

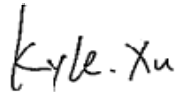

# FCC PART 15.247 TEST REPORT

For

**Nokia Shanghai Bell Co. Ltd.**

No. 388, Ningqiao Rd. Pilot Free Trade Zone, Shanghai, China 201206

**FCC ID: 2ADZR7577WPONAPDC**

<b>Report Type:</b> Original Report	<b>Product Type:</b> WPON
<b>Test Engineer:</b> Kyle Xu 	
<b>Report Number:</b> RSHA181022002-00A	
<b>Report Date:</b> 2018-12-17	
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## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

Applicant	Nokia Shanghai Bell Co. Ltd.
Tested Model	WPON AP-DC
Product Type	WPON
Dimension	252mm(L)*166mm(w)*91.5mm(H)
Power Supply	DC 48V

*\*All measurement and test data in this report was gathered from production sample serial number: 20181022002.  
(Assigned by the BACL. The EUT supplied by the applicant was received on 2018-10-22)*

### Objective

This test report is prepared on behalf of *Nokia Shanghai Bell 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, 15.207, 15.209 and 15.247 rules.

This device is modified base on model: WPON AP-AC, FCC ID: 2ADZR7577WPONAPAC, granted on 2018-12-14, the difference between the Model: WPON AP-DC is change the power supply from “AC 100~240V” to “DC 48V”.

The change made to the device affected AC Line Conducted Emissions test, and Spurious Emissions test, the data for the items recorded in this report, the other items please refer to the related report for FCC ID:2ADZR7577WPONAPAC

### Related Submittal(s)/Grant(s)

FCC Part 15.255 DXX submission with FCC ID: 2ADZR7577WPONAPDC.  
Grant with FCC ID: 2ADZR7577WPONHOU.

### 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 and 558074 D01 15.247 Meas Guidance v05.

All emissions measurement was performed and 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		3.19dB
RF conducted test with spectrum		0.9dB
RF Output Power with Power meter		0.5dB
Radiated emission	30MHz~1GHz	6.11dB
	1GHz~6GHz	4.45dB
	6GHz~18GHz	5.23dB
	18GHz~40GHz	5.65dB
Occupied Bandwidth		0.5kHz
Temperature		1.0℃
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.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01) and the FCC designation No. CN1185 under the FCC KDB 974614 D01. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

## SYSTEM TEST CONFIGURATION

### Description of Test Configuration

Channel list for Bluetooth:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	40	2442
1	2403	...	...
...	...	...	...
...	...	78	2480
39	2441	/	/

EUT was tested with Channel 0, 39 and 78.

### EUT Exercise Software

RF test software: CRT

GFSK Power level: 0C

$\pi/4$ -DQPSK Power level: 0C

8DPSK Power level: 0C

### Special Accessories

No special accessory.

### Equipment Modifications

No modification was made to the EUT tested.

### Support Equipment List and Details

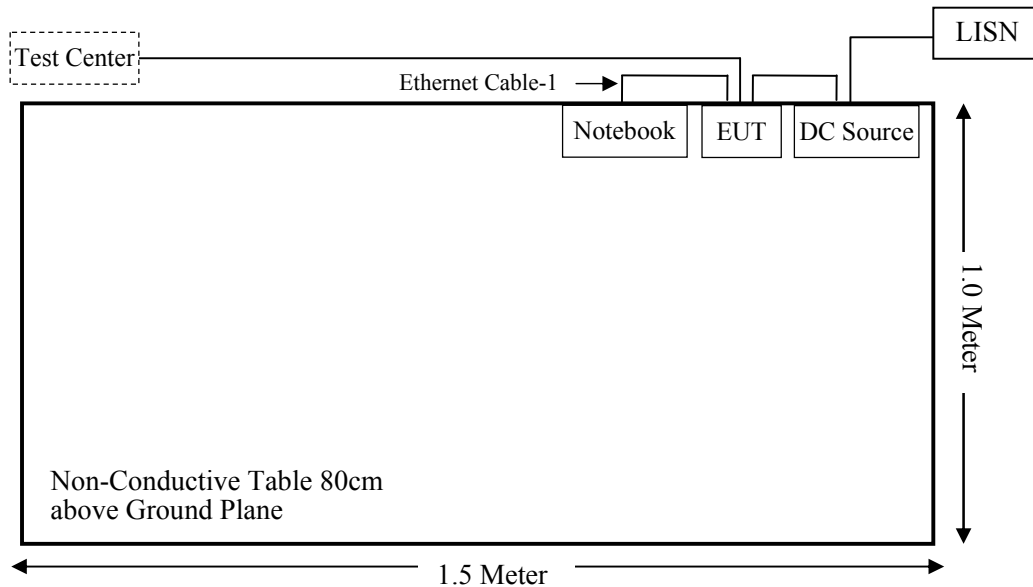
Manufacturer	Description	Model	Serial Number
DELL	Notebook	GX620	D65874152
ZHAOXIN	DC Power Supply	RXN-605D	DC002
Spirent Communications	Test Center	SPT-C1	R18250018

