



FCC PART 15.249

TEST REPORT

For

GALAXYWIND Network System Co., Ltd.

GalaxyWind building, No.5 Xinxin road, Shenzhen High-Tech Industry Park, Nanshan, Shenzhen, China

FCC ID: 2AES6IWULINKS1

Report Type: Original Report	Product Type: iWulink S1 MiNi Smart Home Host
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Report Number: <u>RSH160513052-00A</u>	
Report Date: <u>2016-06-28</u>	
Reviewed By: <u>RF Engineer</u>	
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Note: This test report is prepared for the customer shown above and for the equipment described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *GALAXYWIND Network System Co., Ltd.* 's product, model number: *iWulink S101-1.2 (FCC ID: 2AES6IWULINKS1)* or the "EUT" in this report was an *iWulink S1 MiNi Smart Home Host*, which was measured approximately: 7.8 cm (L) x 2.8 cm (W) x 0.9 cm (H), rated with input voltage: DC 5.0 V from USB Port.

Note: For the product, series model iWulink S101-1.2, iWulink S101-1.1, iWulink S101-1.0 and PA -W5 are identical schematics only named differently. iWulink S101-1.2 was selected for fully testing, the detailed differences bewteen them were explained and stated in the attached product similarity declaration letter by the applicant.

**All measurement and test data in this report was gathered from production sample serial number: 160513052 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2016-05-13.*

Objective

This type approval report is prepared on behalf of *GALAXYWIND Network System Co., Ltd.* in accordance with Part 2-Subpart J, and Part 15-Subparts A, B and C of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.209 and 15.249 rules.

Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS submissions with FCC ID: 2AES6IWULINKS1.

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.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement uncertainty with radiated emission is 5.81 dB for 30MHz-1GHz and 4.88 dB for above 1GHz, 1.95dB for conducted measurement.

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China.

Test site at Bay Area Compliance Laboratories Corp. (Shenzhen) 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 October 31, 2013. 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.: 382179. 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

Justification

The system was configured for testing in engineering mode.

EUT Exercise Software

The software “SecureCRT” was used for testing, which was provided by manufacturer.

Equipment Modifications

No modifications were made to the unit tested.

Support Equipment List and Details

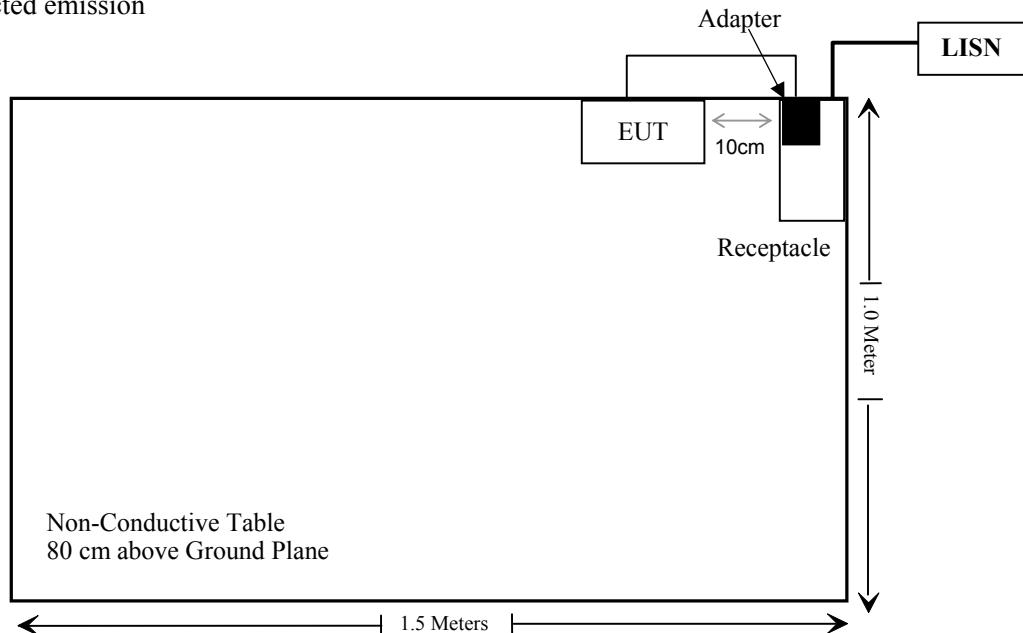
Manufacturer	Description	Model	Serial Number
MICROMAX	adaptor	Q346	N/A

External I/O Cable

Cable Description	Length (m)	From Port	To
Un-shielding Detachable USB Cable	1.0	EUT	Adapter

Block Diagram of Test Setup

For conducted emission



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207(a)	Conduction Emissions	Compliance
15.205, §15.209, §15.249	Radiated Emissions	Compliance
§15.215 (c)	20 dB 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

The EUT used two PCB antenna arrangement and the gain is 3 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliant.

