FCC PART 15.249

TEST REPORT

For

ALATECH Technology Limited

39F., No. 758, Jungming S.RD. Taichung, Taiwan

FCC ID: YQOWB001

Report Type:	**Product Type:**
Original Report	Star ONE

Report Producer:	Kaylee Chiang
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Report Date:	2017-09-22
Reviewed By:	Jerry Chang

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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	No.	Report Number	Issue Date	Description	Author/ Revised by
1.0	RTWA170707003	RTWA170707003-00B	2017.09.22	Original Report	Kaylee

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant :	ALATECH Technology Limited 39F., No. 758, Jungming S. RD. Taichung, Taiwan
Manufacturer :	ZHEJIANG ALA FITNESS TECHOLOGY LTD NO.405 Tongxin Road, Tongxiang Economic Development Zhejiang 314500, China
Product :	Star ONE
Model :	WB001
Trade Name :	ALATECH
Frequency Range :	2457 MHz
Antenna Specification :	Monopole Antenna/Gain: 2.08 dBi
Voltage Range: :	3.7Vdc from battery
Date of Test :	Jul. 18, 2017 ~ Sep. 22, 2017

**All measurement and test data in this report was gathered from production sample serial number: 170707003 (Assigned by BACL, Taiwan) The EUT supplied by the applicant was received on 2017-07-04.*

Objective

This report is prepared on behalf of *ALATECH Technology Limited* in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communications Commission's rules.

The tests were performed in order to determine the ANT+ mode of EUT compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.249 rules.

Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS submission with FCC ID: YQOWB001

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

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.

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.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in an engineering mode, which was provided by manufacturer. The engineering mode was configured the system transmitting with maximum power. For ANT+ mode, only 1 channel (2457MHz) was used.

EUT Exercise Software

No test software was used.

Equipment Modifications

No modification was made to the EUT.

Support Equipment List and Details

Description	Manufacturer	Model Number	BSMI	FCC ID/DOC	S/N
NB	DELL	E6410	N/A	PD98260NGU	10912240367

External Cable List and Details

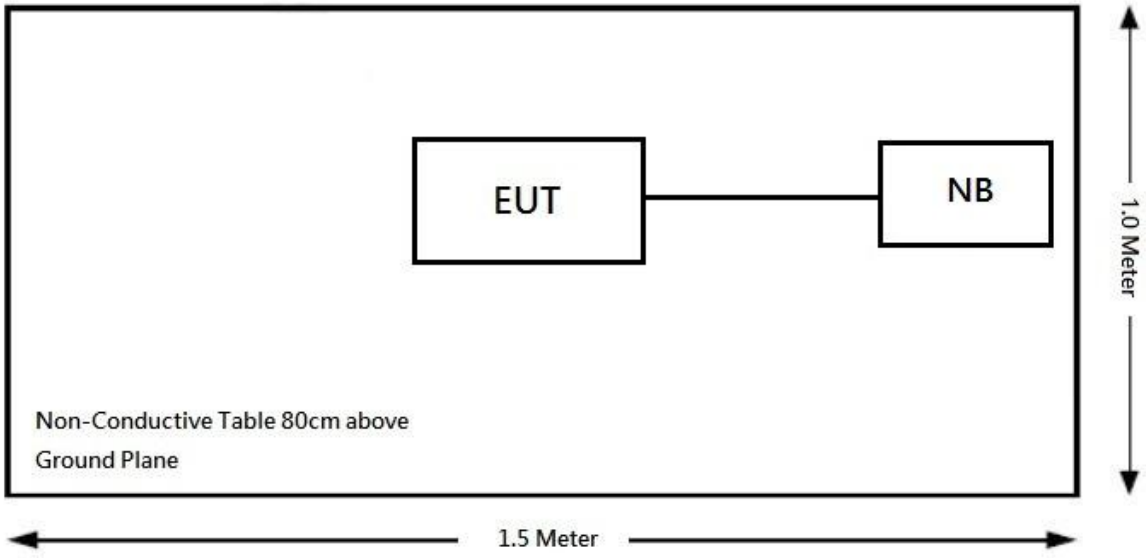
Cable Description	Length (m)	From	To
Mini USB Cable	1.5	NB	EUT

