



FCC PART 15.245

TEST REPORT

For

Hynall intelligent Controls CO.,Ltd

Floor 14th, #531 Nan'pu Road, Shajin, Bao'an District, Shenzhen, China

FCC ID: 2AL7PHNM01

Report Type: Original Report	Product Type: Microwave Motion Sensor Module
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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 *Hynall intelligent Controls CO.,Ltd*'s product, model number: *HNM01 (FCC ID: 2AL7PHNM01)* in this report is a *Microwave Motion Sensor Module* which was measured approximately: 3.17 cm (L) * 2.2 cm (W) * 0.6 cm (H) for Module , rated with input voltage: DC 5.0 V.

** All measurement and test data in this report was gathered from production sample serial number: 1700469 (Assigned by BACL, Kunshan). The EUT supplied by the applicant was received on 2017-03-22.*

Objective

This test report is prepared on behalf of *Hynall intelligent Controls CO.,Ltd* in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, section 15.203, 15.205, 15.209, 15.215 and 15.245 rules.

Related Submittal(s)/Grant(s)

No Related Submittal(s)/Grant(s).

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

Measurement Uncertainty

Item	Uncertainty
AC Power Lines Conducted Emissions	±3.26 dB
Radiated emission	30MHz~1GHz
	Above 1G
Occupied Bandwidth	±0.5kHz
Temperature	±1.0 °C
Humidity	±6%

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Test site at Bay Area Compliance Laboratories Corp. (Kunshan) 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 November 06, 2014. 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.: 815570. 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 engineering mode.

EUT Exercise Software

No exercise software was used

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

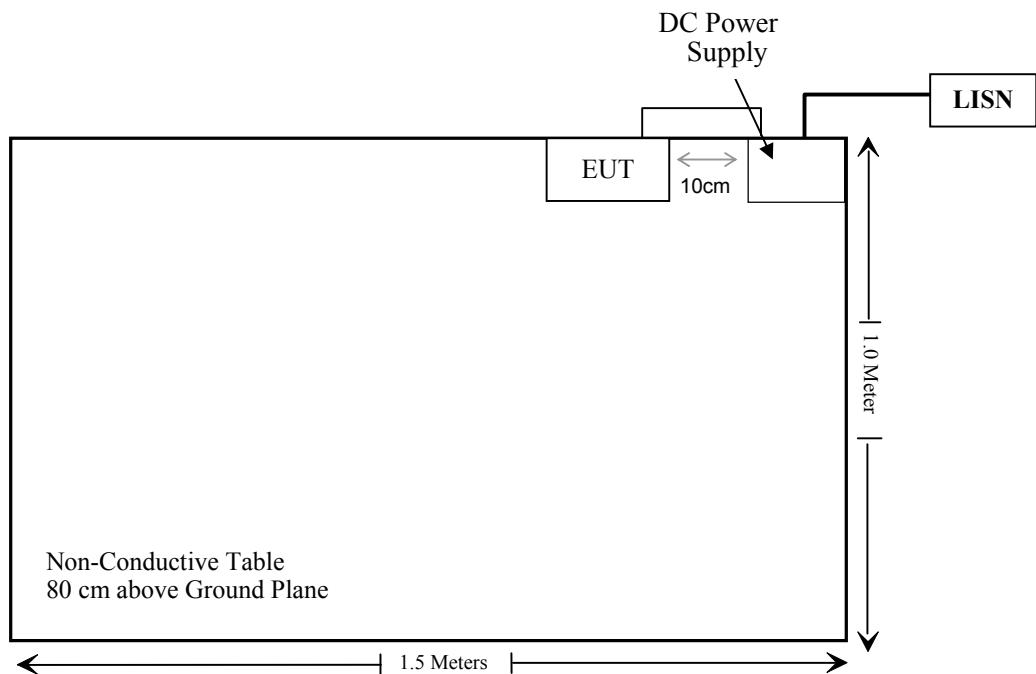
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
N/A	DC Power Supply	N/A	N/A