FCC §15.107 – AC LINE CONDUCTED EMISSIONS

Applicable Standard

According to FCC §15.107

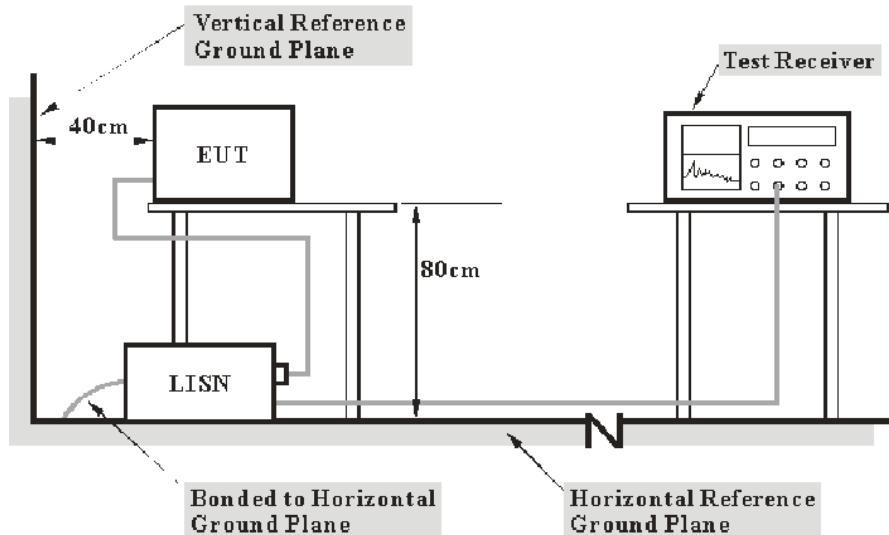
Measurement Uncertainty

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. (Shenzhen) is shown as below. And the uncertainty will not be taken into consideration for the test data recorded in the report

Port	Measurement uncertainty
AC Mains	3.34 dB (k=2, 95% level of confidence)
CAT 3	3.72 dB (k=2, 95% level of confidence)
CAT 5	3.74 dB (k=2, 95% level of confidence)
CAT 6	4.54 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 measurement procedure of EUT setup is according with per ANSI C63.10-2013. The related limit was specified in FCC Part 15.207.

The spacing between the peripherals was 10 cm.

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

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

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2016-06-03	2017-06-03
Rohde & Schwarz	LISN	ENV216	3560.6650.12-101613-Yb	2015-12-01	2016-12-01
Rohde & Schwarz	Transient Limitor	ESH3Z2	DE25985	2016-05-14	2017-05-13
Rohde & Schwarz	CE Test software	EMC 32	V8.53	NCR	NCR
Ducommun technologies	Conducted Emission Cable	RG-214	CB031	2015-06-15	2016-06-15

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

Corrected Factor & Margin Calculation

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

$$\text{Correction Factor} = \text{LISN VDF} + \text{Cable Loss} + \text{Transient Limiter Attenuation}$$

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:

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

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.107, the worst margin as below:

14.1 dB at 0.277500 MHz in the Neutral conducted

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level is in compliance with the limit if

$$L_m + U_{(Lm)} \leq L_{\lim} + U_{\text{cisp}}$$

In BACL., $U_{(Lm)}$ is less than U_{cisp} , if L_m is less than L_{\lim} , it implies that the EUT complies with the limit.

