

# FCC EMI TEST REPORT

**REPORT NO.** : FC681301-02  
**MODEL NO.** : EM-S, EM-EP  
**RECEIVED DATE** : Sep. 10, 2016  
**FINAL TESTED DATE** : Oct. 17, 2016  
**ISSUED DATE** : Nov. 17, 2016

**TEST STANDARD** : 47 CFR FCC Rules and Regulations Part 15 Subpart B, Class B Digital Device  
Canada Standard ICES-003, Issue 6, Class B  
IC RSS-247 Issue 1 (May 2015) and RSS-Gen Issue 4

**FCC ID** : SWX-EMS  
**IC ID** : 6545A-EMS

**APPLICANT** : Ubiquiti Networks, Inc.  
**ADDRESS** : 2580 Orchard Parkway San Jose, CA 95131

**Manufacturer** : Ubiquiti Networks, Inc.  
**ADDRESS** : 2580 Orchard Parkway San Jose CA USA

**ISSUED BY** : SPORTON International Inc.  
**LAB ADDRESS** : No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park,  
Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.

- The test result refers exclusively to the test presented test model / sample.
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## Table of Contents

**VERIFICATION OF COMPLIANCE ..... 1**

**1. Summary of Test Results ..... 2**

**2. General Description of Equipment under Test ..... 3**

**3. Test Configuration of Equipment under Test ..... 4**

**4. General Information of Test ..... 7**

**5. Test of Conducted Emission ..... 8**

**6. Test of Radiated Emission ..... 12**

**7. List of Measuring Equipment Used ..... 21**

**8. Uncertainty of Test Site ..... 22**

**Appendix A. TEST PHOTOS ..... A1 ~ A4**

### History of This Test Report

REPORT NO.	VERSION	ISSUED DATE	Description
FC681301-02	Rev. 01	Nov. 17, 2016	Initial issue of report

## **VERIFICATION OF COMPLIANCE**

**EQUIPMENT NAME : EtherMagic Powerline**

**BRAND NAME : UBIQUITI**

**MODEL NO. : EM-S, EM-EP**

**APPLICANT : Ubiquiti Networks, Inc.**

**ADDRESS : 2580 Orchard Parkway San Jose, CA 95131**

**FINAL TESTED DATE : Oct. 17, 2016**

**TEST STANDARD : 47 CFR FCC Rules and Regulations Part 15 Subpart B,  
Class B Digital Device  
Canada Standard ICES-003, Issue 6, Class B  
IC RSS-247 Issue 1 (May 2015) and RSS-Gen Issue 4**

**I HEREBY** DECLARE THAT:

The measurements shown in this test report were made in accordance with the procedures given in **ANSI C63.4 – 2014**.

The above equipment has been tested by **SPORTON International Inc. LAB.**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMI characteristics under the conditions specified in this report.



**Beck Wu**  
**SPORTON INTERNATIONAL INC.**

### 1. Summary of Test Results

After estimating all the combination of every test mode, the result shown as below is the worst case.

The EUT has been tested according to the following specifications.

EMISSION			
Test Standard	Test Type	Result	Remarks
47 CFR FCC Rules and Regulations Part 15 Subpart B, Class B Digital Device, Canada Standard ICES-003, Issue 6, Class B and IC RSS-247 Issue 1 (May 2015) and RSS-Gen Issue 4	AC Power Port Conducted emission test 150 kHz – 30 MHz	PASS	Meet minimum passing margin is -12.40dB at 0.4941MHz.
	Radiated emission test 30 MHz – 1,000 MHz @ 10 m 1,000 MHz –13,000 MHz @ 3 m	PASS	Meet minimum passing margin is -0.10dB at 66.86MHz.

## 2. General Description of Equipment under Test

Product Detail	
Equipment Name	EtherMagic Powerline
Model No.	EM-S, EM-EP
Brand Name	UBIQUITI
Power Supply	AC Utility Power

### 2.1. Feature of Equipment under Test

1. The EUT's support Bluetooth 4.0 function.
2. The EUT has two model names which are identical to each other in all aspects except for the following table:

Brand Name	Model Name	Color
UBIQUITI	EM-S	Black
	EM-EP	White

From the above models, model: EM-EP was selected as representative model for the test and its data was recorded in this report.

3. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

### 3. Test Configuration of Equipment under Test

#### 3.1. Test Mode

The following table is a list of the test modes shown in this test report.

Conducted Emissions	
Test Mode	Description
1	Idle mode (without data transmit)

Radiated Emissions	
Test Mode	Description
1	Normal Link (with data transmit)

Note: The EUT can be used at Y-axis only.

#### 3.2. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

**For AC Power Port Conducted emission test: N/A**

**For Radiated emission test:**

Support Unit	Brand	Model	FCC ID
NB*2	DELL	E6430	DoC
Device	EtherMagic Powerline	EM-EP	SWX-EMS

#### 3.3. EUT Operation Condition

**For AC Power Port Conducted emission test:**

The PLC function of EUT performed "Idle Mode" for the test.

The mobile phone executed "Beta" to make BT connection between EUT and Device. The mobile phone was removed when the connection was made.

**For Radiated emission test:**

During the test, the following programs under WIN 7 were executed:

The remote notebook executed "ping.exe" to link with the EUT to maintain the connection by LAN.

