_01	2017/11/10	2018/11/09
Active Loop Antenna	ETS-Lindgren	6502	00035796	2017/03/02	2018/03/01
Horn Antenna	EMCO	3115	9311-4158	2017/05/31	2018/05/30
Preamplifier	Sonoma	310N	130602	2017/07/03	2018/07/02
Preamplifier	EMEC	EM01G18G	060697	2017/04/14	2018/04/16
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2017/11/01	2018/10/31
Spectrum Analyzer	Rohde & Schwarz	FSV40	101203	2017/07/13	2018/07/12
Microflex Cable	UTIFLEX	UFB311A-Q-1440-300300	220490-006	2017/10/31	2018/10/30
Microflex Cable	UTIFLEX	UFA210A-1-3149-300300	MFR64639 226389-001	2017/11/10	2018/11/09
Microflex Cable	ROSNOL	K1K50-UP0264-K1K50-450CM	160309-1	2017/03/24	2018/03/23
Microflex Cable	ROSNOL	K1K50-UP0264-K1K50-80CM	160309-2	2017/01/20	2018/01/19
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	Farad	EZ_EMCA	BACL-03A1	N.C.R	N.C.R

***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).

5.9 Test Environmental Conditions

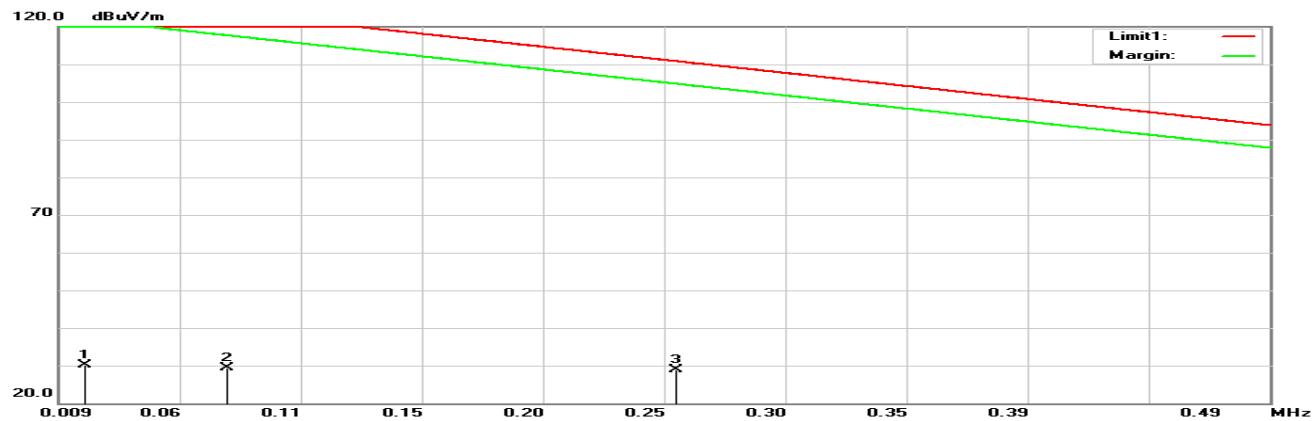
Temperature:	25° C
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