**External I/O Cable**

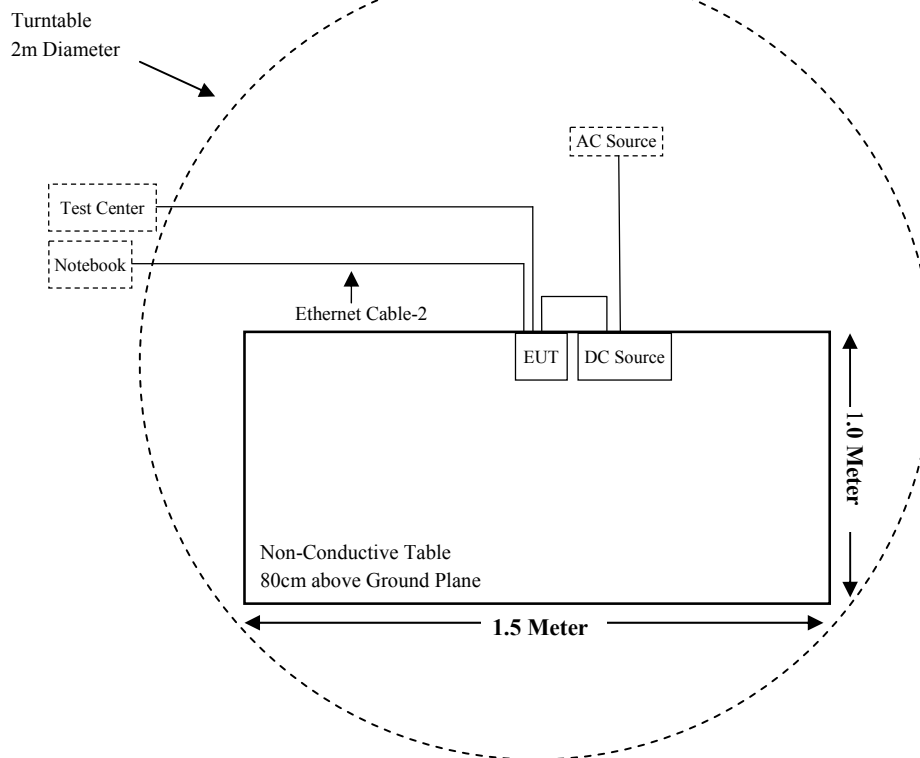
Cable Description	Length (m)	From Port	To
Power Cable-1	1.8	EUT	DC Source
Power Cable-2	1.0	DC Source	LISN/AC Source
Ethernet Cable-1	1.0	EUT	Notebook
Ethernet Cable-2	8.0	EUT	Notebook
Optical Fibre Cable	10	EUT	Test Center

**Block Diagram of Test Setup**

For Conducted Emissions:



For Radiated Emissions (Below 1GHz):



