

## FCC Test Report

**Report No.:** FD180620D13

**Test Model:** Calliope Mini

**Received Date:** Jun. 20, 2018

**Test Date:** Jul. 4 ~ 5, 2018 & Sep. 21 ~ Oct. 1, 2018

**Issued Date:** Oct. 1, 2018

**Applicant:** Calliope gGmbH

**Address:** Raumerstraße 11; 10437 Berlin

**Issued By:** Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

**Lab Address:** No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan (R.O.C.)

**FCC Registration /  
Designation Number:** 418586 / TW1078



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### Release Control Record

Issue No.	Description	Date Issued
FD180620D13	Original release.	Oct. 1, 2018



## 2 Summary of Test Results

47 CFR FCC Part 15, Subpart B / ICES-003:2016 Issue 6, Class B

ANSI C63.4:2014

FCC Clause	ICES-003 Clause	Test Item	Result/Remarks	Verdict
15.107	6.1	Conducted Emissions at mains ports	Minimum passing Class B margin is -11.30 dB at 0.15000 MHz	Pass
15.109	6.2.1	Radiated Emissions up to 1 GHz	Minimum passing Class B margin is -5.45 dB at 52.42 MHz	Pass
	6.2.2	Radiated Emissions above 1 GHz	Minimum passing Class B margin is -19.39 dB at 5161.87 MHz	Pass

Note: There is no deviation to the applied test methods and requirements covered by the scope of this report.

### 2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT:

The listed uncertainties are the worst case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.

Measurement	Frequency	Expanded Uncertainty (k=2) ( $\pm$ )
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.79 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	3.97 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.08 dB
	Above 1GHz	5.06 dB

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

Product	Calliope Mini
Brand	Calliope gGmbH
Test Model	Calliope Mini
Sample Status	Engineering Sample
Operating Software	N/A
Power Supply Rating	3Vdc from Battery holder, 5Vdc from from USB interface
Accessory Device	Battery holder
Data Cable Supplied	USB cable (0.15m)

Note: The EUT with Bluetooth technology.

#### 3.2 Features of EUT

The tests reported herein were performed according to the method specified by Calliope gGmbH, for detailed feature description, please refer to the manufacturer's specifications or user's manual.

#### 3.3 Operating Modes of EUT and Determination of Worst Case Operating Mode

1. The EUT has been pre-tested under following test modes, and test mode 1 was the worst case for final test.

Test Mode	Test Condition
1	Normal mode + BT Link+ power from adapter
2	Normal mode + BT Link+ power from Notebook

2. Test modes are presented in the report as below.

Mode	Test Condition	Input Power
Conducted emission test		
1	Normal mode + BT Link	120Vac / 60Hz (DC Power Supply)
2	Normal mode + BT Link+ power from adapter	120Vac / 60Hz (Adapter)
3	Normal mode + BT Link+ power from Notebook	120Vac / 60Hz (Notebook)
Radiated emission test		
1	Normal mode + BT Link	3Vdc
2	Normal mode + BT Link+ power from adapter	120Vac / 60Hz (Adapter)

### 3.4 Test Program Used and Operation Descriptions

#### Mode 1:

- a. Connect the battery box / DC Power Supply to EUT.
- b. Turned on the power of all equipment.
- c. Tablet link EUT via Bluetooth.
- d. Tablet received messages from EUT.

#### Mode 2:

- a. Connect the adapter to EUT.
- b. Turned on the power of all equipment.
- c. Tablet link EUT via Bluetooth.
- d. Tablet received messages from EUT.

#### Mode 3:

- a. Connect the Notebook to EUT.
- b. Turned on the power of all equipment.
- c. Tablet link EUT via Bluetooth.
- d. Tablet received messages from EUT.

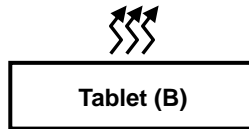
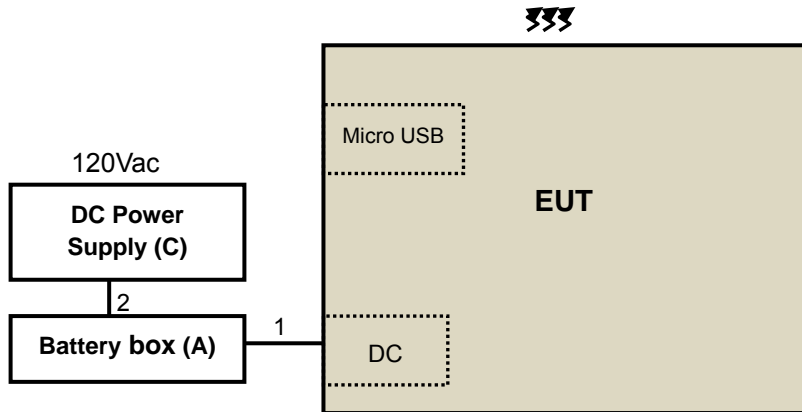
### 3.5 Primary Clock Frequencies of Internal Source

The highest frequency generated or used within the EUT or on which the EUT operates or tunes is 2.5GHz, provided by Calliope gGmbH, for detailed internal source, please refer to the manufacturer's specifications.