Test Data

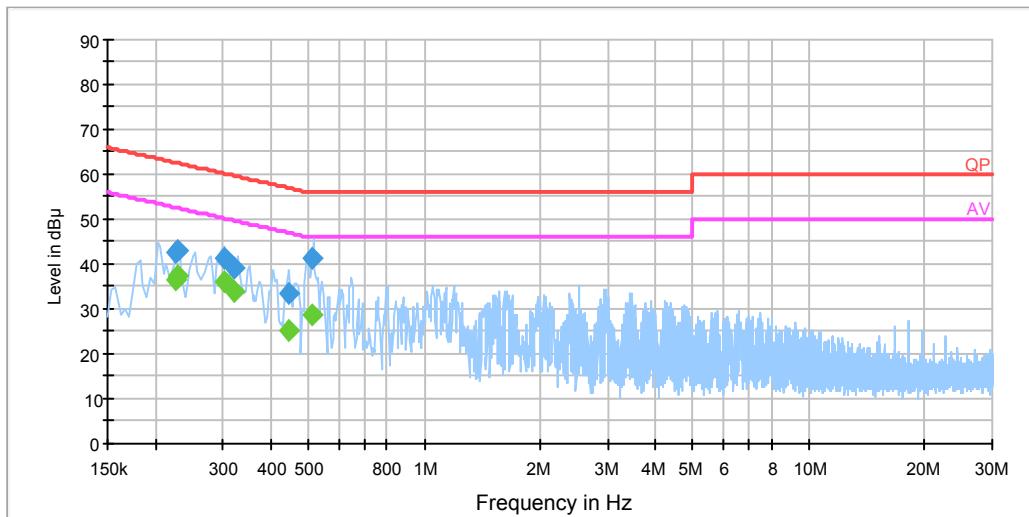
Environmental Conditions

Temperature:	25 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Vincent Zheng on 2016-06-12.

EUT Operation Mode: Transmitting

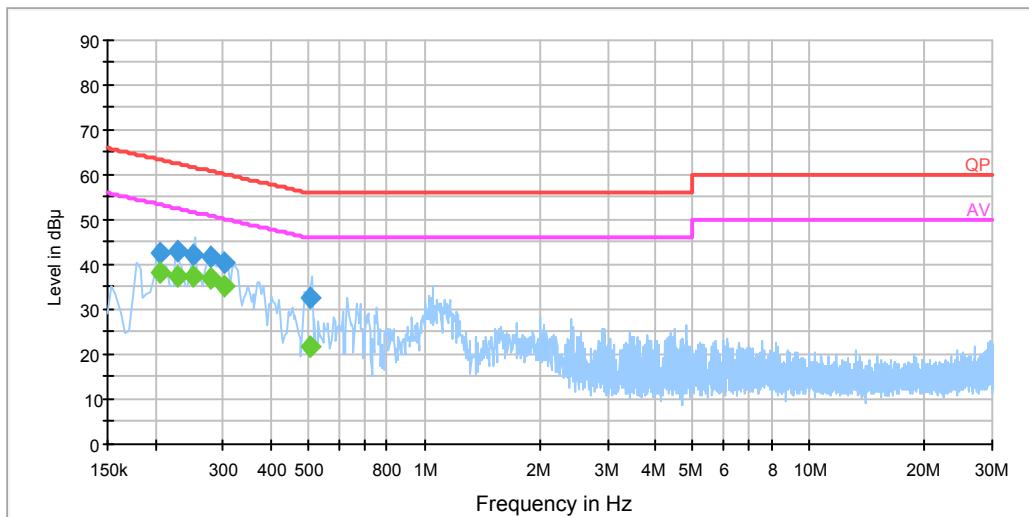
EMI Auto Test L



Frequency (MHz)	Corrected Amplitude (dB μ V)	Correction Factor (dB)	Limit (dB μ V)	Margin (dB)	Detector (PK/Ave./QP)
0.225500	42.4	20.0	62.6	20.2	QP
0.229500	43.0	20.0	62.5	19.5	QP
0.301470	41.5	19.9	60.2	18.7	QP
0.321110	39.3	19.9	59.7	20.4	QP
0.443310	33.3	19.9	57.0	23.7	QP
0.510290	41.5	19.9	56.0	14.5	QP
0.225500	36.6	20.0	52.6	16.0	Ave.
0.229500	37.3	20.0	52.5	15.2	Ave.
0.301470	36.0	19.9	50.2	14.2	Ave.
0.321110	34.1	19.9	49.7	15.6	Ave.
0.443310	25.2	19.9	47.0	21.8	Ave.
0.510290	28.8	19.9	46.0	17.2	Ave.