**SUMMARY OF TEST RESULTS**

FCC Rules	Description of Test	Result
§15.247 (I), §1.1310 & §2.1091	MAXIMUM PERMISSIBLE EXPOSURE (MPE)	Compliant
§15.203	Antenna Requirement	Compliant
§15.207(a)	AC Line Conducted Emissions	Compliant
§15.205, §15.209 & §15.247(d)	Radiated Emissions & Restricted Bands Emissions (Below 1GHz)	Compliant
§15.205, §15.209 & §15.247(d)	Radiated Emissions & Restricted Bands Emissions (Above 1GHz)	Compliant*
§15.247(a)(1)	20 dB Emission Bandwidth	Compliant*
§15.247(a)(1)	Channel Separation Test	Compliant*
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliant*
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliant*
§15.247(b)(1)	Peak Output Power Measurement	Compliant*
§15.247(d)	Band edges	Compliant*

Compliant\*: For these items, all the test data please refer to the original report RSHA181022001-00A  
FCC ID: 2ADZR7577WPONAPAC.



**TEST EQUIPMENT LIST**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
<b>Radiated Emission Test (Chamber 1#)</b>					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2018-11-12	2019-11-11
Sunol Sciences	Broadband Antenna	JB3	A090413-1	2016-12-26	2019-12-25
Sonoma Instrument	Pre-amplifier	310N	171205	2018-08-15	2019-08-14
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-8	008	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2018-08-15	2019-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2018-08-15	2019-08-14
<b>Conducted Emission Test</b>					
Rohde & Schwarz	EMI Test Receiver	ESCS30	834115/007	2018-11-12	2019-11-11
Rohde & Schwarz	LISN	ENV216	3560655016	2018-11-12	2019-11-11
BACL	Auto test Software	BACL-EMC	CE001	/	/
Narda	Attenuator/6dB	10690812-2	26850-6	2018-01-10	2019-01-09
MICRO-COAX	Coaxial Cable	Cable-15	015	2018-08-15	2019-08-14

\* **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 §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)**

### **Applicable Standard**

According to subpart 15.247 (i) and subpart 1.1310, 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging Time (minutes)
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f <sup>2</sup> )	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz; \* = Plane-wave equivalent power density

### **Calculated Formulary:**

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$  = power density (in appropriate units, e.g. mW/cm<sup>2</sup>);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

### **Calculated Data:**

Radio	Frequency Range (GHz)	EIRP		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )
		(dBm)	(mW)			
60G Module 1	58.32-62.64	34.2	2630.27	25	0.3349	1.00
60G Module 2	58.32-62.64	32.0	1584.89	25	0.2018	1.00
60G Module 3	58.32-62.64	35.2	3311.31	25	0.4216	1.00
Bluetooth	2.402-2.48	4.6	2.88	25	0.0004	1.00

**Note:**

The output power was declared by manufacturer. (Bluetooth conducted power is -0.3dBm, antenna gain is 4.9dBi)

The three 60GHz radio and Bluetooth can transmit simultaneously:

$$\sum_i \frac{S_i}{S_{Limit,i}}$$

$$= 0.3349/1.00 + 0.2018/1.00 + 0.4216/1.00 + 0.0004/1.00$$

$$= 0.3349 + 0.2018 + 0.4216 + 0.0004$$

$$= 0.9585 < 1.0$$

**Result:** The device complied with the applicable MPE Limit at the 25 cm distance.

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**FCC §15.203 – ANTENNA REQUIREMENT**

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**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.