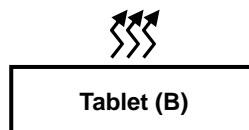
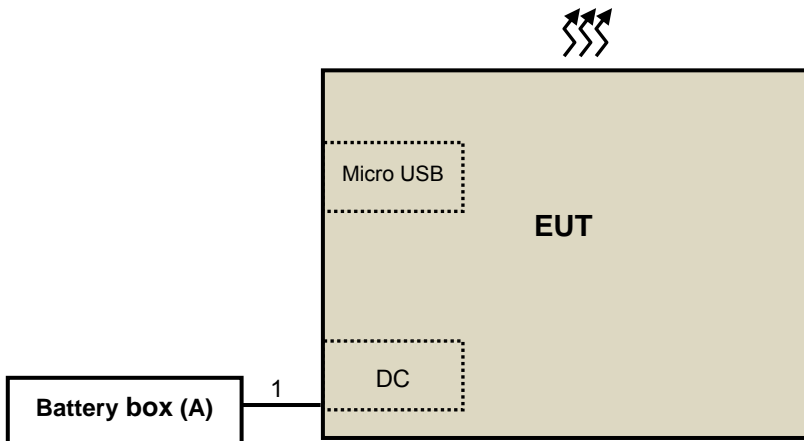
#### 4 Configuration and Connections with EUT