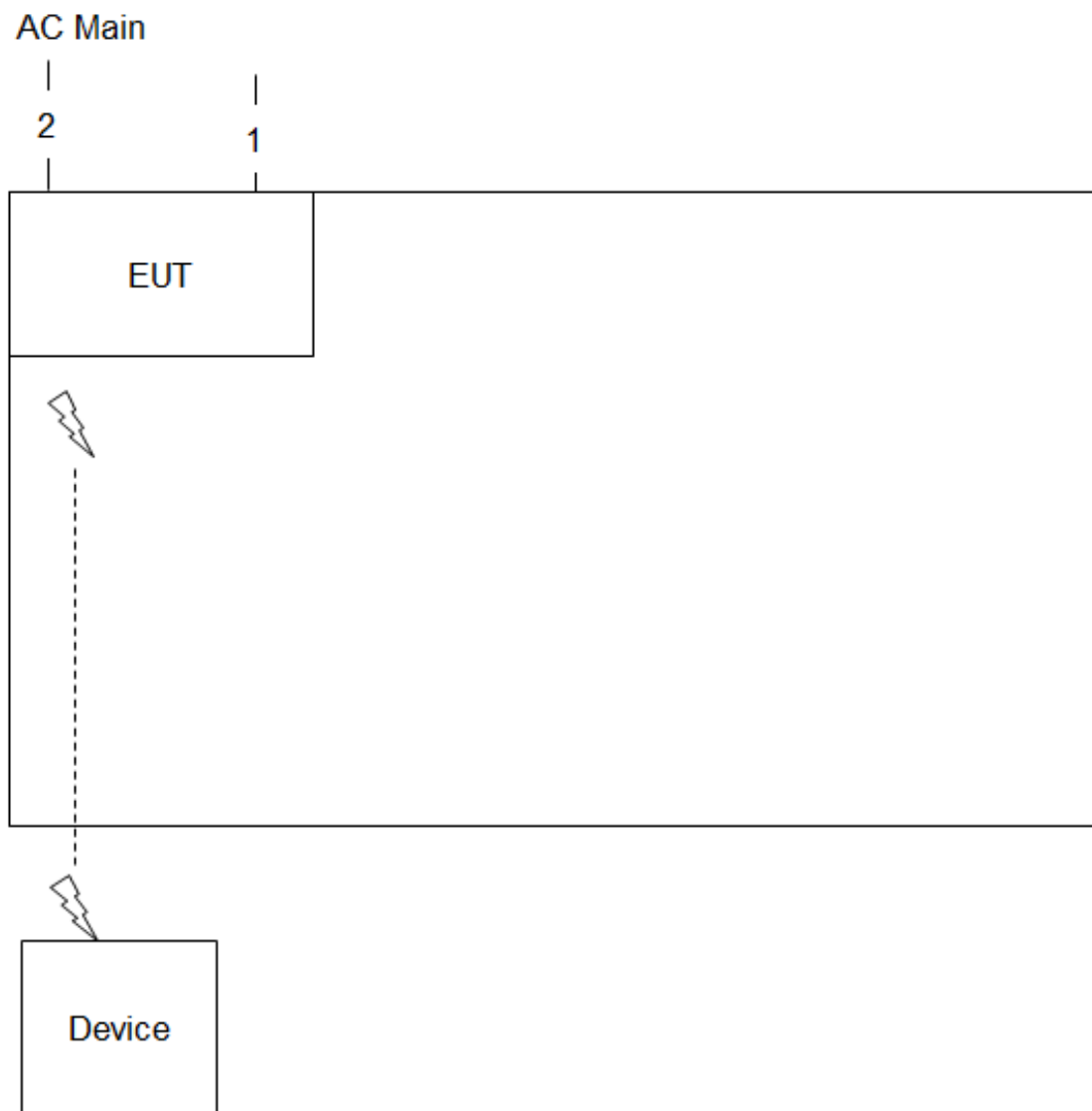
The remote notebook executed "iperf" to link with the EUT to traffic packet data generated software and keep maximum traffic load by LAN.

The mobile phone executed "Beta" to make BT connection between EUT and Device. The mobile phone was removed when the connection was made.

The EUT and the device were connected through power network.

### 3.4. Connection Diagram of Test System

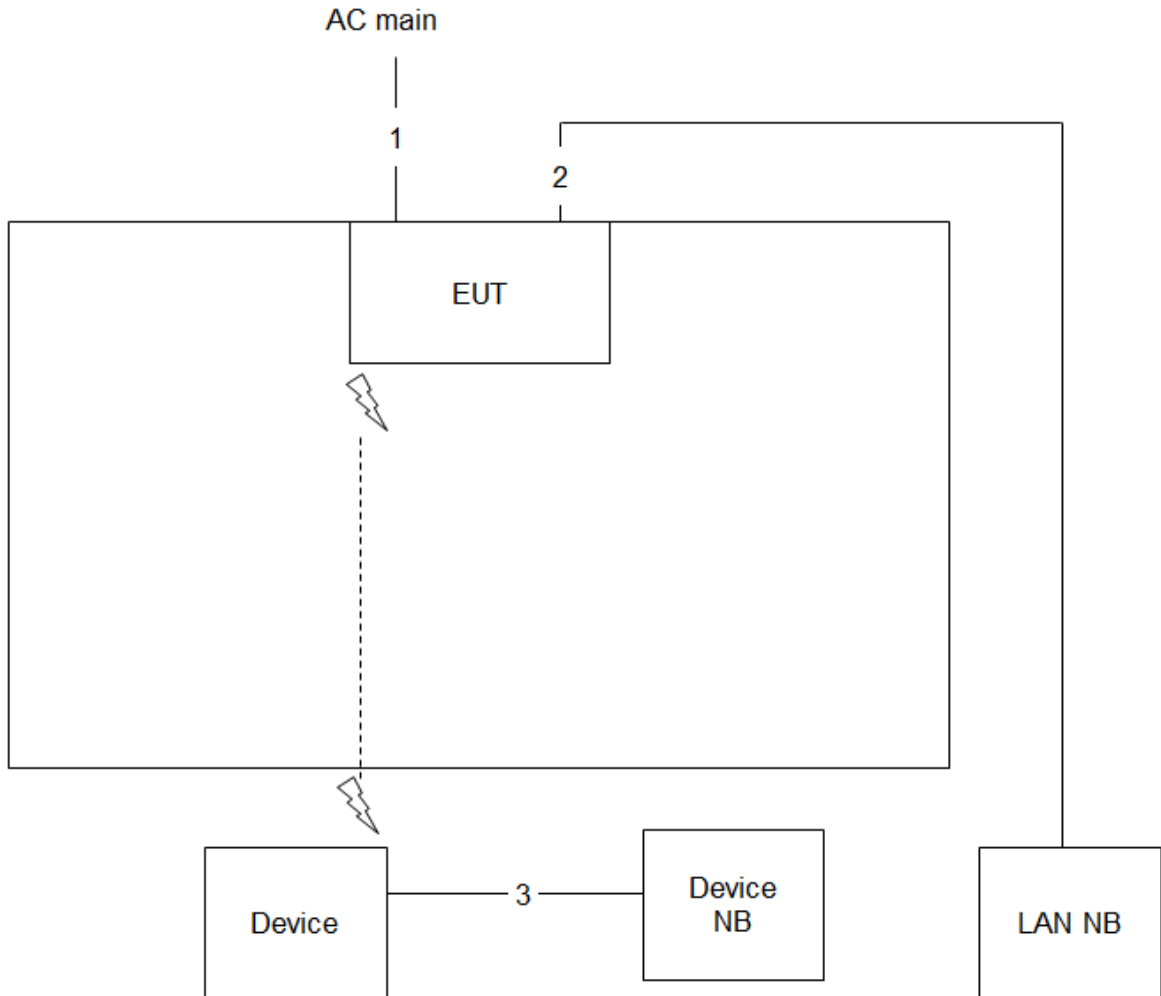
#### 3.4.1. AC Power Line Conduction Emissions Test Configuration