AC 120V/60 Hz, Neutral

EMI Auto Test N



Frequency (MHz)	Corrected Amplitude (dB μ V)	Correction Factor (dB)	Limit (dB μ V)	Margin (dB)	Detector (PK/Ave./QP)
0.206500	42.8	20.0	63.3	20.5	QP
0.229500	43.0	20.0	62.5	19.5	QP
0.249500	42.3	20.0	61.8	19.5	QP
0.277500	41.7	19.9	60.9	19.2	QP
0.302500	40.5	19.9	60.2	19.7	QP
0.502350	32.7	19.9	56.0	23.3	QP
0.206500	38.4	20.0	53.3	14.9	Ave.
0.229500	37.3	20.0	52.5	15.2	Ave.
0.249500	37.2	20.0	51.8	14.6	Ave.
0.277500	36.8	19.9	50.9	14.1	Ave.
0.302500	35.1	19.9	50.2	15.1	Ave.
0.502350	21.7	19.9	46.0	24.3	Ave.

Note:

- 1) Correction Factor =LISN VDF (Voltage Division Factor) + Cable Loss + Transient Limiter Attenuation
The corrected factor has been input into the transducer of the test software.
- 2) Corrected Amplitude = Reading + Correction Factor
- 3) Margin = Limit – Corrected Amplitude

FCC§15.205, §15.209 & §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.

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. (Shenzhen) is 5.81 dB for 30MHz-1GHz, 4.88 dB for above 1GHz, and it will not be taken into consideration for the test data recorded in the report

Test Equipment Setup

The spectrum analyzer or receiver is set as:

Below 1000MHz:

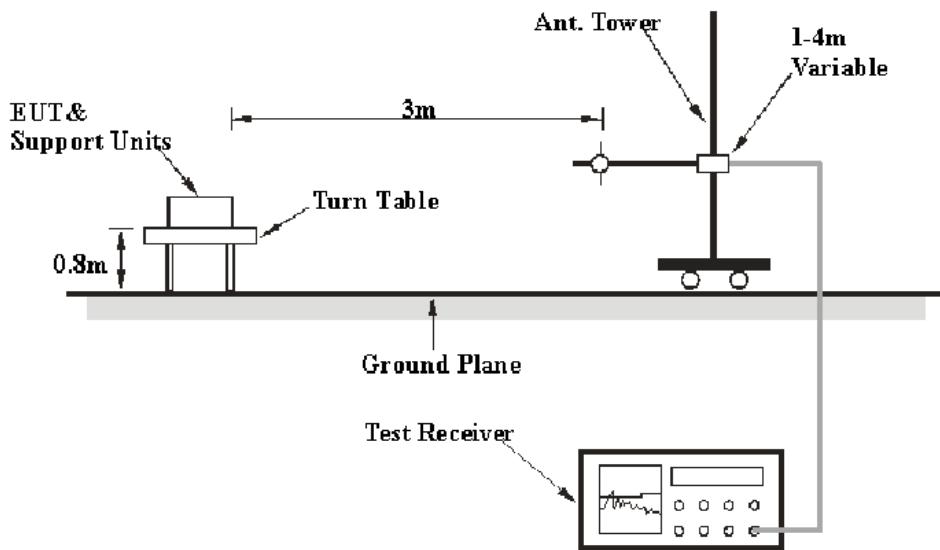
RBW = 100 kHz / VBW = 300 kHz / Sweep = Auto

Above 1000MHz:

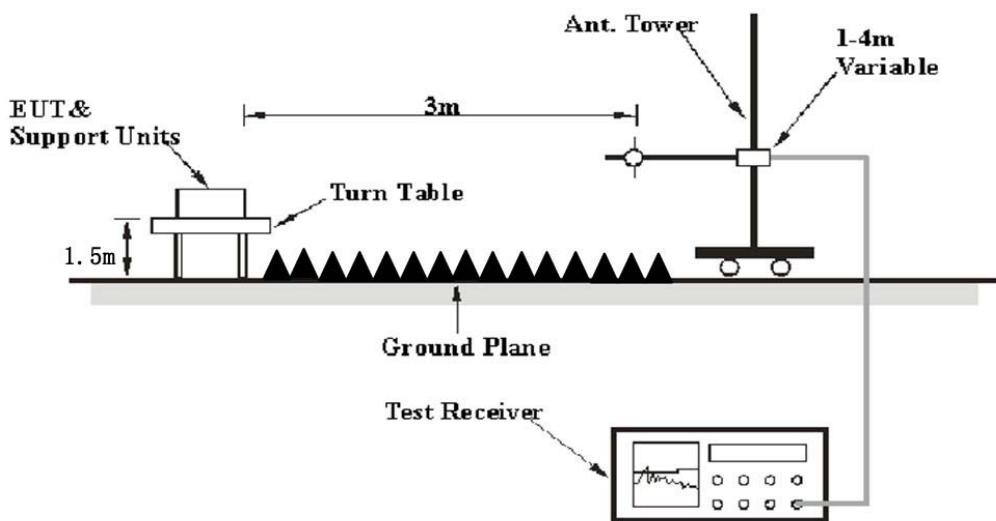
Peak: RBW = 1MHz / VBW = 1MHz / Sweep = Auto
Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