##### 4.1 Connection Diagram of EUT and Peripheral Devices

###### Mode 1: Conducted test

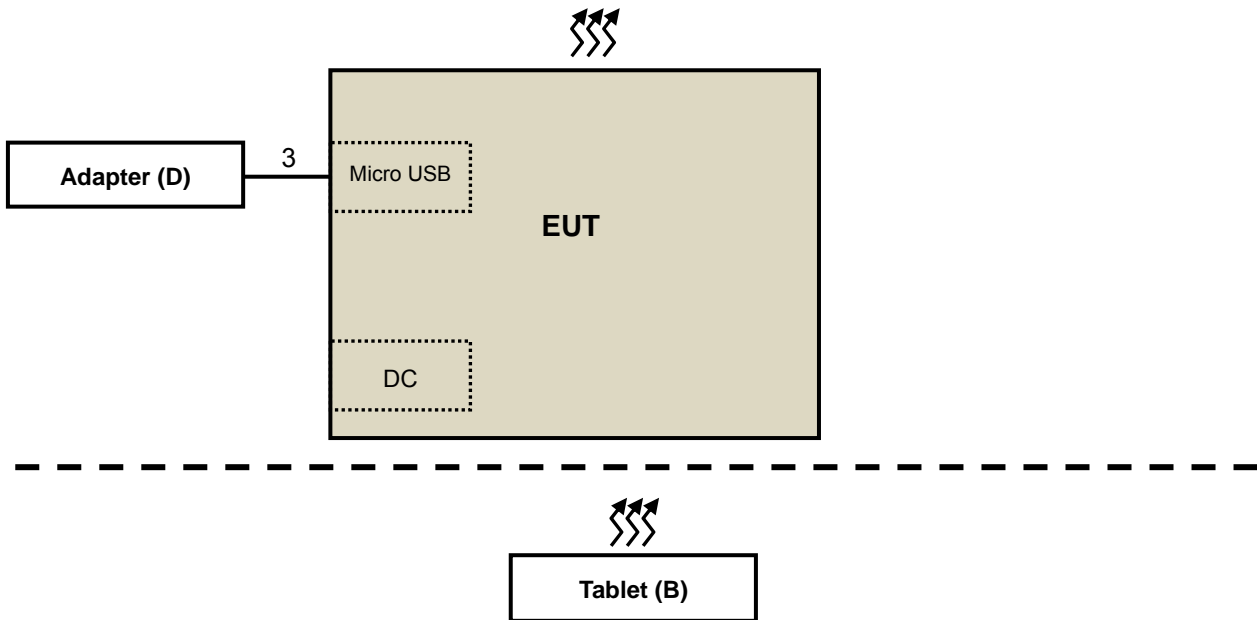


###### Mode 1: Radiated test

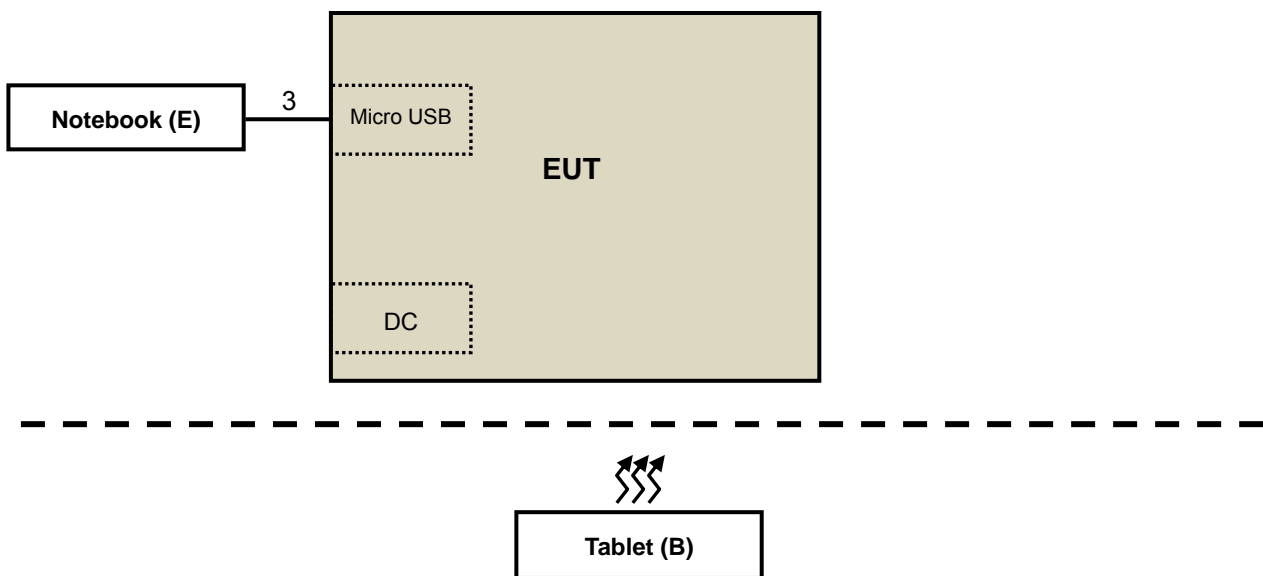




### Mode 2:



### Mode 3:



#### 4.2 Configuration of Peripheral Devices and Cable Connections

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Battery Box	N/A	N/A	N/A	N/A	Supplied by client
B.	Tablet	ASUS	K00R(ME572CL)	N/A	N/A	Provided by Lab
C.	DC Power Supply	hila	DP6010	1616AP051502087	N/A	Provided by Lab
D.	Adapter	HTC	TC U250	N/A	N/A	Provided by Lab
E.	Notebook PC	Lenovo	80WG	YD01YRC9	FCC DoC Approved	Provided by Lab

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item B acted as communication partners to transfer data.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC cable	1	0.1	N	0	Supplied by client
2.	DC cable	1	1.5	N	0	Provided by Lab
3.	USB cable	1	0.15	Y	0	Supplied by client

Note: The core(s) is(are) originally attached to the cable(s).

## 5 Conducted Emissions at Mains Ports

### 5.1 Limits

Frequency (MHz)	Class A (dBUV)		Class B (dBUV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.5	79	66	66 - 56	56 - 46
0.50 - 5.0	73	60	56	46
5.0 - 30.0	73	60	60	50

Notes: 1. The lower limit shall apply at the transition frequencies.  
 2. The limit decreases linearly with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

### 5.2 Test Instruments

#### Mode 1

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ROHDE & SCHWARZ TEST RECEIVER	ESR3	102413	Feb. 8, 2018	Feb. 7, 2019
ROHDE & SCHWARZ Artificial Mains Network (for EUT)	ESH2-Z5	100104	Dec. 6, 2017	Dec. 5, 2018
LISN With Adapter (for EUT)	AD10	C09Ada-001	Dec. 6, 2017	Dec. 5, 2018
ROHDE & SCHWARZ Artificial Mains Network (for peripherals)	ESH3-Z5	847265/023	Nov. 3, 2017	Nov. 2, 2018
SCHWARZBECK Artificial Mains Network (For EUT)	NNLK8129	8129229	May 3, 2018	May 2, 2019
Software	Cond_V7.3.7.4	NA	NA	NA
RF cable (JYEBAO) With 10dB PAD	5D-FB	Cable-C09.01	Feb. 21, 2018	Feb. 20, 2019
SUHNER Terminator (For ROHDE & SCHWARZ LISN)	65BNC-5001	E1-010789	May 8, 2018	May 7, 2019