The testing was performed by Ian from 2018-01-08 to 2018-01-29

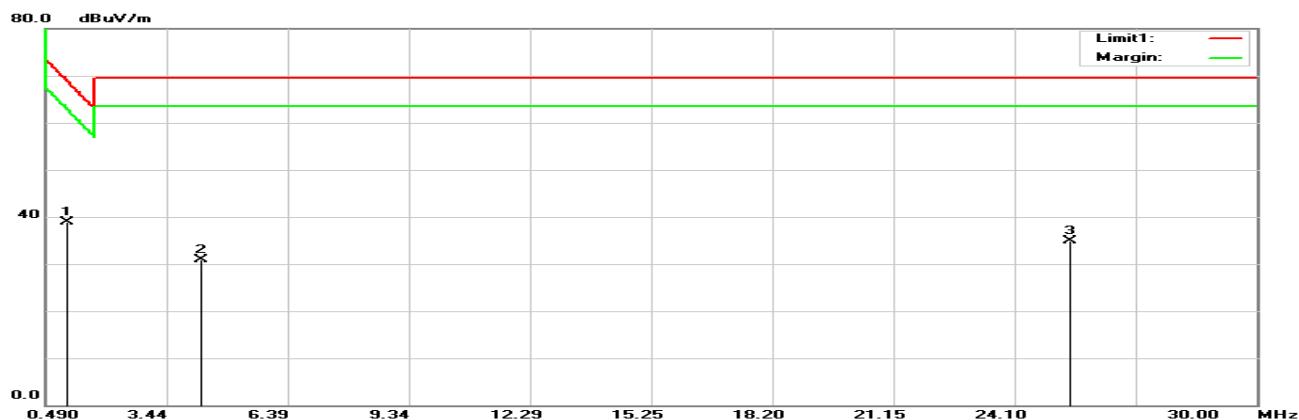
5.10 Test Results

NFC 13.56 MHz Mode: Transmitting Mode (*Pre-scan with three orthogonal axis, and worse case as Z axis*)

9 kHz to 490 kHz:

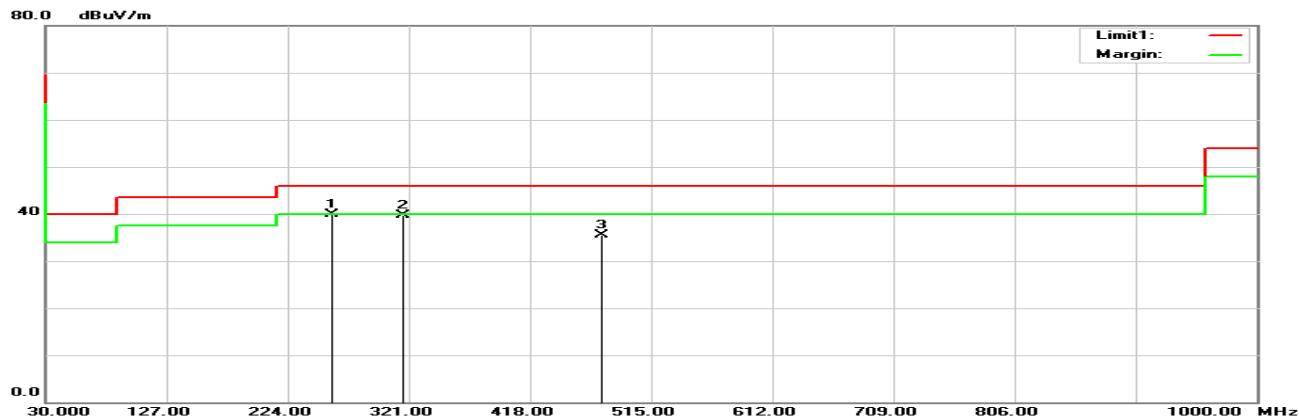


490 kHz to 30 MHz:

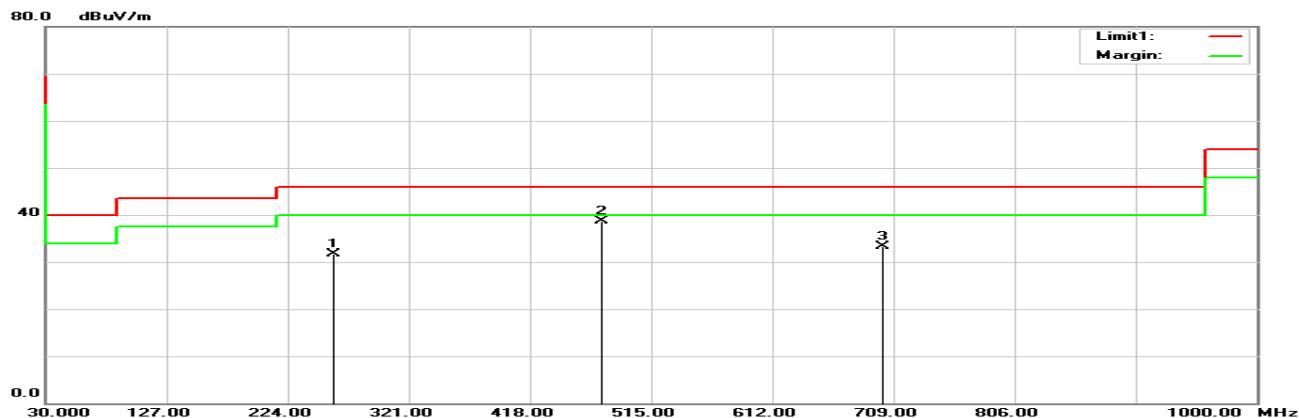


9 kHz to 30 MHz:

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
0.0196	12.67	17.37	30.04	127.74	-97.70	100	360	peak
0.0760	16.42	13.05	29.47	123.67	-94.20	100	159	peak
0.2543	16.20	12.57	28.77	110.80	-82.03	100	1	peak
1.0212	26.43	12.48	38.91	69.08	-30.17	100	235	peak
4.2673	18.96	11.96	30.92	69.50	-38.58	100	7	peak
13.5600	34.91	12.09	47.00	124.00	-77.00	100	0	peak
25.4555	24.07	10.90	34.97	69.50	-34.53	100	135	peak

30 MHz to 1 GHz**Horizontal**

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
259.8900	51.33	-11.38	39.95	46.00	-6.05	100	116	peak
316.1500	49.24	-9.55	39.69	46.00	-6.31	100	213	peak
475.2300	41.63	-6.15	35.48	46.00	-10.52	100	285	peak

Vertical

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
260.8600	42.98	-11.28	31.70	46.00	-14.30	100	87	peak
475.2300	44.81	-6.15	38.66	46.00	-7.34	100	189	peak
700.2700	36.24	-2.84	33.40	46.00	-12.60	100	206	peak

6 FCC §15.225(e) – FREQUENCY STABILITY

6.1 Applicable Standard

According to FCC §15.225(e),

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+ 50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

6.2 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2017/11/15	2018/11/14
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21
Temp & midity Chamber	BACL	BTH-150	30028	2017/12/18	2018/12/17
DC Power Supply	KIKUSUI	PMC35-2	MK002127	N/A	N/A
Multimeter	Fluke	114	28810152WS	2018/02/09	2019/02/08

***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).

6.3 Test Environmental Conditions

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

The testing was performed by Ian Tu on 2018-01-18.

6.4 Test Results

Test Frequency

Condition		Frequency (MHz)			
Extreme	Test Freq	0 min	2 min	5 min	10 min
T _{20°C} Vmax	13.56	13.559955	13.559942	13.559923	13.559913
T _{20°C} Vmin	13.56	13.559955	13.559942	13.559923	13.559913
T _{50°C} Vnom	13.56	13.560131	13.560116	13.560101	13.560087
T _{40°C} Vnom	13.56	13.560087	13.560058	13.560029	13.560015
T _{30°C} Vnom	13.56	13.560015	13.560000	13.559971	13.559955
T _{20°C} Vnom	13.56	13.559955	13.559942	13.559923	13.559913
T _{10°C} Vnom	13.56	13.559913	13.559898	13.559884	13.559865
T _{0°C} Vnom	13.56	13.559865	13.559884	13.559898	13.559913
T _{-10°C} Vnom	13.56	13.559913	13.559923	13.559942	13.559955
T _{-20°C} Vnom	13.56	13.559955	13.559971	13.560000	13.560015