External I/O Cable

Cable Description	Length (m)	From Port	To
Un-shielding Detachable DC cable	1.0	DC Power Supply	EUT

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207(a)	AC Line Conducted Emissions	Compliance
§15.205, §15.209 & §15.245(b)	Radiated Emissions	Compliance
§15.215(c)	20 dB Emission Bandwidth	Compliance

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
AC Line Conducted test					
Rohde & Schwarz	EMI Test Receiver	ESCS30	834115/007	2016-11-25	2017-11-25
Rohde & Schwarz	LISN	ESH3-Z5	862770/011	2016-10-10	2017-10-10
Rohde & Schwarz	Pulse limiter	ESH3-Z2	879940/0058	2016-06-19	2017-06-18
MICRO-COAX	Coaxial line	UFB-293B-1-0480-50X50	97F0173	2016-09-08	2017-09-08
Rohde & Schwarz	CE Test software	EMC 32	V 09.10.0	NCR	NCR
Radiation test					
Sonoma Instrumen	Amplifier	330	171377	2016-12-12	2017-12-12
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2016-11-25	2017-11-25
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2016-01-09	2019-01-08
Narda	Pre-amplifier	AFS42-00101800	2001270	2016-09-08	2017-09-08
EMCO	Horn Antenna	3116	00084159	2016-10-18	2019-10-17
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2016-11-25	2017-11-25
Rohde & Schwarz	FSV40 Signal Analyzer	FSV40	101116	2016-07-04	2017-07-03
Heatsink required	Amplifier	QLW-18405536-J0	15964001003	2016-10-22	2017-10-22
ETS	Horn Antenna	3115	6229	2016-12-12	2019-12-12
R&S	Auto test Software	EMC32	V 09.10.0	NCR	NCR
haojintech	Coaxial Cable	Cable-1	001	2016-12-12	2017-12-12
haojintech	Coaxial Cable	Cable-2	002	2016-12-12	2017-12-12
haojintech	Coaxial Cable	Cable-3	003	2016-12-12	2017-12-12
MICRO-COAX	Coaxial Cable	Cable-4	004	2016-12-12	2017-12-12
MICRO-COAX	Coaxial Cable	Cable-5	005	2016-12-12	2017-12-12

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

FCC §15.203 – ANTENNA REQUIREMENT

Applicable Standard

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

Antenna Connector Construction

The EUT has one internal antenna arrangement which was permanently attached and the antenna gain is 2.0 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

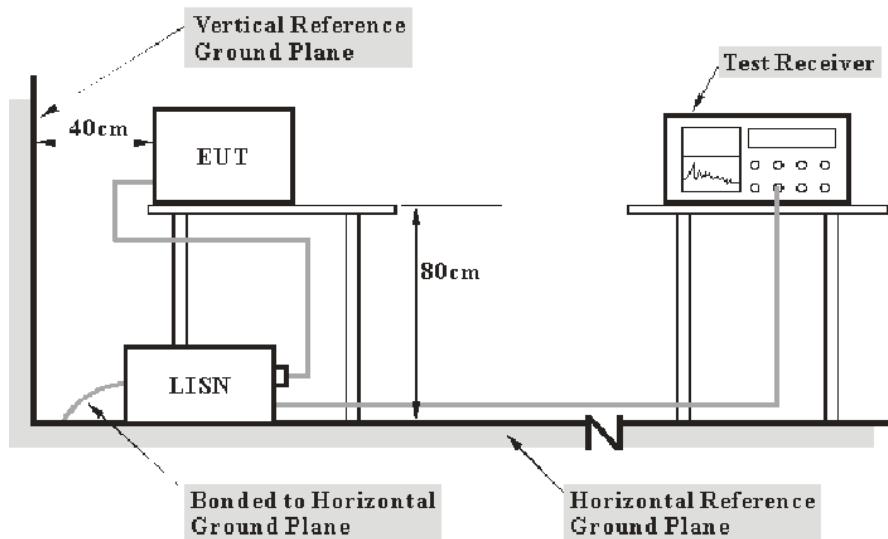
Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207(a)

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 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.

Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN 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 15.207.

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

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

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

Test Data

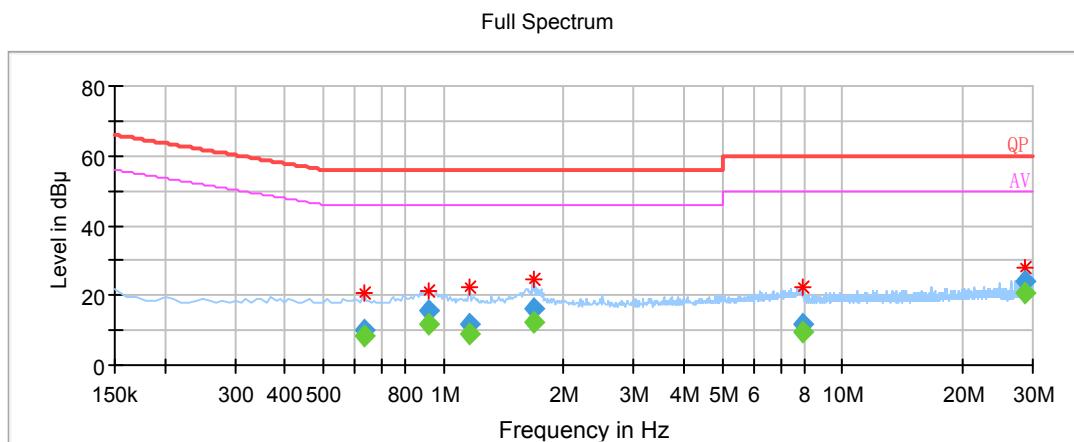
Environmental Conditions

Temperature:	25 °C
Relative Humidity:	46 %
ATM Pressure:	101.0 kPa

The testing was performed by Layne Li on 2017-06-12.

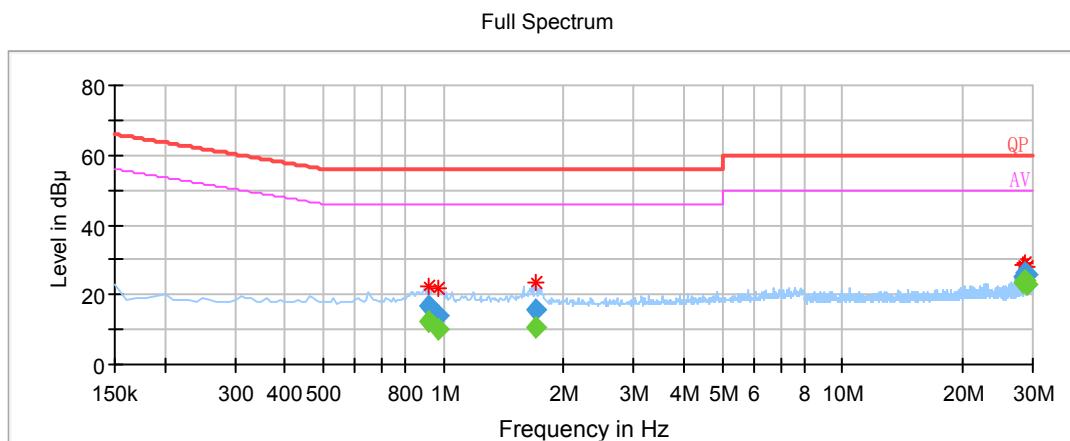
EUT operation mode: Transmitting

AC 120V/60 Hz, Line:



Frequency (MHz)	QuasiPeak (dB μ V)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)	Comment
0.630000	---	8.37	9.000	L1	10.0	37.63	46.00	Compliance
0.630000	10.28	---	9.000	L1	10.0	45.72	56.00	Compliance
0.920000	---	11.68	9.000	L1	9.9	34.32	46.00	Compliance
0.920000	15.65	---	9.000	L1	9.9	40.35	56.00	Compliance
1.160000	---	8.89	9.000	L1	9.9	37.11	46.00	Compliance
1.160000	11.54	---	9.000	L1	9.9	44.46	56.00	Compliance
1.690000	---	12.05	9.000	L1	9.9	33.95	46.00	Compliance
1.690000	16.46	---	9.000	L1	9.9	39.54	56.00	Compliance
7.930000	---	9.58	9.000	L1	10.0	40.42	50.00	Compliance
7.930000	11.95	---	9.000	L1	10.0	48.05	60.00	Compliance
28.560000	---	20.68	9.000	L1	10.6	29.32	50.00	Compliance
28.560000	23.85	---	9.000	L1	10.6	36.15	60.00	Compliance

AC 120V/60 Hz, Neutral



Frequency (MHz)	QuasiPeak (dB μ V)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)	Comment
0.920000	---	12.51	9.000	N	10.0	33.49	46.00	Compliance
0.920000	16.71	---	9.000	N	10.0	39.29	56.00	Compliance
0.970000	---	10.03	9.000	N	9.9	35.97	46.00	Compliance
0.970000	13.83	---	9.000	N	9.9	42.17	56.00	Compliance
1.710000	---	10.79	9.000	N	9.9	35.21	46.00	Compliance
1.710000	15.70	---	9.000	N	9.9	40.30	56.00	Compliance
28.320000	---	23.57	9.000	N	10.3	26.43	50.00	Compliance
28.320000	25.36	---	9.000	N	10.3	34.64	60.00	Compliance
28.560000	---	23.90	9.000	N	10.3	26.10	50.00	Compliance
28.560000	26.13	---	9.000	N	10.3	33.87	60.00	Compliance
29.110000	---	22.81	9.000	N	10.3	27.19	50.00	Compliance
29.110000	25.63	---	9.000	N	10.3	34.37	60.00	Compliance

Note:

- 1) Corrected Amplitude = Reading + Correction Factor
- 2) Correction Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation
- 3) Margin = Limit – Corrected Amplitude

FCC §15.205, §15.209 & §15.245(b) – RADIATED EMISSIONS

Applicable Standard

As per FCC§15.245 (b), the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

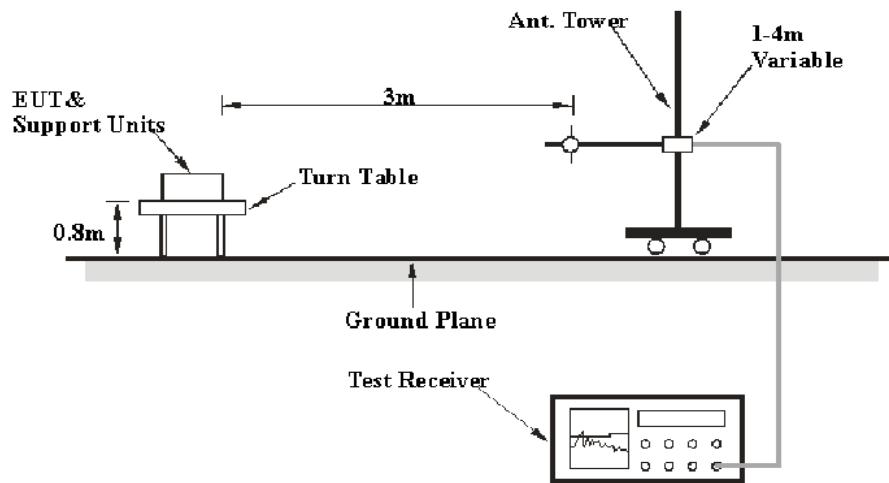
Fundamental frequency (MHz)	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (millivolts/meter)
902–928	500	1.6
2435–2465	500	1.6
5785–5815	500	1.6
10500–10550	2500	25.0
24075–24175	2500	25.0