Notes: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.  
 2. The test was performed in Shielded Room No. 9.  
 3. The VCCI Site Registration No. C-1312.  
 4. Tested Date: Jul. 4, 2018

**Mode 2 & 3**

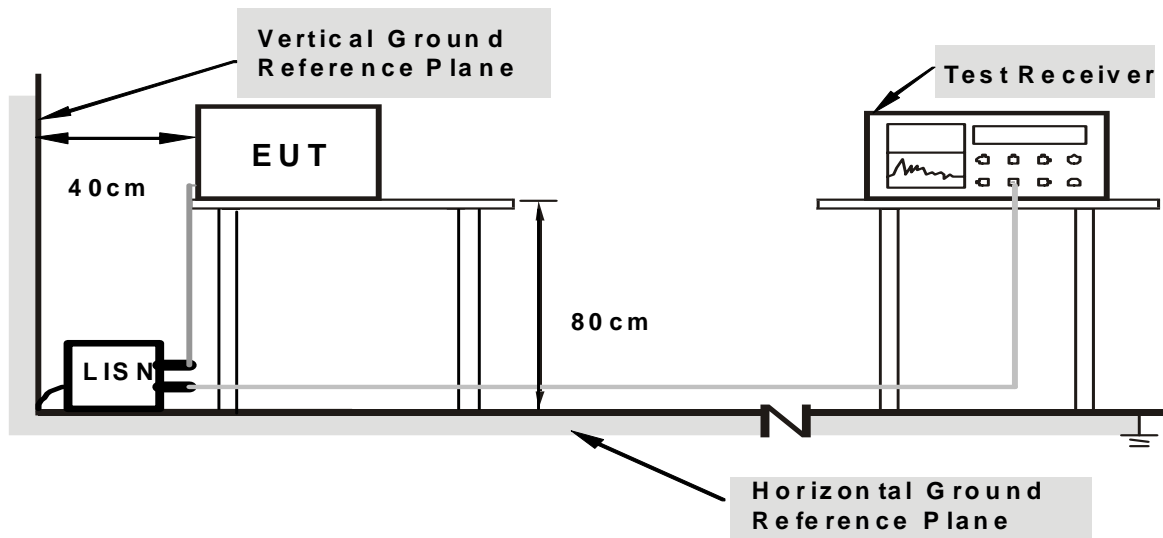
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ROHDE & SCHWARZ TEST RECEIVER	ESR3	102414	Feb. 7, 2018	Feb. 6, 2019
ROHDE & SCHWARZ Artificial Mains Network (for EUT)	ENV216	101197	May 23, 2018	May 22, 2019
LISN With Adapter (for EUT)	AD10	C10Ada-002	May 23, 2018	May 22, 2019
ROHDE & SCHWARZ Artificial Mains Network (for peripherals)	ESH3-Z5	100218	Nov. 23, 2017	Nov. 22, 2018
SCHWARZBECK Artificial Mains Network (For EUT)	NNLK8129	8129229	May 3, 2018	May 2, 2019
Software	Cond_V7.3.7.4	NA	NA	NA
RF cable (JYEBAO) With 10dB PAD	5D-FB	Cable-C10.01	Feb. 14, 2018	Feb. 13, 2019
SUHNER Terminator (For ROHDE & SCHWARZ LISN)	65BNC-5001	E1-011484	May 8, 2018	May 7, 2019
ROHDE & SCHWARZ Artificial Mains Network (For TV EUT)	ESH3-Z5	100220	Nov. 14, 2017	Nov. 13, 2018
LISN With Adapter (for TV EUT)	100220	N/A	Nov. 14, 2017	Nov. 13, 2018

- Notes: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.  
2. The test was performed in Shielded Room No. 10.  
3. Tested Date: Sep. 21, 2018

### 5.3 Test Arrangement

- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The test results of conducted emissions at mains ports are recorded of six worst margins for quasi-peak (mandatory) [and average (if necessary)] values against the limits at frequencies of interest unless the margin is 20 dB or greater.

Note: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.