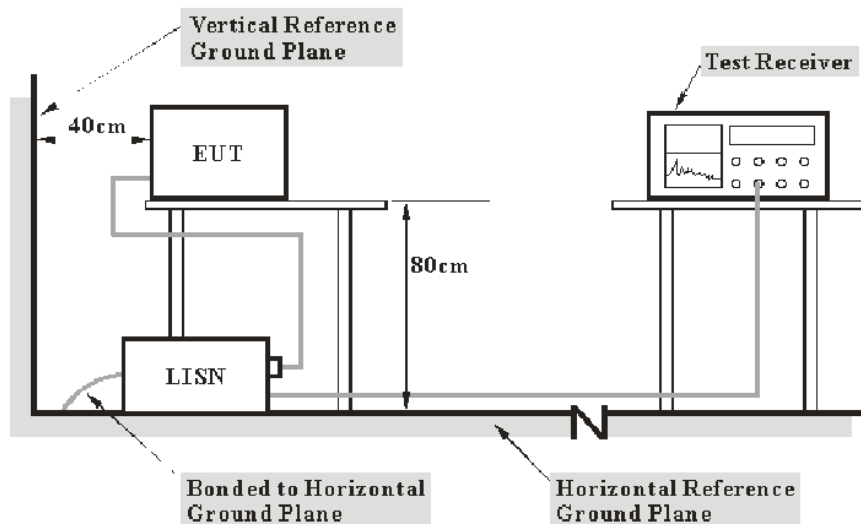
**Antenna Connector Construction**

The EUT has a ceramic antenna for Bluetooth, and the antenna gain is 4.9dBi, which is permanently attached to the unit, 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.

**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 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:

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

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.

### Test Data

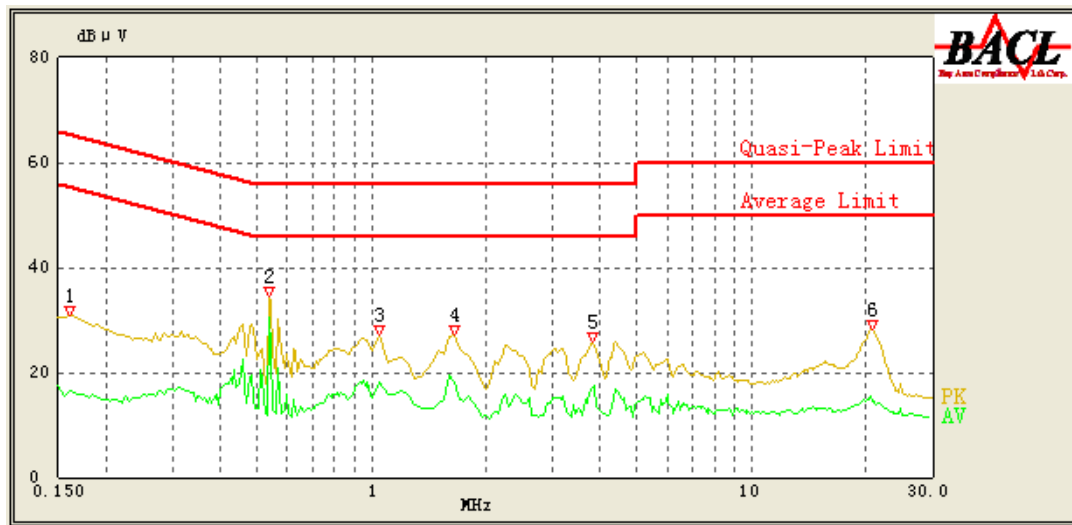
#### Environmental Conditions

<b>Temperature:</b>	25.4 °C
<b>Relative Humidity:</b>	51 %
<b>ATM Pressure:</b>	101.0 kPa

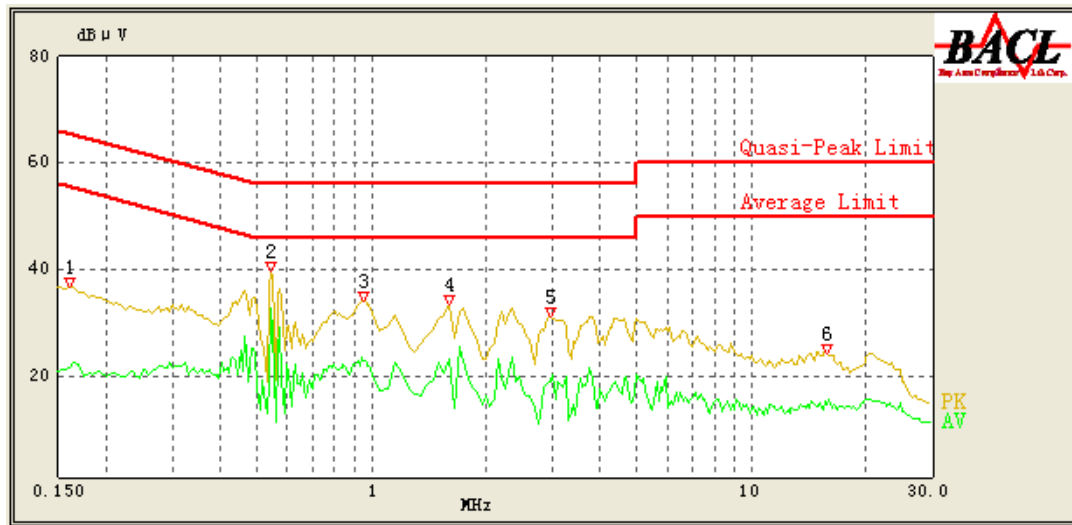
*The testing was performed by Kyle Xu on 2018-11-27.*