Frequency Error

Condition		Freq. Error (ppm)			
Extreme	Test Freq	0 min	2 min	5 min	10 min
T _{20°C} Vmax	13.56	-3.32	-4.28	-5.68	-6.42
T _{20°C} Vmin	13.56	-3.32	-4.28	-5.68	-6.42
T _{50°C} Vnom	13.56	9.66	8.55	7.45	6.42
T _{40°C} Vnom	13.56	6.42	4.28	2.14	1.11
T _{30°C} Vnom	13.56	1.11	0.00	-2.14	-3.32
T _{20°C} Vnom	13.56	-3.32	-4.28	-5.68	-6.42
T _{10°C} Vnom	13.56	-6.42	-7.52	-8.55	-9.96
T _{0°C} Vnom	13.56	-9.96	-8.55	-7.52	-6.42
T _{-10°C} Vnom	13.56	-6.42	-5.68	-4.28	-3.32
T _{-20°C} Vnom	13.56	-3.32	-2.14	0.00	1.11
Limit (ppm) = 100 ppm					

7 FCC §15.215(c) – 20 dB Bandwidth

7.1 Applicable Standard

According to 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. In the case of intentional radiators operating under the provisions of subpart E, the emission bandwidth may span across multiple contiguous frequency bands identified in that subpart. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

7.2 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 measuring equipment.

7.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2017/11/15	2018/11/14
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21

***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

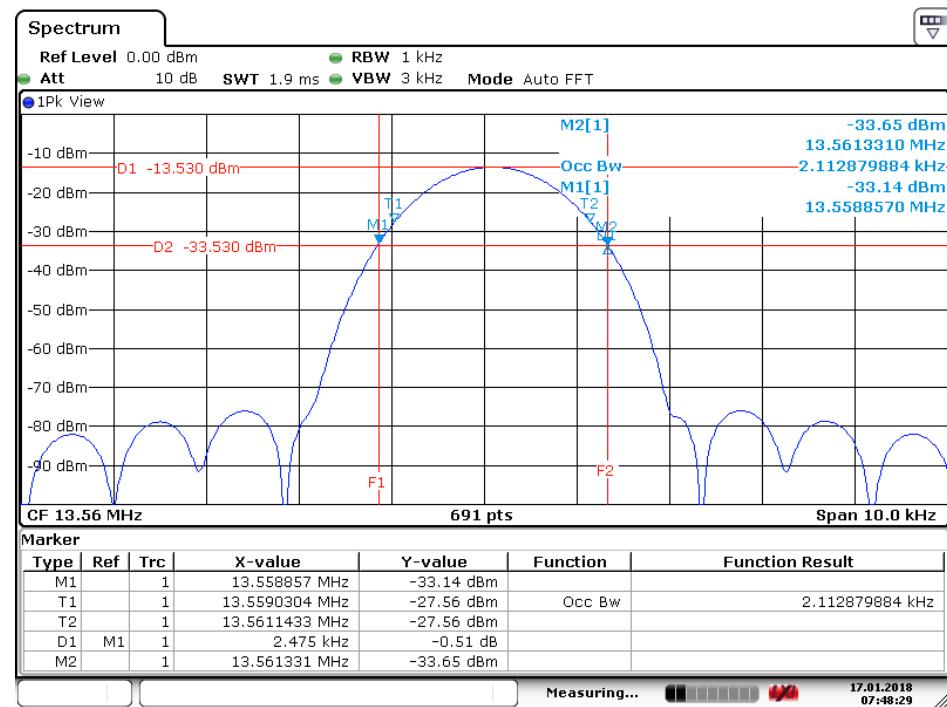
Temperature:	26° C
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

The testing was performed by Ian on 2018-01-17.

7.5 Test Results

Frequency (MHz)	20dB Bandwidth (kHz)	99% Occupied BW (kHz)	$F_L > 13.553$ (MHz)	$F_H < 13.567$ MHz	Result
13.56	2.4750	2.1128	13.55885	13.56133	Compliance

20 dB Emission Bandwidth



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