**Note: Support units were connected to second LISN.**

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

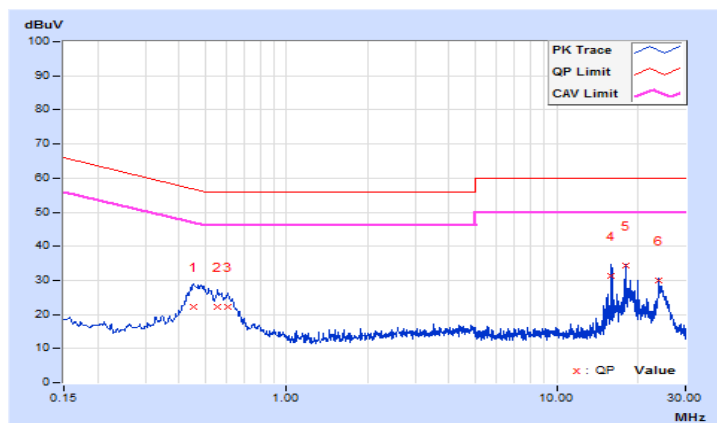
### 5.4 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	28°C, 68%RH
Tested by	Steven Lin		
Test Mode	Mode 1		

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.45096	10.05	12.20	6.16	22.25	16.21	56.86	46.86	-34.61	-30.65
2	0.55474	10.06	12.09	6.81	22.15	16.87	56.00	46.00	-33.85	-29.13
3	0.60557	10.07	12.03	5.90	22.10	15.97	56.00	46.00	-33.90	-30.03
4	15.96364	10.46	20.96	5.67	31.42	16.13	60.00	50.00	-28.58	-33.87
5	17.95832	10.50	23.84	9.09	34.34	19.59	60.00	50.00	-25.66	-30.41
6	23.99087	10.60	19.29	17.87	29.89	28.47	60.00	50.00	-30.11	-21.53

**Remarks:**

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

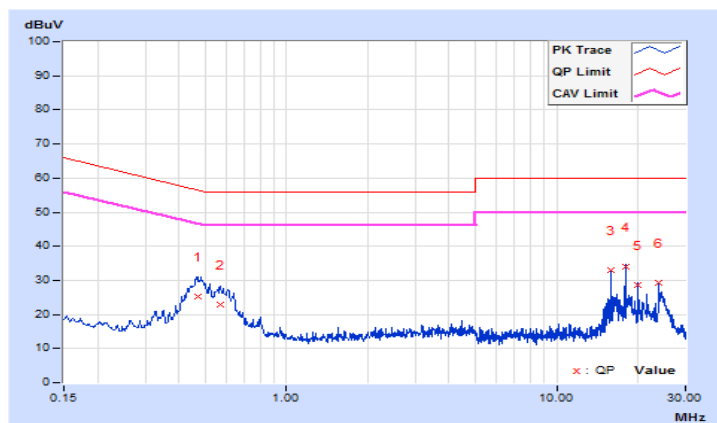


<b>Frequency Range</b>	150kHz ~ 30MHz	<b>Detector Function &amp; Resolution Bandwidth</b>	Quasi-Peak (QP) / Average (AV), 9kHz
<b>Input Power</b>	120Vac, 60Hz	<b>Environmental Conditions</b>	28°C, 68%RH
<b>Tested by</b>	Steven Lin		
<b>Test Mode</b>	Mode 1		

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.47062	10.07	15.25	9.14	25.32	19.21	56.50	46.50	-31.18	-27.29
2	0.56647	10.08	12.98	7.39	23.06	17.47	56.00	46.00	-32.94	-28.53
3	15.99217	10.53	22.51	21.25	33.04	31.78	60.00	50.00	-26.96	-18.22
4	17.95774	10.58	23.37	8.26	33.95	18.84	60.00	50.00	-26.05	-31.16
5	19.99113	10.63	18.03	16.95	28.66	27.58	60.00	50.00	-31.34	-22.42
6	23.99087	10.69	18.50	17.20	29.19	27.89	60.00	50.00	-30.81	-22.11

**Remarks:**

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

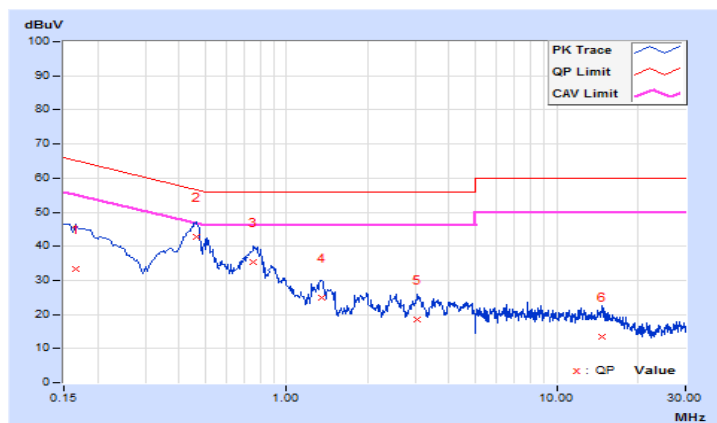


<b>Frequency Range</b>	150kHz ~ 30MHz	<b>Detector Function &amp; Resolution Bandwidth</b>	Quasi-Peak (QP) / Average (AV), 9kHz
<b>Input Power</b>	120Vac, 60Hz (Adapter)	<b>Environmental Conditions</b>	27°C, 71%RH
<b>Tested by</b>	Ian Chang		
<b>Test Mode</b>	Mode 2		