EUT Setup

Below 1G:



Above 1GHz:



The radiated emission and out of band 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 15.209/15.205 and FCC 15.249 limits.

Test Procedure

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

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 meter, and the EUT is placed on a turntable, which is 0.8 meter above ground plane for below 1GHz and 1.5 meter above ground plane for above 1GHz, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

Corrected Amplitude & Margin Calculation

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

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

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

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
HP	Amplifier	HP8447E	1937A01046	2016-05-06	2017-05-05
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2015-11-03	2016-11-03
Sunol Sciences	Bi-log Antenna	JB1	A040904-2	2014-12-07	2017-12-06
Mini	Amplifier	ZVA-183-S+	5969001149	2016-04-23	2017-04-22
A.H. System	Horn Antenna	SAS-200/571	135	2015-08-18	2018-08-17
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2015-12-11	2016-12-11
the electro-Mechanics Co.	Horn Antenna	3116	9510-2270	2013-10-14	2016-10-13
TDK	Chamber	Chamber A	2#	2015-10-15	2018-10-15
TDK	Chamber	Chamber B	1#	2015-07-22	2016-07-22
DUCOMMUN	Pre-amplifier	ALN-22093530-01	991373-01	2015-08-03	2016-08-03
Rohde & Schwarz	Auto test Software	EMC32	V9.10	NCR	NCR
Ducommun technologies	RF Cable	UFA210A-1-4724-30050U	MFR64369 223410-001	2015-06-15	2016-06-15
Ducommun technologies	RF Cable	104PEA	218124002	2015-06-15	2016-06-15
Ducommun technologies	RF Cable	RG-214	1	2015-06-15	2016-06-15
Ducommun technologies	RF Cable	RG-214	2	2015-06-15	2016-06-15

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

Test Results Summary

According to the data in the following table, the worst margin reading as below:

5.54 dB at 7440.00 MHz in the Vertical polarization for High Channel

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cisp}$$

In BACL, $U_{(Lm)}$ is less than U_{cisp} , if L_m is less than L_{lim} , it implies that the EUT complies with the limit.

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Vincent Zheng on 2016-06-12.

30 MHz to 25 GHz:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dB μ V/m)	FCC Part 15.249/15.205/15.209	
	Reading (dB μ V)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dB μ V/m)	Margin (dB)
Low Channel (2403 MHz)									
211.29	41.47	QP	44	1.9	H	-9.80	31.67	43.5	11.83
2403.00	102.85	PK	323	2.5	H	-6.46	96.39	114	17.61
2403.00	96.25	Ave.	323	2.5	H	-6.46	89.79	94	4.21
2403.00	98.38	PK	165	1.7	V	-6.46	91.92	114	22.08
2403.00	93.53	Ave.	165	1.7	V	-6.46	87.07	94	6.93
2398.26	68.53	PK	194	1.9	H	-6.46	62.07	74	11.93
2398.26	41.86	Ave.	194	1.9	H	-6.46	35.40	54	18.60
2396.79	67.25	PK	185	1.3	H	-6.46	60.79	74	13.21
2396.79	40.85	Ave.	185	1.3	H	-6.46	34.39	54	19.61
2497.38	56.36	PK	11	1.9	H	-4.74	51.62	74	22.38
2497.38	38.13	Ave.	11	1.9	H	-4.74	33.39	54	20.61
4806.00	45.98	PK	72	1.7	V	3.79	49.77	74	24.23
4806.00	32.53	Ave.	72	1.7	V	3.79	36.32	54	17.68
7209.00	43.81	PK	317	2.0	V	9.79	53.60	74	20.40
7209.00	29.59	Ave.	317	2.0	V	9.79	39.38	54	14.62
Middle Channel (2440 MHz)									
211.29	42.58	QP	87	2.2	H	-9.80	32.78	43.5	10.72
2440.00	100.31	PK	181	2.4	H	-6.46	93.85	114	20.15
2440.00	96.73	Ave.	181	2.4	H	-6.46	90.27	94	3.73
2440.00	97.25	PK	345	1.8	V	-6.46	90.79	114	23.21
2440.00	92.41	Ave.	345	1.8	V	-6.46	85.95	94	8.05
2398.26	61.13	PK	308	1.4	H	-6.46	54.67	74	19.33
2398.26	33.46	Ave.	308	1.4	H	-6.46	27.00	54	27.00
2484.28	53.18	PK	29	1.6	H	-4.74	48.44	74	25.56
2484.28	32.62	Ave.	29	1.6	H	-4.74	27.88	54	26.12
2484.52	54.02	PK	229	2.2	H	-4.74	49.28	74	24.72
2484.52	35.18	Ave.	229	2.2	H	-4.74	30.44	54	23.56
4880.00	48.74	PK	243	1.9	V	3.56	52.30	74	21.70
4880.00	31.29	Ave.	243	1.9	V	3.56	34.85	54	19.15
7320.00	46.28	PK	14	2.2	V	10.11	56.39	74	17.61
7320.00	33.16	Ave.	14	2.2	V	10.11	43.27	54	10.73