Item	Connection	Shielded	Length
1	RJ-45 cable	No	1m
2	Power cable	No	0.8m



3.4.2. Radiation Emissions Test Configuration



Item	Connection	Shielded	Length
1	Power cable	No	10m
2	RJ-45 cable	No	10m
3	RJ-45 cable	No	1m

## 4. General Information of Test

### 4.1. Test Facility

Test Site Location : No.8, Lane 724, Bo-ai St., Jhubei City,  
Hsinchu County 302, Taiwan, R.O.C.  
TEL : 886-3-656-9065  
FAX : 886-3-656-9085  
Test Site No. : Conduction: CO01-CB  
Radiation: 10CH01-CB

### 4.2. Test Voltage

Power Type	Test Voltage
AC Power Supply	120 V / 60 Hz

### 4.3. Standard for Methods of Measurement

ANSI C63.4-2014

### 4.4. Frequency Range Investigated

Test Items	Frequency Range
Conducted emission test	150 kHz to 30 MHz
Radiated emission test	30 MHz to 13,000 MHz

### 4.5. Test Distance

Test Items	Test Distance
Radiated emission test below 1 GHz (30 MHz to 1,000 MHz)	10 m
Radiated emission test above 1 GHz (1,000 MHz to 5,000 MHz)	3 m

## 5. Test of Conducted Emission

### 5.1. Limit

Frequency (MHz)	QP Limit (dBuV)	AV Limit (dBuV)
0.15~0.5	66~56	56~46
0.5~5	56	46
5~30	60	50

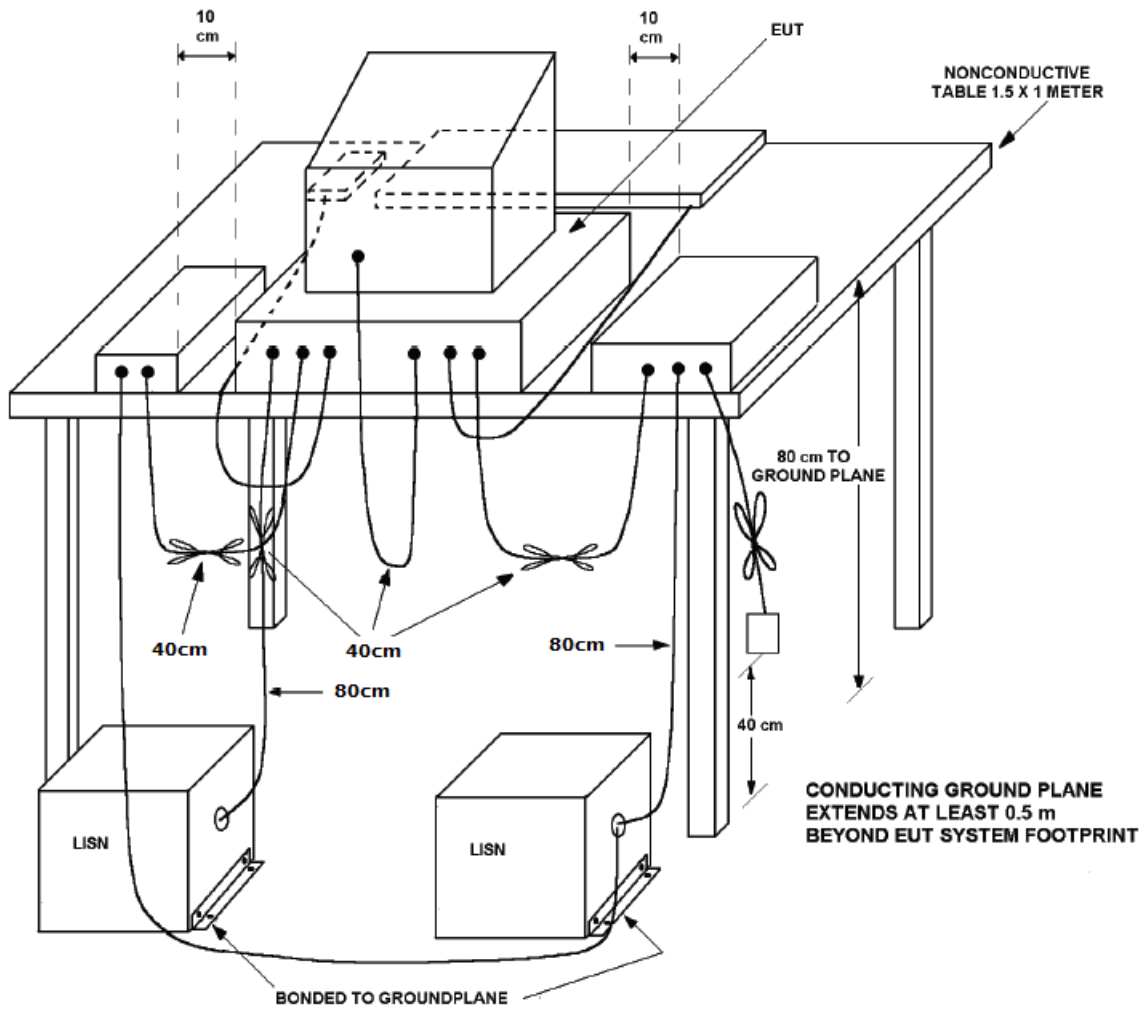
### 5.2. Description of Major Test Instruments