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16564	9.69	23.63	2.92	33.32	12.61	65.18	55.18	-31.86	-42.57
2	0.46280	9.77	32.99	17.56	42.76	27.33	56.64	46.64	-13.88	-19.31
3	0.75415	9.82	25.58	10.66	35.40	20.48	56.00	46.00	-20.60	-25.52
4	1.34456	9.90	15.06	5.27	24.96	15.17	56.00	46.00	-31.04	-30.83
5	3.03368	10.02	8.39	3.08	18.41	13.10	56.00	46.00	-37.59	-32.90
6	14.78282	10.30	3.05	1.73	13.35	12.03	60.00	50.00	-46.65	-37.97

**Remarks:**

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



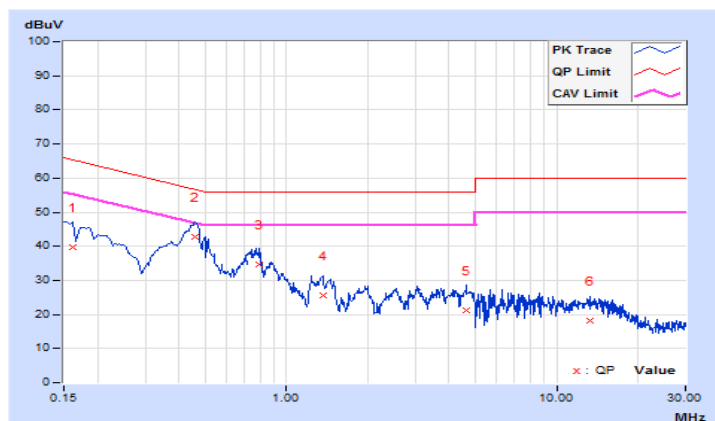


<b>Frequency Range</b>	150kHz ~ 30MHz	<b>Detector Function &amp; Resolution Bandwidth</b>	Quasi-Peak (QP) / Average (AV), 9kHz
<b>Input Power</b>	120Vac, 60Hz (Adapter)	<b>Environmental Conditions</b>	27°C, 71%RH
<b>Tested by</b>	Ian Chang		
<b>Test Mode</b>	Mode 2		

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16173	9.70	29.93	5.61	39.63	15.31	65.37	55.37	-25.74	-40.06
2	0.45889	9.81	33.03	15.06	42.84	24.87	56.71	46.71	-13.87	-21.84
3	0.78934	9.86	24.85	8.43	34.71	18.29	56.00	46.00	-21.29	-27.71
4	1.36411	9.93	15.79	3.34	25.72	13.27	56.00	46.00	-30.28	-32.73
5	4.64460	10.08	11.02	1.54	21.10	11.62	56.00	46.00	-34.90	-34.38
6	13.30484	10.28	8.02	0.65	18.30	10.93	60.00	50.00	-41.70	-39.07

**Remarks:**

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

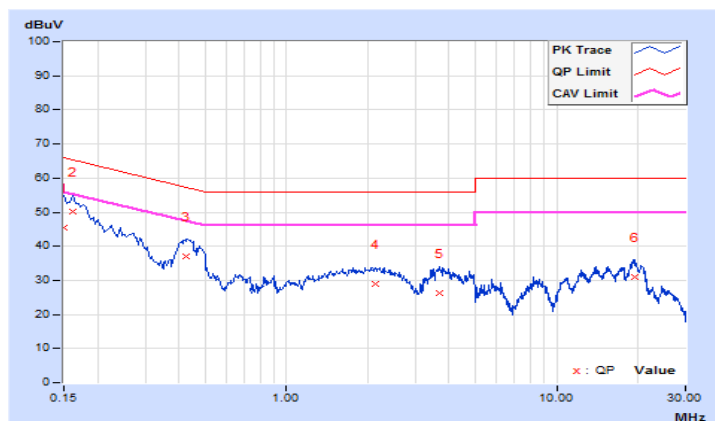


<b>Frequency Range</b>	150kHz ~ 30MHz	<b>Detector Function &amp; Resolution Bandwidth</b>	Quasi-Peak (QP) / Average (AV), 9kHz
<b>Input Power</b>	120Vac, 60Hz (System)	<b>Environmental Conditions</b>	27°C, 71%RH
<b>Tested by</b>	Ian Chang		
<b>Test Mode</b>	Mode 3		