(1) Regardless of the limits shown in the above table, harmonic emissions in the restricted bands below 17.7 GHz, as specified in §15.205, shall not exceed the field strength limits shown in §15.209. Harmonic emissions in the restricted bands at and above 17.7 GHz shall not exceed the following field strength limits:

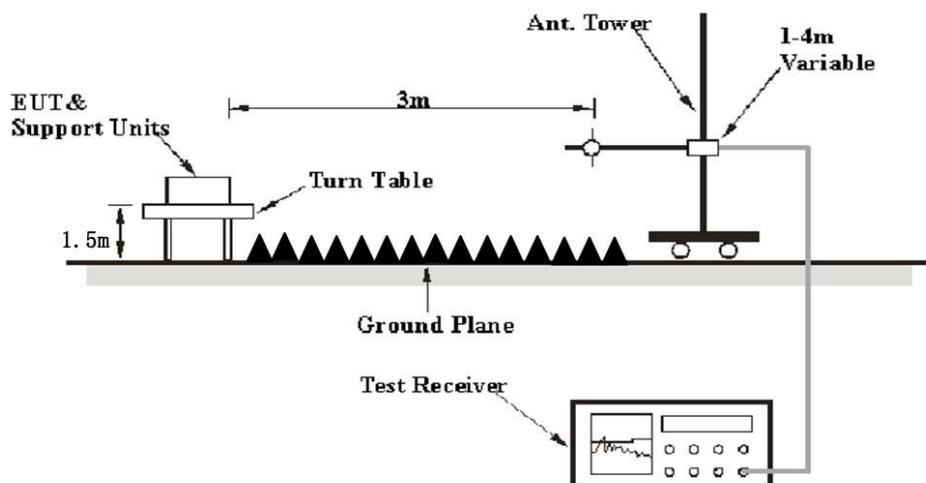
- (i) For the second and third harmonics of field disturbance sensors operating in the 24075-24175 MHz band and for other field disturbance sensors designed for use only within a building or to open building doors, 25.0 mV/m.
- (ii) For all other field disturbance sensors, 7.5 mV/m.
- (iii) Field disturbance sensors designed to be used in motor vehicles or aircraft must include features to prevent continuous operation unless their emissions in the restricted bands, other than the second and third harmonics from devices operating in the 24075-24175 MHz band, fully comply with the limits given in §15.209. Continuous operation of field disturbance sensors designed to be used in farm equipment, vehicles such as fork lifts that are intended primarily for use indoors or for very specialized operations, or railroad locomotives, railroad cars and other equipment which travels on fixed tracks is permitted. A field disturbance sensor will be considered not to be operating in a continuous mode if its operation is limited to specific activities of limited duration (e.g., putting a vehicle into reverse gear, activating a turn signal, etc.).
- (2) Field strength limits are specified at a distance of 3 meters.
- (3) 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.
- (4) The emission limits shown above are based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply.

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters, using the setup accordance with the ANSI ANSI C63.10-2013. The specification used was the FCC 15.209, 205 and FCC 15.245 limits.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 40 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	1 MHz	3 MHz	/	PK
	1 MHz	10 Hz	/	Ave.

Test Procedure

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

All final data was recorded in Quasi-peak detection mode for frequency range of 30 MHz -1 GHz and peak and Average detection modes for frequencies above 1 GHz.

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 Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.245.

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

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

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.

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	46 %
ATM Pressure:	101.0 kPa

The testing was performed by Layne Li on 2017-05-04.