*EUT operation mode: Transmitting in low channel of GFSK mode (Worst case)*

## AC 120V/60 Hz, Line



Frequency (MHz)	Corrected Amplitude (dBμV)	Detector (PK/AV/QP)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Limit (dBμV)	Margin (dB)	Comment
0.160	30.88	QP	9.000	L1	16.05	65.46	34.58	Compliant
0.160	16.58	AV	9.000	L1	16.05	55.46	38.88	Compliant
0.540	34.45	QP	9.000	L1	16.05	56.00	21.55	Compliant
0.540	30.64	AV	9.000	L1	16.05	46.00	15.36	Compliant
1.050	27.25	QP	9.000	L1	15.88	56.00	28.75	Compliant
1.050	18.01	AV	9.000	L1	15.88	46.00	27.99	Compliant
1.650	27.01	QP	9.000	L1	15.86	56.00	28.99	Compliant
1.650	18.26	AV	9.000	L1	15.86	46.00	27.74	Compliant
3.800	25.80	QP	9.000	L1	15.85	56.00	30.20	Compliant
3.850	17.38	AV	9.000	L1	15.85	46.00	28.62	Compliant
20.750	28.17	QP	9.000	L1	16.44	60.00	31.83	Compliant
20.750	14.66	AV	9.000	L1	16.44	50.00	35.34	Compliant

**AC 120V/60 Hz, Neutral**

Frequency (MHz)	Corrected Amplitude (dBμV)	Detector (PK/AV/QP)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Limit (dBμV)	Margin (dB)	Comment
0.160	36.69	QP	9.000	N	16.06	65.46	28.77	Compliant
0.160	21.50	AV	9.000	N	16.06	55.46	33.96	Compliant
0.545	39.64	QP	9.000	N	16.08	56.00	16.36	Compliant
0.545	32.72	AV	9.000	N	16.08	46.00	13.28	Compliant
0.955	34.22	QP	9.000	N	15.95	56.00	21.78	Compliant
0.950	22.75	AV	9.000	N	15.95	46.00	23.25	Compliant
1.600	33.28	QP	9.000	N	15.92	56.00	22.72	Compliant
1.600	23.35	AV	9.000	N	15.92	46.00	22.65	Compliant
2.950	31.24	QP	9.000	N	15.90	56.00	24.76	Compliant
2.950	19.06	AV	9.000	N	15.90	46.00	26.94	Compliant
15.750	24.34	QP	9.000	N	16.03	60.00	35.66	Compliant
15.750	14.55	AV	9.000	N	16.03	50.00	35.45	Compliant