Block Diagram of Test Setup

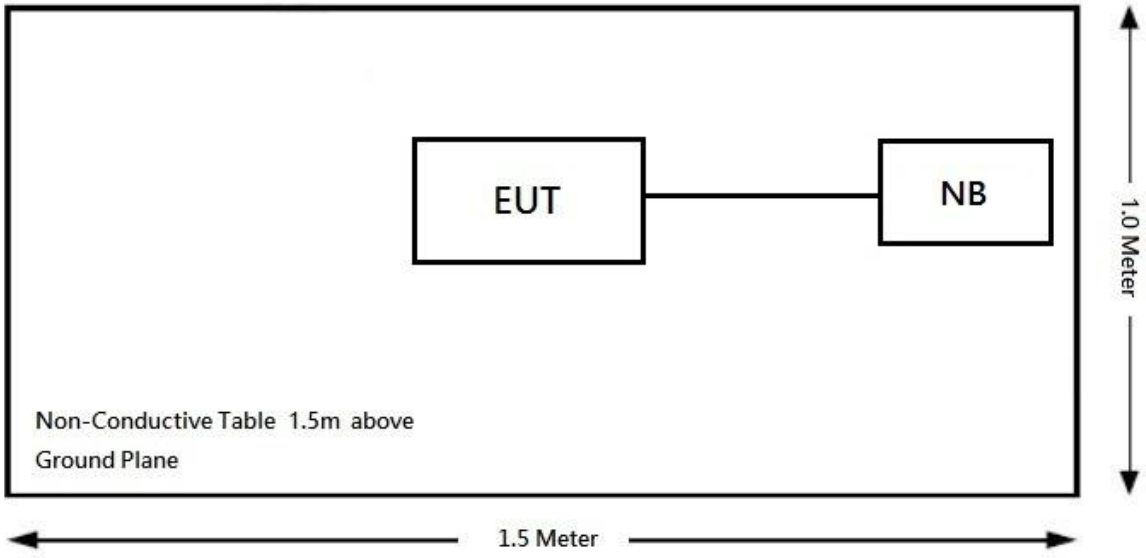
See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment

Radiation:

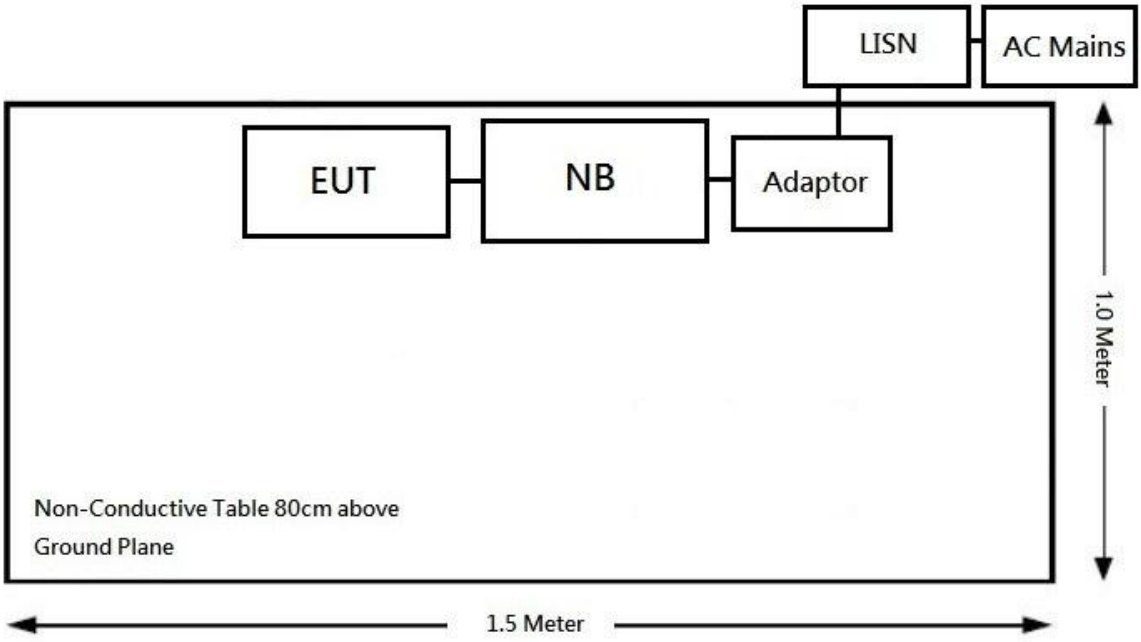
Below 1GHz:



Above 1GHz:



Conduction:


LISN
AC Mains
EUT
NB
Adaptor
1.0 Meter
Non-Conductive Table 80cm above
Ground Plane
1.5 Meter

SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§15.203	Antenna Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	Compliance
§15.205, §15.209,§15.249	Radiated Emissions	Compliance
§15.215 (c)	20 dB Emission Bandwidth	Compliance

FCC §15.203 – ANTENNA REQUIREMENT

Applicable Standard

For intentional device, 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.

Antenna Connector Construction

Manufacturer	Type	Antenna Gain	Result
Alatech Technology Limited	monopole Antenna	2.08 dBi	Compliance

Result: Compliance.

FCC §15.207 - AC LINE CONDUCTED EMISSIONS

Applicable Standard

According to FCC §15.207 Conducted limits:

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 Note 1	56 to 46 Note 2
0.5-5	56	46
5-30	60	50

Note 1: Decreases with the logarithm of the frequency.
Note 2: A linear average detector is required

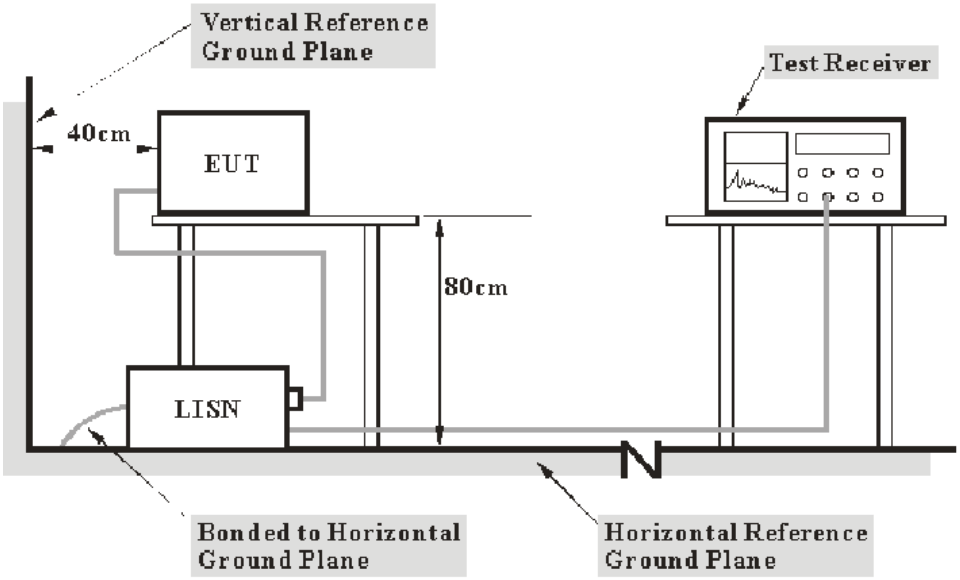
Measurement Uncertainty

Input quantities to be considered for conducted disturbance measurements maybe receiver reading, attenuation of the connection between LISN/ISN and receiver, LISN/ISN voltage division factor, LISN/ISN VDF frequency interpolation and receiver related input quantities, etc.

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

Port	Expanded Measurement uncertainty
AC Mains	4.64 dB (k=2, 95% level of confidence)

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 limits.

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 outlet of the 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 Factor & Margin Calculation

The factor is calculated by adding LISN/ISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation

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

Over Limit = Level – Limit Line

Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Date	Calibration Due Date
LISN	Rohde & Schwarz	ENV216	101248	2017/07/20	2018/07/19
LISN	EMCO	3816/2	75848	2017/08/02	2018/08/01
EMI Test Receiver	Rohde & Schwarz	ESCI	100540	2017/05/24	2018/05/23
Pulse Limiter	Rohde & Schwarz	ESH3Z2	TXZEM025	2017/08/11	2018/08/10
RF Cable	EMEC	EM-CB5D	001	2017/07/24	2018/07/23
Software	AUDIX	E3	V9.150826k	NCR	N.C.R

**** Statement of Traceability:*** BACL Corp. attests that all calibrations have been performed according to TAF requirements, traceable to the ETC.