Test Receiver	Agilent N9038A
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

### 5.3. Test Procedures

- a. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- b. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- c. All the support units are connect to the other LISN.
- d. The LISN provides 50 Ω coupling impedance for the measuring instrument.
- e. The FCC states that a 50 Ω, 50 uH LISN should be used.
- f. Both sides of AC line were checked for maximum conducted interference.
- g. The frequency range from 150 kHz to 30 MHz was searched.
- h. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

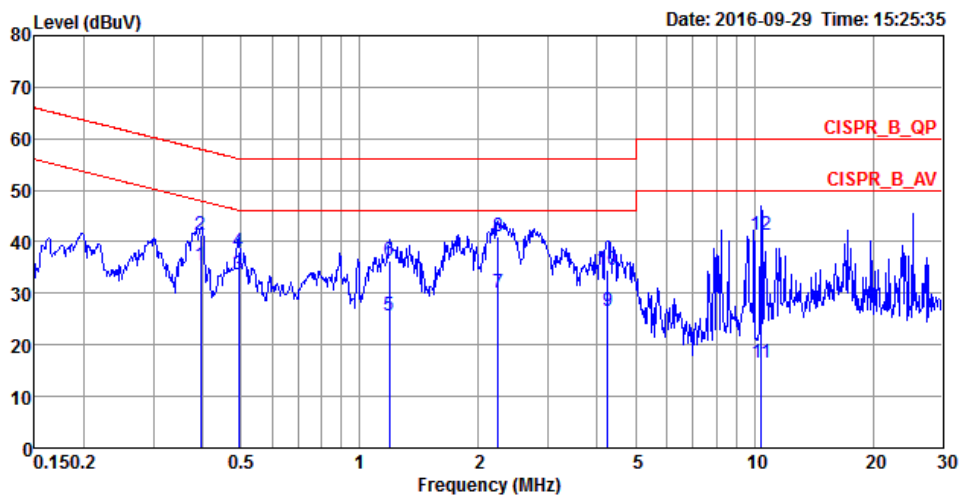
### 5.4. Typical Test Setup Layout of Conducted Emission



5.5. Test Result of AC Power Ports

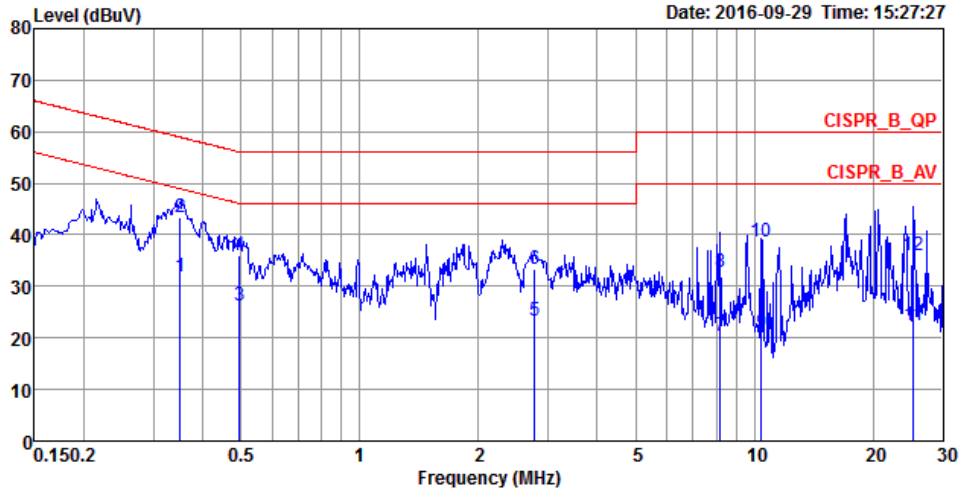
Temperature	23°C	Humidity	60%
Test Engineer	Hank Yang	Frequency Range	0.15 MHz to 30 MHz
Test Mode	Mode 1		
<ul style="list-style-type: none"> <li>Corrected Reading (dBuV) = LISN Factor + Cable Loss + Read Level = Level</li> <li>Margin = - Limit + (Read Level + LISN Factor + Cable Loss)</li> <li>All emissions not reported here are more than 10 dB below the prescribed limit.</li> <li>The test was passed at the minimum margin that marked by a frame in the following table</li> </ul>			

Line



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Remark	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB		
1	0.3956	35.45	-12.50	47.95	25.24	10.01	Average	LINE
2	0.3956	41.21	-16.74	57.95	31.00	10.01	QP	LINE
3	0.4941	33.70	-12.40	46.10	23.48	10.02	Average	LINE
4	0.4941	38.16	-17.94	56.10	27.94	10.02	QP	LINE
5	1.1907	25.61	-20.39	46.00	15.35	10.06	Average	LINE
6	1.1907	36.25	-19.75	56.00	25.99	10.06	QP	LINE
7	2.2400	29.99	-16.01	46.00	19.64	10.08	Average	LINE
8	2.2400	41.09	-14.91	56.00	30.74	10.08	QP	LINE
9	4.2466	26.50	-19.50	46.00	16.06	10.11	Average	LINE
10	4.2466	34.50	-21.50	56.00	24.06	10.11	QP	LINE
11	10.3972	16.50	-33.50	50.00	5.96	10.16	Average	LINE
12	10.3972	41.47	-18.53	60.00	30.93	10.16	QP	LINE