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dB μ V/m)	FCC Part 15.249/15.205/15.209	
	Reading (dB μ V)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dB μ V/m)	Margin (dB)
High Channel (2480 MHz)									
211.29	42.18	QP	48	1.8	H	-9.80	32.38	43.5	11.12
2480.00	100.25	PK	83	2.4	H	-4.74	95.51	114	18.49
2480.00	94.15	Ave.	83	2.4	H	-4.74	89.41	94	4.59
2480.00	98.21	PK	351	1.2	V	-4.74	93.47	114	20.53
2480.00	90.32	Ave.	351	1.2	V	-4.74	85.58	94	8.42
2398.13	59.26	PK	308	2.4	H	-6.46	52.80	74	21.20
2398.13	31.17	Ave.	308	2.4	H	-6.46	24.71	54	29.29
2483.36	65.21	PK	52	1.2	H	-4.74	60.47	74	13.53
2483.36	38.24	Ave.	52	1.2	H	-4.74	33.50	54	20.50
2484.54	61.38	PK	156	2.2	H	-4.74	56.64	74	17.36
2484.54	43.29	Ave.	156	2.2	H	-4.74	38.55	54	15.45
4960.00	51.37	PK	123	1.4	V	3.19	54.56	74	19.44
4960.00	38.62	Ave.	123	1.4	V	3.19	41.81	54	12.19
7440.00	56.91	PK	159	1.4	V	8.17	65.08	74	8.92
7440.00	40.29	Ave.	159	1.4	V	8.17	48.46	54	5.54

Note:

Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor

Corrected Amplitude = Corrected Factor + Reading

Margin = Limit - Corrected. Amplitude

FCC§15.215(c) - 20dB EMISSION BANDWIDTH

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 indicated 20dB bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2015-12-11	2016-12-11
Ducommun technologies	RF Cable	RG-214	3	2016-06-15	2017-06-15
WEINSCHEL	10dB Attenuator	5324	AU0709	2016-06-18	2017-06-18

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

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	54 %
ATM Pressure:	100.1~101.0 kPa