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.68	35.71	13.39	45.39	23.07	66.00	56.00	-20.61	-32.93
2	0.16173	9.68	40.64	22.12	50.32	31.80	65.37	55.37	-15.05	-23.57
3	0.42370	9.76	27.31	18.82	37.07	28.58	57.38	47.38	-20.31	-18.80
4	2.12656	9.99	19.02	14.12	29.01	24.11	56.00	46.00	-26.99	-21.89
5	3.67101	10.05	16.13	10.18	26.18	20.23	56.00	46.00	-29.82	-25.77
6	19.48655	10.37	20.69	15.71	31.06	26.08	60.00	50.00	-28.94	-23.92

**Remarks:**

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

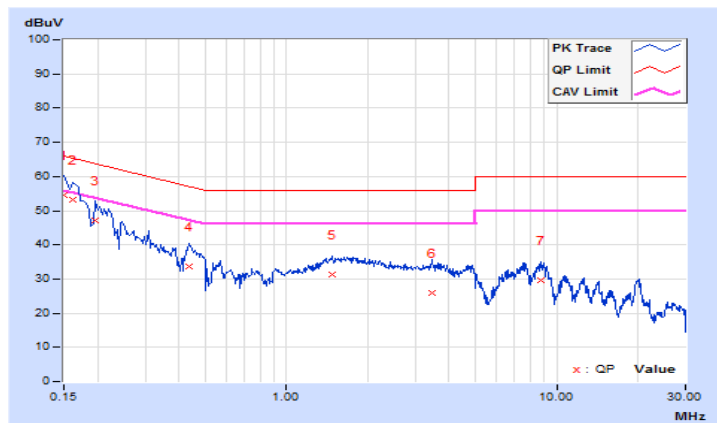


<b>Frequency Range</b>	150kHz ~ 30MHz	<b>Detector Function &amp; Resolution Bandwidth</b>	Quasi-Peak (QP) / Average (AV), 9kHz
<b>Input Power</b>	120Vac, 60Hz (System)	<b>Environmental Conditions</b>	27°C, 71%RH
<b>Tested by</b>	Ian Chang		
<b>Test Mode</b>	Mode 3		

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.69	45.01	25.28	54.70	34.97	66.00	56.00	-11.30	-21.03
2	0.16173	9.70	43.65	26.01	53.35	35.71	65.37	55.37	-12.02	-19.66
3	0.19692	9.72	37.38	18.79	47.10	28.51	63.74	53.74	-16.64	-25.23
4	0.43543	9.81	23.80	15.11	33.61	24.92	57.15	47.15	-23.54	-22.23
5	1.48517	9.94	21.42	15.20	31.36	25.14	56.00	46.00	-24.64	-20.86
6	3.45596	10.05	16.04	8.68	26.09	18.73	56.00	46.00	-29.91	-27.27
7	8.79661	10.17	19.39	13.04	29.56	23.21	60.00	50.00	-30.44	-26.79

**Remarks:**

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



## 6 Radiated Emissions up to 1 GHz

### 6.1 Limits

Emissions radiated outside of the specified bands, shall be according to the general radiated limits as following:

Radiated Emissions Limits at 10 meters (dB $\mu$ V/m)				
Frequencies (MHz)	FCC 15B / ICES-003, Class A	FCC 15B / ICES-003, Class B	CISPR 22, Class A	CISPR 22, Class B
30-88	39	29.5	40	30
88-216	43.5	33.1		
216-230	46.4	35.6		
230-960				
960-1000	49.5	43.5	47	37

Radiated Emissions Limits at 3 meters (dB $\mu$ V/m)				
Frequencies (MHz)	FCC 15B / ICES-003, Class A	FCC 15B / ICES-003, Class B	CISPR 22, Class A	CISPR 22, Class B
30-88	49.5	40	50.5	40.5
88-216	54	43.5		
216-230	56.9	46		
230-960				
960-1000	60	54	57.5	47.5

- Notes:
1. The lower limit shall apply at the transition frequencies.
  2. Emission level (dB $\mu$ V/m) = 20 log Emission level (uV/m).
  3. QP detector shall be applied if not specified.