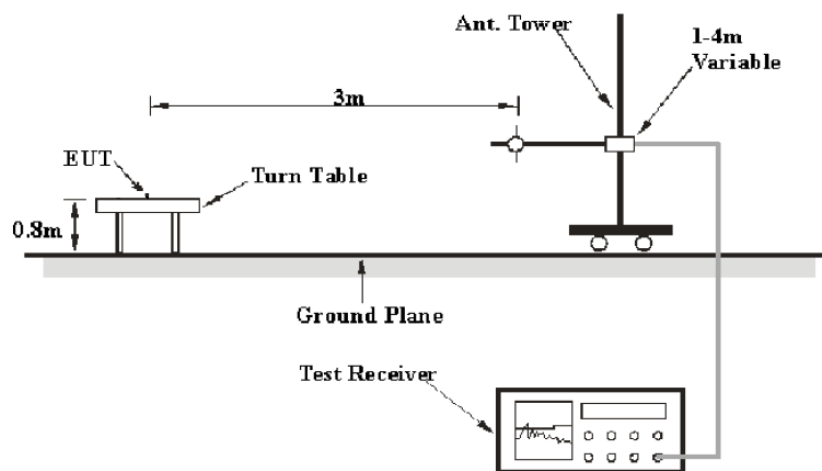
**Note:**

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



**FCC §15.205, §15.209 & §15.247(d) – RADIATED EMISSIONS****Applicable Standard**

FCC §15.205; §15.209; §15.247(d)

**EUT Setup****Below 1 GHz:**

The radiated emission tests were performed in the 3 meters, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209 and FCC 15.247 limits.

**EMI Test Receiver Setup**

The system was investigated from 30 MHz to 1 GHz.

During the radiated emission test, the EMI test receiver Setup was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP

**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.

### 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 15.247.

### Test Data

#### Environmental Conditions

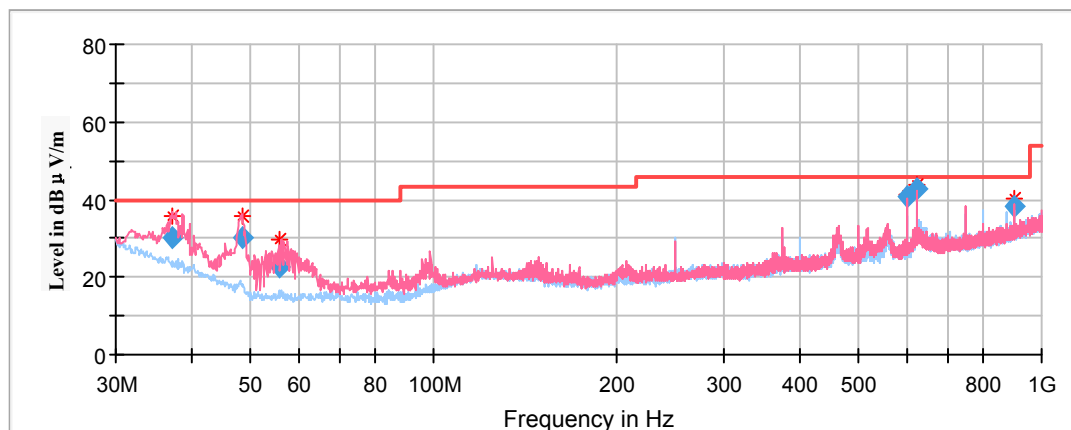
<b>Temperature:</b>	24.3℃
<b>Relative Humidity:</b>	50%
<b>ATM Pressure:</b>	101.3kPa

*The testing was performed by Kyle Xu on 2018-11-15.*

*EUT operation mode: Transmitting*

**Spurious Emission Test:****30MHz-1GHz:**

*Pre-Scan with GFSK,  $\pi/4$ -DQPSK, 8DPSK modes of operation in the X,Y and Z axes of orientation, the worst case GFSK Mode in X-axis of orientation was recorded*



Frequency (MHz)	Corrected Amplitude	Rx Antenna		Turntable Degree	Corrected Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
	Quasi-peak (dBμV/m)	Height (cm)	Polar (H/V)				
37.028350	30.37	101.0	V	286.0	-8.7	40.00	9.63
48.322850	29.98	101.0	V	348.0	-16.4	40.00	10.02
55.594500	22.71	101.0	V	2.0	-17.8	40.00	17.29
600.113550	40.59	101.0	V	163.0	-5.2	46.00	5.41
625.084200	42.96	101.0	V	153.0	-4.7	46.00	3.04
900.148200	38.24	101.0	V	204.0	0.0	46.00	7.76

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