Test Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	58 %
ATM Pressure:	1020 hPa

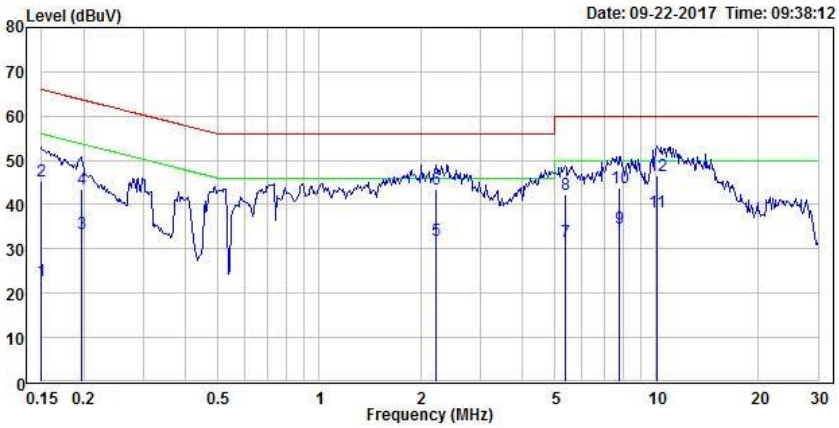
The testing was performed by Andy Shih on 2017-09-22.

Test Results

Test Mode: Charge+ Transmitting

Please refer to the following plots and tables.

Main: AC 120V/60 Hz, Line



Condition: Line
EUT :
Mode :
Note :

	Freq	Level	Limit Line	Over Limit	Factor	Read Level	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB	dB	dBuV		
1	0.150	22.91	56.00	-33.09	19.50	3.41	Average	Line
2	0.150	45.31	66.00	-20.69	19.50	25.81	QP	Line
3	0.197	33.48	53.75	-20.27	19.50	13.98	Average	Line
4	0.197	43.49	63.75	-20.26	19.50	23.99	QP	Line
5	2.216	31.96	46.00	-14.04	19.59	12.37	Average	Line
6	2.216	43.45	56.00	-12.55	19.59	23.86	QP	Line
7	5.367	31.72	50.00	-18.28	19.68	12.04	Average	Line
8	5.367	42.20	60.00	-17.80	19.68	22.52	QP	Line
9	7.805	34.73	50.00	-15.27	19.73	15.00	Average	Line
10	7.805	43.84	60.00	-16.16	19.73	24.11	QP	Line
11	10.071	38.33	50.00	-11.67	19.76	18.57	Average	Line
12	10.071	46.46	60.00	-13.54	19.76	26.70	QP	Line

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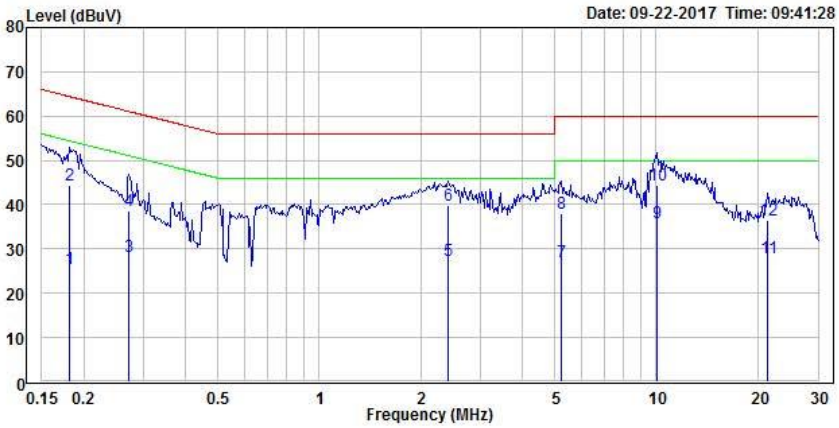
Main: AC 120V/60 Hz, Neutral



Condition: Neutral
EUT :
Mode :
Note :