Neutral



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Remark	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB		
1	0.3510	31.87	-17.09	48.96	21.71	9.97	Average	NEUTRAL
2	0.3510	43.48	-15.48	58.96	33.32	9.97	QP	NEUTRAL
3	0.4967	26.36	-19.69	46.05	16.19	9.97	Average	NEUTRAL
4	0.4967	35.99	-20.06	56.05	25.82	9.97	QP	NEUTRAL
5	2.7794	23.38	-22.62	46.00	13.09	10.00	Average	NEUTRAL
6	2.7794	33.25	-22.75	56.00	22.96	10.00	QP	NEUTRAL
7	8.1916	20.44	-29.56	50.00	9.95	10.12	Average	NEUTRAL
8	8.1916	32.69	-27.31	60.00	22.20	10.12	QP	NEUTRAL
9	10.3972	21.01	-28.99	50.00	10.47	10.16	Average	NEUTRAL
10	10.3972	38.57	-21.43	60.00	28.03	10.16	QP	NEUTRAL
11	25.3214	22.39	-27.61	50.00	11.55	10.32	Average	NEUTRAL
12	25.3214	36.05	-23.95	60.00	25.21	10.32	QP	NEUTRAL

**6. Test of Radiated Emission**

**6.1. Limit**

**Radiated Emission below 1 GHz test at 10 m:**

Frequency (MHz)	QP (dBuV/m)
30~230	30
230~1,000	37

**Radiated Emission 1~13 GHz test at 3 m:**

Frequency (MHz)	PK (dBuV/m)	AV (dBuV/m)
1,000 to 13,000	74	54

**6.2. Description of Major Test Instruments**

**6.2.1. 30 MHz ~ 1,000 MHz**

Receiver Parameter	Setting
Start ~ Stop Frequency	30MHz~1000MHz / RBW 120kHz for QP

**6.2.2. Above 1 GHz**

Spectrum Parameter	Setting
Start Frequency	1000 MHz
Stop Frequency	5th harmonic of highest frequency
RBW / VBW	1 MHz / 3MHz for Peak ; 1 MHz / 1Hz for Average

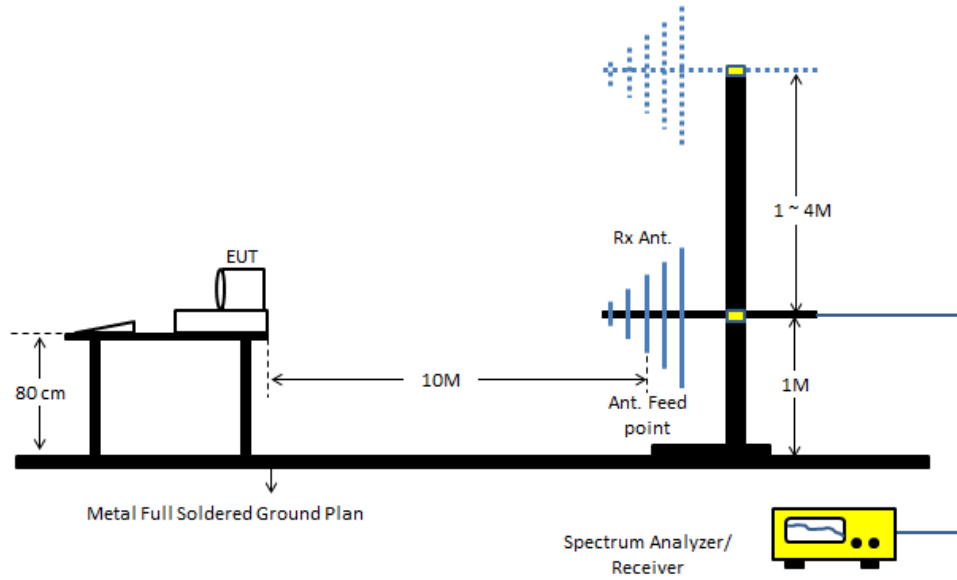
**6.3. Test Procedures**

- a. The EUT was placed on a rotatable table top 0.8 meter above ground.
- b. The EUT was set 10m (below 1GHz) / 3m (1GHz-13GHz) meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
- c. The table was rotated 360 degrees to determine the position of the highest radiation.
- d. The antenna height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
- e. For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turn table (from 0 degree to 360 degrees) to find the maximum reading.
- f. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.
- h. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.



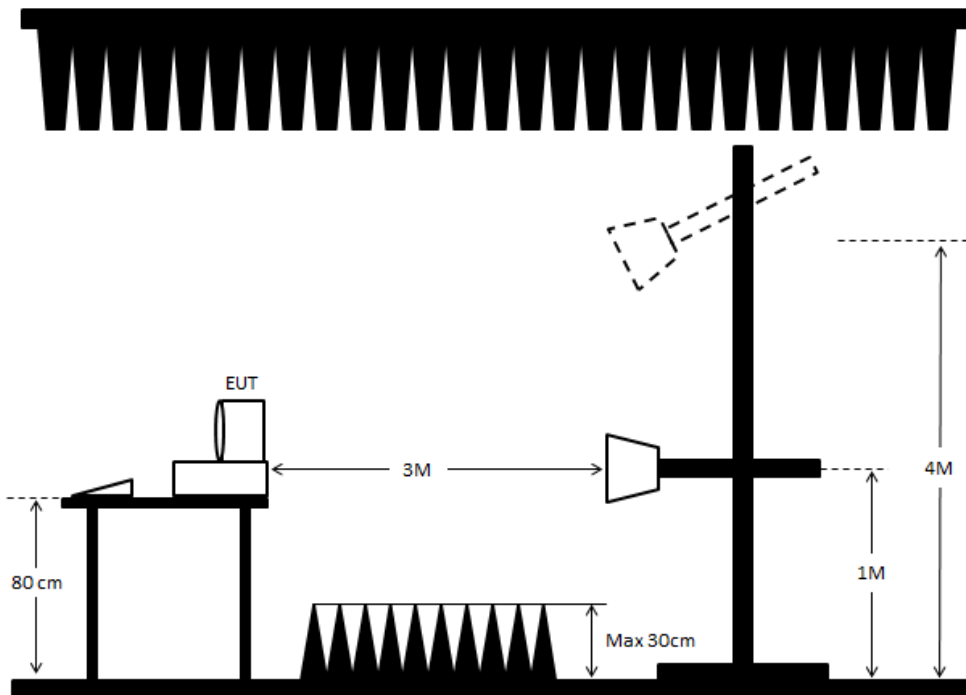
### 6.4. Typical Test Setup Layout of Radiated Emission

<Below 1 GHz>:



<Above 1 GHz>:

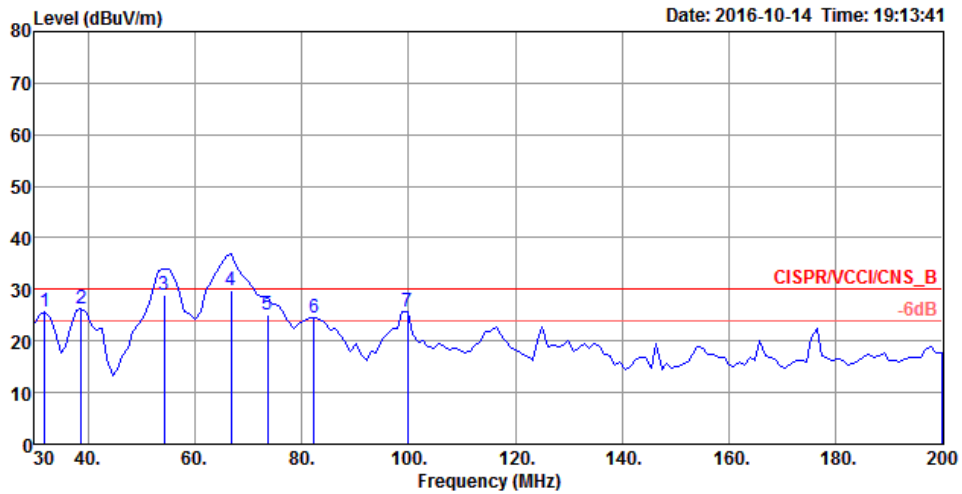
1,000~13,000 MHz



6.5. Test Result of Radiated Emission below 1 GHz

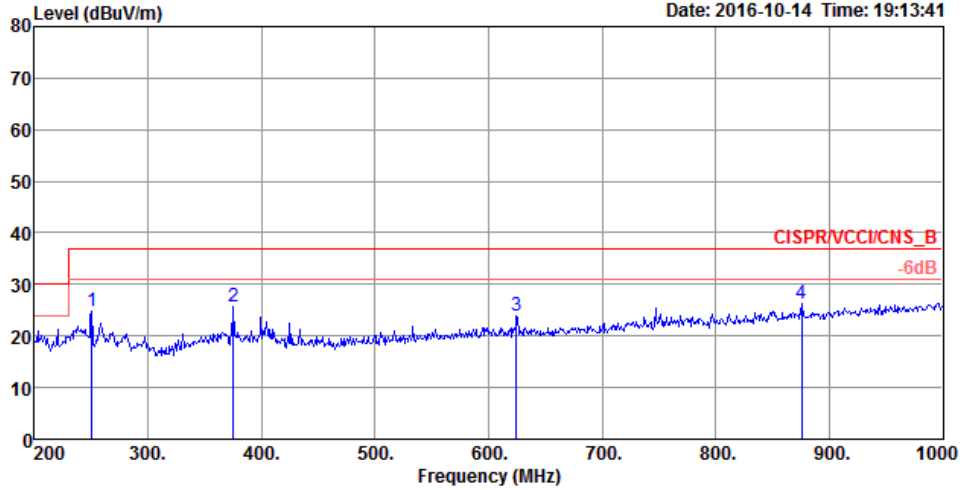
Temperature	23°C	Humidity	60%
Test Engineer	Kane Liu	Frequency Range	30 MHz to 1,000 MHz
Test Mode	Mode 1		
<ul style="list-style-type: none"> <li>Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level</li> <li>Margin = - Limit + (Read Level + Antenna Factor + Cable Loss - Preamp Factor)</li> <li>The test was passed at the minimum margin that marked by the frame in the following test record</li> </ul>			

Vertical 30 MHz to 200 MHz



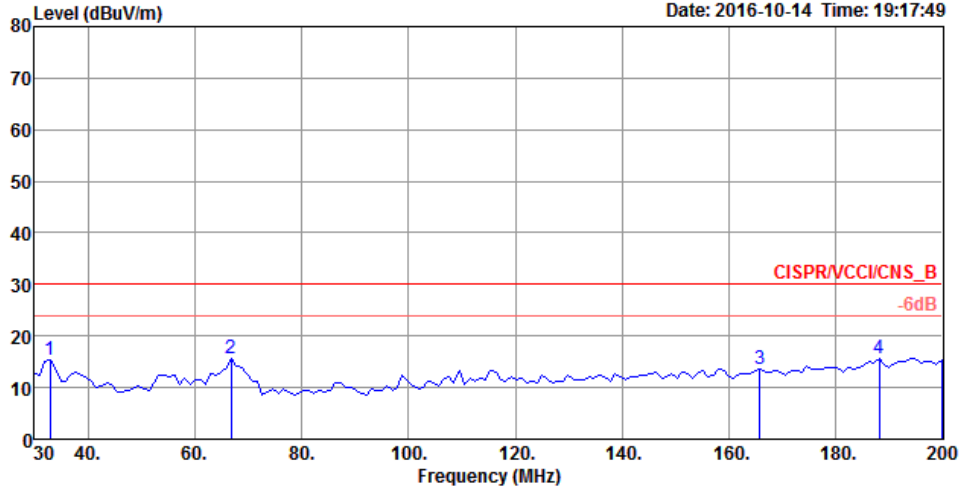
	Freq	Level	Limit	Over	Read	Preamp	Antenna	Cable	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	31.94	25.82	30.00	-4.18	39.70	28.62	13.18	1.56	Peak	100	297	VERTICAL
2	38.73	26.40	30.00	-3.60	41.51	28.61	11.77	1.73	Peak	100	358	VERTICAL
3	54.25	29.08	30.00	-0.92	45.64	28.57	10.00	2.01	QP	100	166	VERTICAL
4	66.86	29.90	30.00	-0.10	46.88	28.54	9.32	2.24	QP	200	129	VERTICAL
5	73.65	25.19	30.00	-4.81	42.24	28.53	9.13	2.35	QP	100	360	VERTICAL
6	82.38	24.59	30.00	-5.41	41.62	28.51	9.00	2.48	Peak	200	327	VERTICAL
7	99.84	25.82	30.00	-4.18	41.68	28.47	9.88	2.73	Peak	100	192	VERTICAL