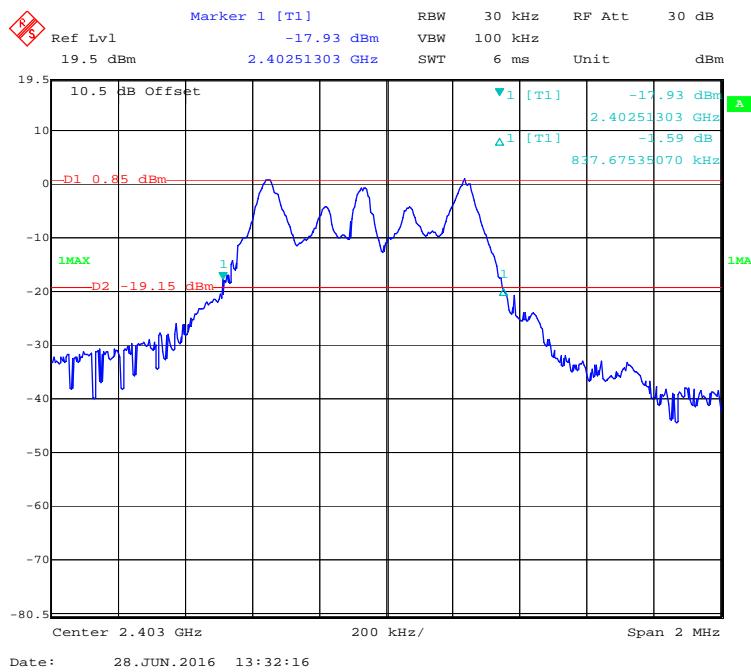
The testing was performed by Vincent Zheng on 2016-06-28.

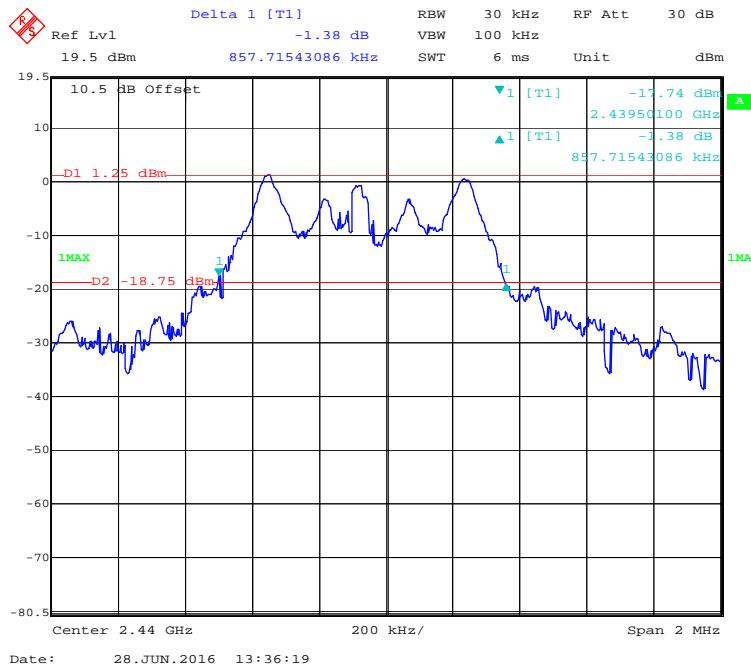
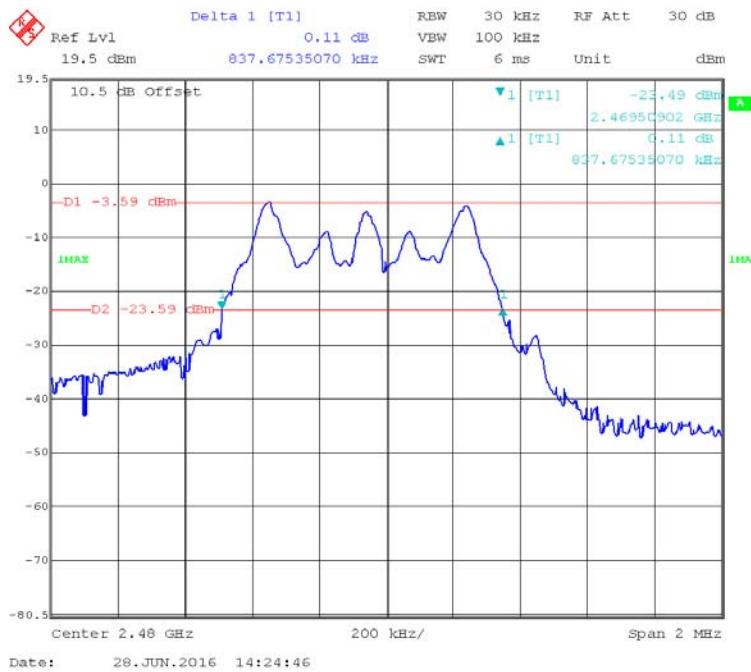
Please refer to the following table and plots.

Test Mode: Transmitting

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2403	0.838
Middle	2440	0.858
High	2480	0.838

Low Channel



Middle Channel**High Channel********* END OF REPORT *******