	Freq	Level	Limit Line	Over Limit	Factor	Read Level	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB	dB	dBuV		
1	0.182	25.65	54.41	-28.76	19.63	6.02	Average	Neutral
2	0.182	44.36	64.41	-20.05	19.63	24.73	QP	Neutral
3	0.273	28.28	51.04	-22.76	19.63	8.65	Average	Neutral
4	0.273	38.64	61.04	-22.40	19.63	19.01	QP	Neutral
5	2.419	27.23	46.00	-18.77	19.73	7.50	Average	Neutral
6	2.419	39.94	56.00	-16.06	19.73	20.21	QP	Neutral
7	5.240	26.96	50.00	-23.04	19.82	7.14	Average	Neutral
8	5.240	37.93	60.00	-22.07	19.82	18.11	QP	Neutral
9	10.071	36.02	50.00	-13.98	19.91	16.11	Average	Neutral
10	10.071	44.36	60.00	-15.64	19.91	24.45	QP	Neutral
11	21.298	27.96	50.00	-22.04	20.06	7.90	Average	Neutral
12	21.298	36.52	60.00	-23.48	20.06	16.46	QP	Neutral

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FCC§15.209, §15.205 & §15.249 - 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.

Measurement Uncertainty

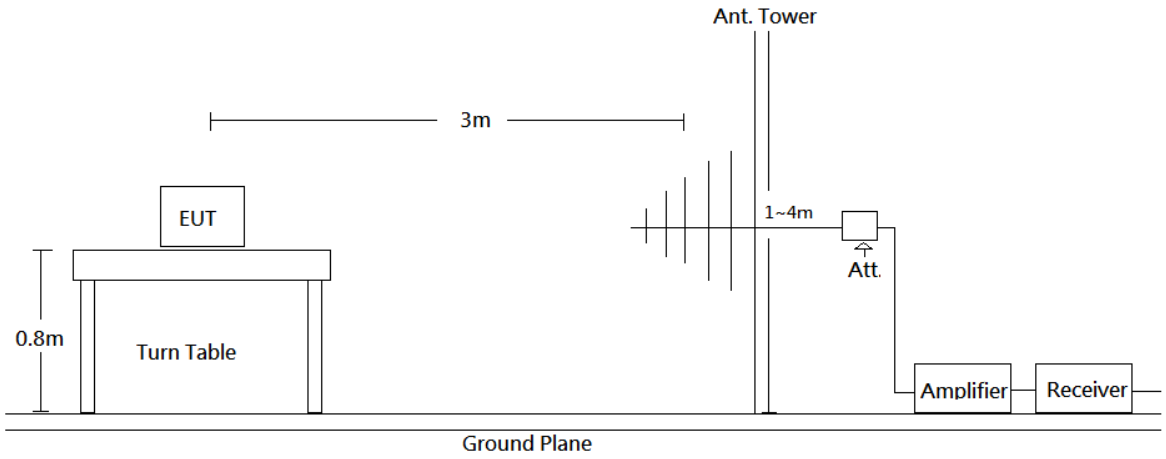
All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency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

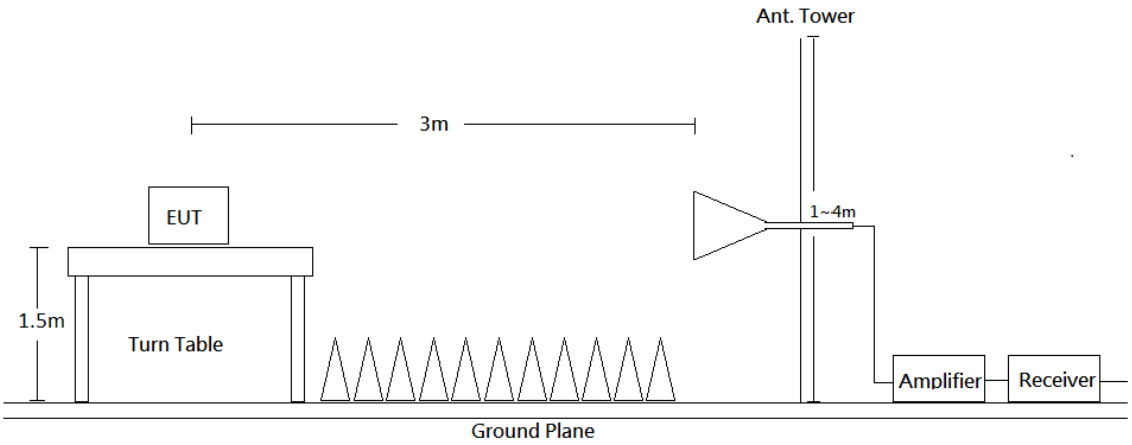
Frequency	Measurement uncertainty
30 MHz~200 MHz	3.76 dB (k=2, 95% level of confidence)
200 MHz~1 GHz	4.12 dB (k=2, 95% level of confidence)
1 GHz~6 GHz	4.84 dB (k=2, 95% level of confidence)
6 GHz~18 GHz	5.16 dB (k=2, 95% level of confidence)
18 GHz~26 GHz	4.84 dB (k=2, 95% level of confidence)
26 GHz~40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