EUT operation mode: Transmitting

30 MHz -40 GHz:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dB μ V/m)	FCC Part 15.245/205/209	
	Reading (dB μ V)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dB μ V/m)	Margin (dB)
253.47	46.78	QP	336	1.3	H	-11.97	34.81	46	11.19
5794.50	84.08	PK	269	1.1	H	3.49	87.57	134	46.43
5794.50	62.43	Ave.	269	1.1	H	3.49	65.92	114	48.08
5794.50	81.9	PK	341	2.5	V	3.49	85.39	134	48.61
5794.50	59.56	Ave.	341	2.5	V	3.49	63.05	114	50.95
5785.00	43.62	PK	245	1.5	H	3.49	47.11	74	26.89
5785.00	29.67	Ave.	245	1.5	H	3.49	33.16	54	20.84
5815.00	42.63	PK	98	2.2	H	3.49	46.12	74	27.88
5815.00	27.44	Ave.	98	2.2	H	3.49	30.93	54	23.07
5585.17	44.46	PK	119	1.1	V	2.61	47.07	74	26.93
5585.17	30.4	AV	119	1.1	V	2.61	33.01	54	20.99
5924.62	44.25	PK	317	1.3	H	3.49	47.74	74	26.26
5924.62	29.06	AV	317	1.3	H	3.49	32.55	54	21.45
11589.00	44.77	PK	276	2.2	H	14.76	59.53	74	14.47
11589.00	28.58	Ave.	276	2.2	H	14.76	43.34	54	10.66
17383.5	42.75	PK	154	1.9	H	19.29	62.04	74	11.96
17383.5	29.45	Ave.	154	1.9	H	19.29	48.74	54	5.26

Note:

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

Corrected Amplitude = Corrected Factor + Reading

Margin = Limit - Corrected. Amplitude

The other spurious emission which is 20dB to the limit was not recorded.

FCC §15.215(c) – 20 dB 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. 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.

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 Data

Environmental Conditions

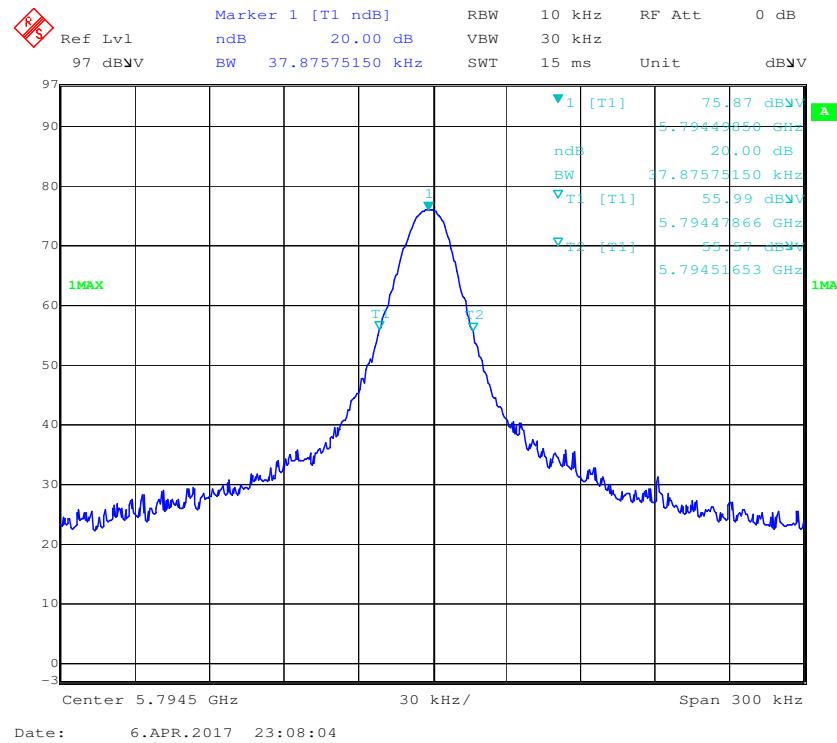
Temperature:	26 °C
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Alisa Gao on 2017-04-06.

EUT operation mode: Transmitting

Test Result: Compliance. Please refer to following table and plots.

20 db bandwidth



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