Vertical 200 MHz to 1,000 MHz



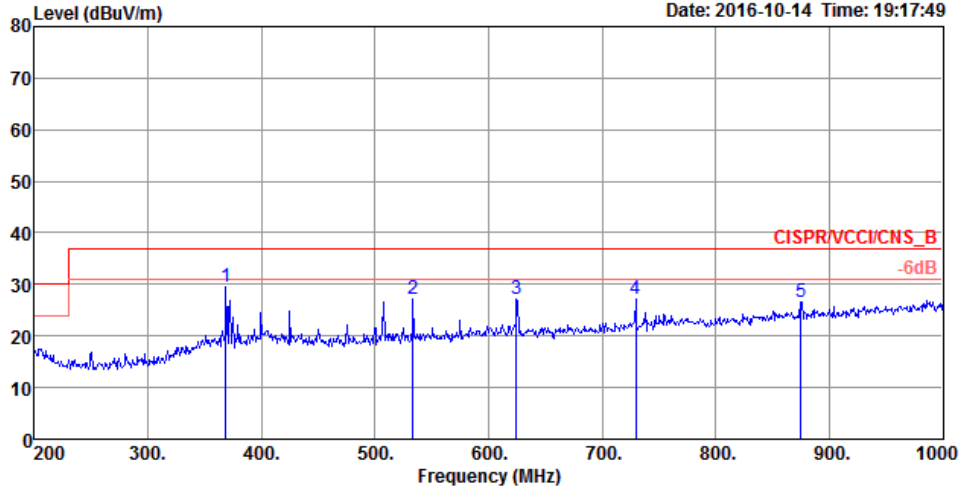
	Freq	Level	Limit Line	Over Limit	Read Level	Preamp Factor	Antenna Factor	Cable Loss	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	250.19	24.88	37.00	-12.12	36.90	27.22	12.40	2.80	Peak	100	21	VERTICAL
2	375.32	25.68	37.00	-11.32	34.08	27.70	15.85	3.45	Peak	400	21	VERTICAL
3	624.61	24.03	37.00	-12.97	28.77	28.42	19.25	4.43	Peak	300	206	VERTICAL
4	875.84	26.42	37.00	-10.58	27.18	27.57	21.55	5.26	Peak	200	222	VERTICAL

Horizontal 30 MHz to 200 MHz



	Freq	Level	Limit	Over	Read	Preamp	Antenna	Cable	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	32.91	15.46	30.00	-14.54	29.53	28.62	12.96	1.59	Peak	400	51	HORIZONTAL
2	66.86	15.71	30.00	-14.29	32.69	28.54	9.32	2.24	Peak	300	206	HORIZONTAL
3	165.80	13.67	30.00	-16.33	25.71	28.15	12.59	3.52	Peak	300	98	HORIZONTAL
4	188.11	15.78	30.00	-14.22	26.05	28.04	14.01	3.76	Peak	400	358	HORIZONTAL

Horizontal 200 MHz to 1,000 MHz

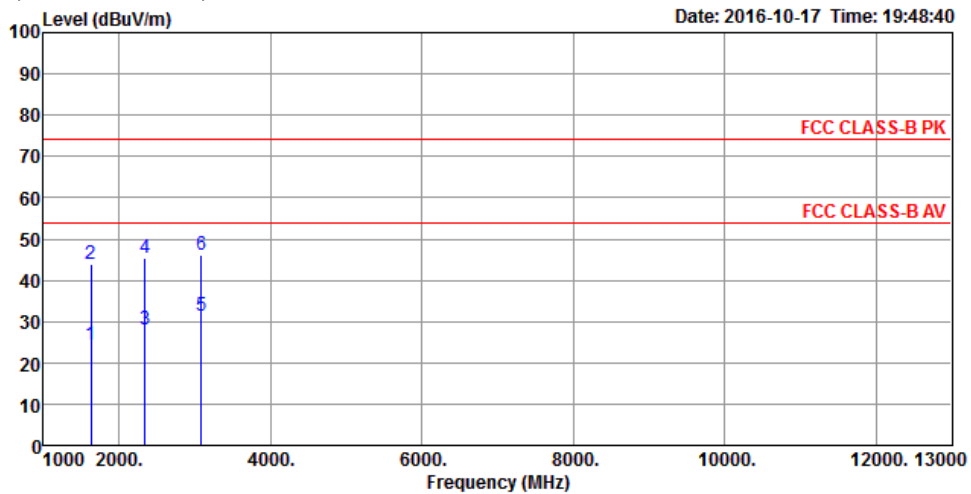


	Freq	Level	Limit	Over	Read	Preamp	Antenna	Cable	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	368.53	29.39	37.00	-7.61	37.83	27.65	15.79	3.42	Peak	300	15	HORIZONTAL
2	533.43	27.25	37.00	-9.75	33.56	28.45	18.07	4.07	Peak	200	345	HORIZONTAL
3	624.61	27.03	37.00	-9.97	31.77	28.42	19.25	4.43	Peak	200	139	HORIZONTAL
4	729.37	27.20	37.00	-9.80	30.22	28.15	20.27	4.86	Peak	300	360	HORIZONTAL
5	874.87	26.71	37.00	-10.29	27.47	27.57	21.55	5.26	Peak	100	225	HORIZONTAL