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.249 limits.

EMI Test Receiver & Spectrum Analyzer 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	Detector
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	Ave.

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.

Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
966A Room					
Bilog Antenna	Sunol & Mini-Circuits	JB6/ UNAT-6+	A050115 / 15542_01	2016/11/16	2017/11/15
Horn Antenna	EMCO	3115	9311-4158	2017/05/31	2018/05/30
Horn Antenna	ETS-Lindgren	3116	00062638	2016/09/05	2017/09/04
Preamplifier	Sonoma	310N	130602	2017/07/03	2018/07/02
Preamplifier	EMEC	EM01G18G	060697	2017/04/14	2018/04/16
Preamplifier	EMEC	EM18G40G	060656	2016/12/13	2017/12/12
EMI Test Receiver	R & S	ESR7	101419	2016/11/03	2017/11/03
Spectrum Analyzer	Rohde & Schwarz	FSV40	101203	2017/07/13	2018/07/12
Microflex Cable	UTIFLEX	UFB311A-Q-1440-300300	220490-006	2016/11/02	2017/11/01
Microflex Cable	UTIFLEX	UFA210A-1-3149-300300	MFR64639 226389-001	2016/11/29	2017/11/28
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_EMC	BACL-03A1	N.C.R	N.C.R

*** *Statement of Traceability:*** BACL Corp. attests that all calibrations have been performed according to TAF requirements, traceable to the ETC.

Corrected Amplitude & 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 + Attenuator

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

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, and section 15.205, 15.209 and 15.249.

Test Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	1010 hPa

The testing was performed by Andy Shih on 2017-07-31.

Test Results

(Pre-scan with three orthogonal axis, and worse case as Y axis.)

Mode: Transmitting

Horizontal

Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
268.62	28.38	-10.46	17.92	46.00	-28.08	100	94	QP
402.48	27.78	-7.67	20.11	46.00	-25.89	100	269	QP
527.61	28.12	-5.32	22.80	46.00	-23.20	100	146	QP
651.77	27.77	-3.34	24.43	46.00	-21.57	100	125	QP
830.25	28.13	0.03	28.16	46.00	-17.84	100	26	QP
973.81	27.23	3.26	30.49	54.00	-23.51	100	352	QP
2390.00	53.09	-4.89	48.20	74.00	-25.80	165	317	peak
2390.00	39.13	-4.89	34.24	54.00	-19.76	165	317	AVG
2400.00	52.00	-4.87	47.13	74.00	-26.87	160	322	peak
2400.00	37.11	-4.87	32.24	54.00	-21.76	160	322	AVG
2457.00	89.58	-4.74	84.84	114.00	-29.16	165	351	peak
2457.00	61.79	-4.74	57.05	94.00	-36.95	165	351	AVG
2483.50	58.84	-4.69	54.15	74.00	-19.85	165	125	peak
2483.50	43.85	-4.69	39.16	54.00	-14.84	165	125	AVG
4914.00	46.86	1.35	48.21	74.00	-25.79	112	160	peak
4914.00	39.01	1.35	40.36	54.00	-13.64	112	160	AVG
7371.00	45.51	7.21	52.72	74.00	-21.28	129	315	peak
7371.00	30.24	7.21	37.45	54.00	-16.55	129	315	AVG

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

Vertical

Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
(MHz)	(dBμV)	Factor(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	(cm)	(°)	
97.90	35.55	-15.06	20.49	43.50	-23.01	100	93	QP
166.77	30.36	-11.98	18.38	43.50	-25.12	100	300	QP
199.75	28.13	-10.76	17.37	43.50	-26.13	100	318	QP
314.21	30.54	-9.54	21.00	46.00	-25.00	100	122	QP
579.99	28.68	-4.38	24.30	46.00	-21.70	100	67	QP
865.17	28.65	0.71	29.36	46.00	-16.64	100	281	QP
2390.00	53.38	-4.89	48.49	74.00	-25.51	125	111	peak
2390.00	39.21	-4.89	34.32	54.00	-19.68	125	111	AVG
2400.00	51.53	-4.87	46.66	74.00	-27.34	129	133	peak
2400.00	37.85	-4.87	32.98	54.00	-21.02	129	133	AVG
2457.00	88.55	-4.74	83.81	114.00	-30.19	125	120	peak
2457.00	61.33	-4.74	56.59	94.00	-37.41	125	120	AVG
2483.50	53.49	-4.69	48.80	74.00	-25.20	125	271	peak
2483.50	39.24	-4.69	34.55	54.00	-19.45	125	271	AVG
4914.00	45.67	1.35	47.02	74.00	-26.98	177	308	peak
4914.00	36.19	1.35	37.54	54.00	-16.46	177	308	AVG
7371.00	44.94	7.21	52.15	74.00	-21.85	143	15	peak
7371.00	29.90	7.21	37.11	54.00	-16.89	143	15	AVG

Result = Reading + Correct Factor

Margin = Result – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported.

FCC§15.215(c) – 20 dB BANDWIDTH TESTING

Applicable Standard

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.

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 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSEK30	825084/006	2016/12/15	2017/12/14
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21
Attenuator	MINI-CIRCUITS	BW-S10W5+	N/A	2017/3/14	2018/3/13

**** Statement of Traceability:*** BACL Corp. attests that all calibrations have been performed according to TAF requirements, traceable to the ETC.

Test Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	1010 hPa

The testing was performed by Andy Shih on 2017-07-18.

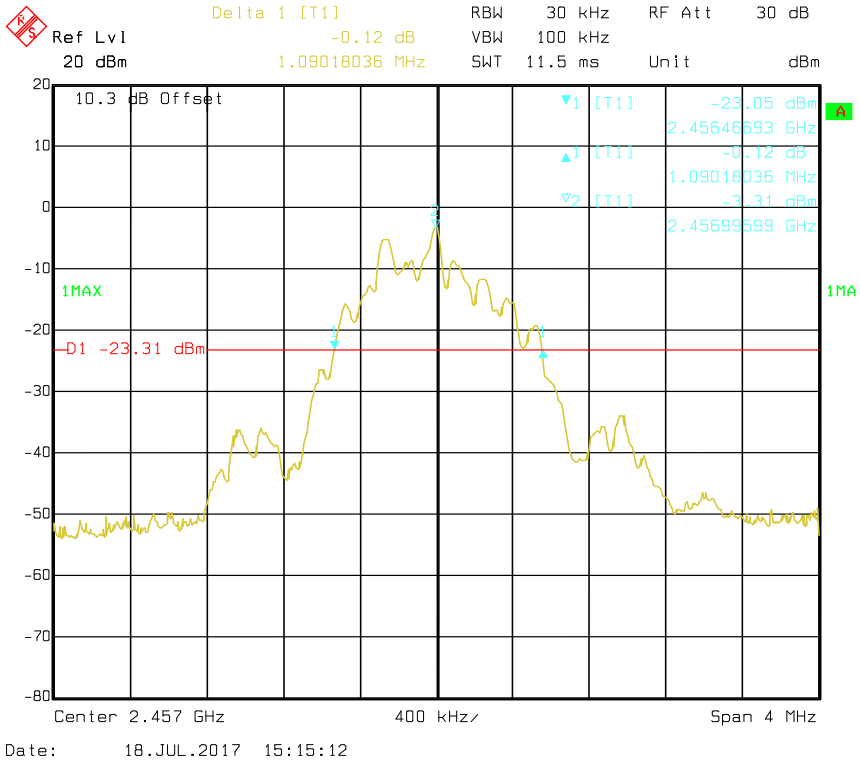
Test Results

Test Mode: Transmitting

Channel	Frequency (MHz)	20 dB Emission Bandwidth (MHz)
Middle	2457	1.090

Please refer to the following tables and plots.

Middle Channel



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