6.6. Test Result of Radiated Emission above 1 GHz

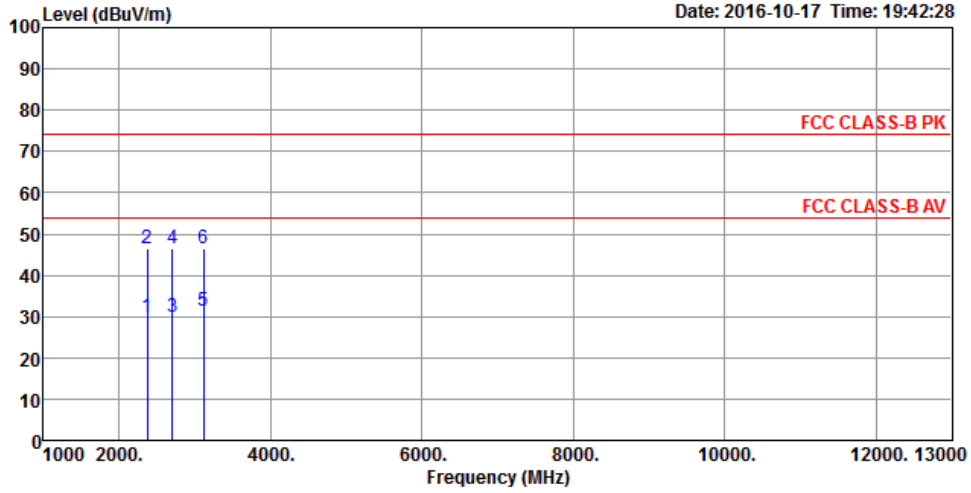
Temperature	23°C	Humidity	60%
Test Engineer	Deven Huang	Frequency Range	1,000 MHz to 13,000 MHz
Test Mode	Mode 1		
<ul style="list-style-type: none"> <li>Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level</li> <li>Margin = - Limit + (Read Level + Antenna Factor + Cable Loss - Preamp Factor)</li> <li>The test was passed at the minimum margin that marked by the frame in the following test record</li> </ul>			

Vertical 1,000 MHz to 13,000 MHz



	Freq	Level	Limit Line	Over Limit	Read Level	Preamp Factor	Antenna Factor	Cable Loss	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	1624.00	24.51	54.00	-29.49	24.95	35.98	28.77	6.77	Average	100	99	VERTICAL
2	1624.00	43.85	74.00	-30.15	44.29	35.98	28.77	6.77	Peak	100	99	VERTICAL
3	2344.00	28.08	54.00	-25.92	23.85	36.04	32.32	7.95	Average	100	140	VERTICAL
4	2344.00	45.38	74.00	-28.62	41.15	36.04	32.32	7.95	Peak	100	140	VERTICAL
5	3088.00	31.33	54.00	-22.67	25.63	36.35	33.07	8.98	Average	100	78	VERTICAL
6	3088.00	45.99	74.00	-28.01	40.29	36.35	33.07	8.98	Peak	100	78	VERTICAL

Horizontal 1,000 MHz to 13,000 MHz



Date: 2016-10-17 Time: 19:42:28

	Freq	Level	Limit	Over	Read	Preamp	Antenna	Cable	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	2368.00	29.93	54.00	-24.07	25.63	36.06	32.35	8.01	Average	100	296	HORIZONTAL
2	2368.00	46.40	74.00	-27.60	42.10	36.06	32.35	8.01	Peak	100	296	HORIZONTAL
3	2704.00	30.06	54.00	-23.94	24.99	36.21	32.80	8.48	Average	100	167	HORIZONTAL
4	2704.00	46.44	74.00	-27.56	41.37	36.21	32.80	8.48	Peak	100	167	HORIZONTAL
5	3112.00	31.54	54.00	-22.46	25.85	36.35	33.06	8.98	Average	100	156	HORIZONTAL
6	3112.00	46.34	74.00	-27.66	40.65	36.35	33.06	8.98	Peak	100	156	HORIZONTAL

**7. List of Measuring Equipment Used**

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
EMI Receiver	Agilent	N9038A	My52260123	9kHz ~ 8.45GHz	Jan. 27, 2016	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150kHz ~ 100MHz	Dec. 08, 2015	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Dec. 23, 2015	Conduction (CO01-CB)
COND Cable	Woken	Cable	01	150kHz ~ 30MHz	May 24, 2016	Conduction (CO01-CB)
Software	Audix	E3	6.120210n	-	N.C.R.	Conduction (CO01-CB)
10m Semi Anechoic Chamber	TDK	NSA	10CH01-CB	30MHz~1GHz 10m	Mar. 30, 2016	Radiation (10CH01-CB)
10m Semi Anechoic Chamber	TDK	VSWR	10CH01-CB	1GHz ~40GHz 3m	Nov. 24, 2015	Radiation (10CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10783	9kHz ~ 1.3GHz	Mar. 24, 2016	Radiation (10CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10784	9kHz ~ 1.3GHz	Mar. 09, 2016	Radiation (10CH01-CB)
Low Cable	Woken	SUCOFLEX 104	-	25MHz ~ 1GHz	Nov. 30, 2015	Radiation (10CH01-CB)
High Cable	Woken	SUCOFLEX 104	-	25MHz ~ 1GHz	Nov. 30, 2015	Radiation (10CH01-CB)
Biconical Antenna	Schwarzbeck	VHBB 9124	324	30MHz ~ 200MHz	Apr. 20, 2016	Radiation (10CH01-CB)
Log Antenna	Schwarzbeck	VUSLP 9111	247	200MHz ~ 1GHz	May 26, 2016	Radiation (10CH01-CB)
EMI Test Receiver	Rohde&Schwarz	ESCI	100186	9kHz ~ 3GHz	Jul. 07, 2016	Radiation (10CH01-CB)
Spectrum Analyzer	Rohde&Schwarz	FSV30	101026	9kHz ~ 30GHz	Jan. 04, 2016	Radiation (10CH01-CB)
Horn Antenna	ESCO	3117	00081283	1GHz ~ 18GHz	Nov. 25, 2015	Radiation (10CH01-CB)
Amplifier	Agilent	8449B	3008A02660	1GHz ~ 26.5GHz	May 23, 2016	Radiation (10CH01-CB)
CABLE(1~40G)	Woken	SUCOFLEX 104	-	1GHz ~ 40GHz	Nov. 30, 2015	Radiation (10CH01-CB)
Software	Audix	E3	6.120210m	-	N.C.R.	Radiation (10CH01-CB)

※ Calibration Interval of instruments listed above is one year.

※ N.C.R. means Non-Calibration required.



**8. Uncertainty of Test Site**

<b>Test Items</b>	<b>Uncertainty</b>	<b>Remark</b>
Conducted Emissions	3.2 dB	Confidence levels of 95%
Radiated Emissions below 1GHz	4.0 dB	Confidence levels of 95%
Radiated Emissions 1GHz ~ 18GHz	2.5 dB	Confidence levels of 95%