### 6.2 Test Instruments

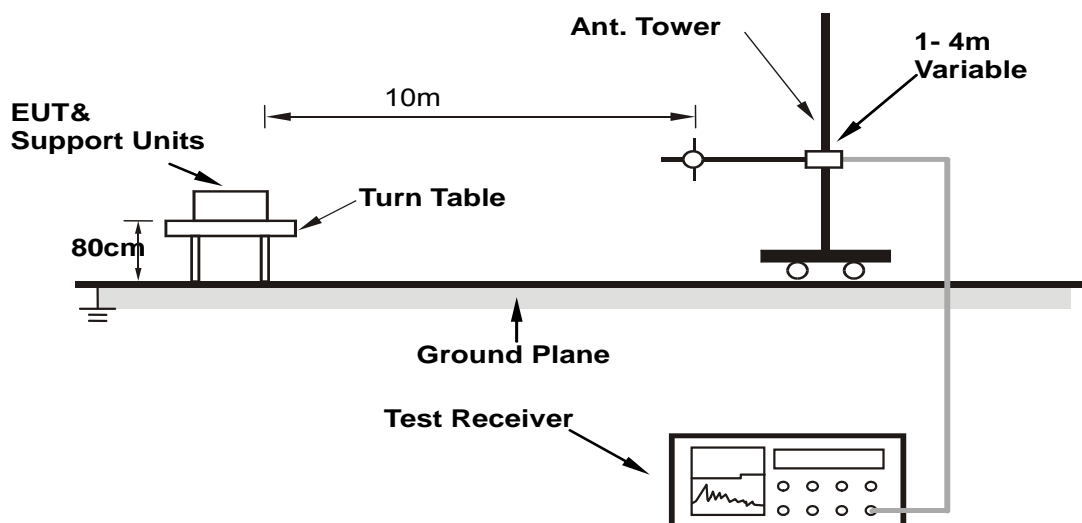
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ROHDE & SCHWARZ TEST RECEIVER	ESCS 30	100027	Dec. 4, 2017	Dec. 3, 2018
Schwarzbeck Bilog Antenna	VULB9168	9168-303	Nov. 29, 2017	Nov. 28, 2018
Agilent Preamplifier	8447D	2944A08119	Feb. 21, 2018	Feb. 20, 2019
ADT. Turn Table	TT100	0205	NA	NA
ADT. Tower	AT100	0205	NA	NA
Software	Radiated_V7.6.15.9.5	NA	NA	NA
ADT RF Switches BOX	EMH-011	1001	Oct. 26, 2017	Oct. 25, 2018
Pacific RF cable With 5dB PAD	8D	CABLE-ST2-01	Oct. 26, 2017	Oct. 25, 2018

- Notes:
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
  2. The test was performed in Open Site No. 2.
  3. The VCCI Site Registration No. R-237.
  4. Tested Date: Jul. 5 ~ Oct. 1, 2018

### 6.3 Test Arrangement

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at an accredited test facility. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is up to 1 GHz.

Note: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for quasi-peak detection (QP) at frequency up to 1GHz.



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

## 6.4 Test Results

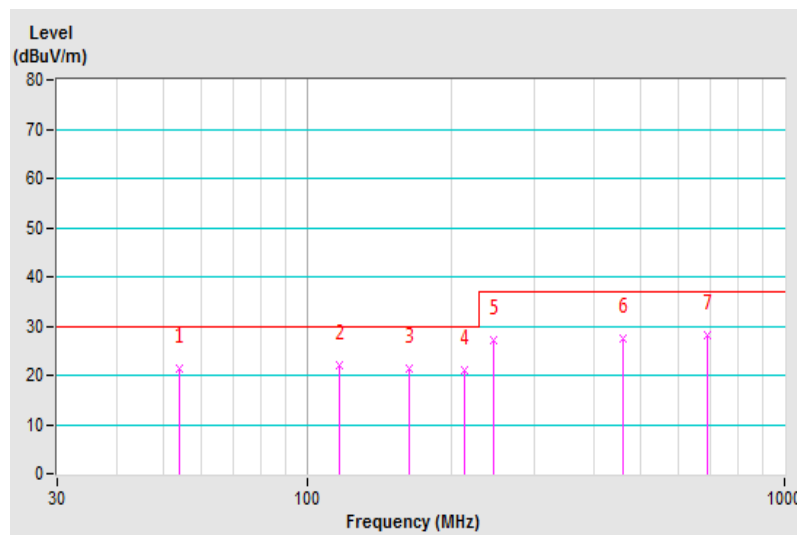
<b>Frequency Range</b>	30MHz ~ 1GHz	<b>Detector Function &amp; Resolution Bandwidth</b>	Quasi-Peak (QP), 120kHz
<b>Input Power</b>	3Vdc	<b>Environmental Conditions</b>	29°C, 62%RH
<b>Tested by</b>	Paul Chen		
<b>Test Mode</b>	Mode 1		

### Antenna Polarity & Test Distance : Horizontal at 10 m

No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	54.22	21.38 QP	30.00	-8.62	4.00 H	88	30.27	-8.89
2	116.86	21.94 QP	30.00	-8.06	4.00 H	239	33.41	-11.47
3	163.92	21.32 QP	30.00	-8.68	4.00 H	262	30.28	-8.96
4	213.12	20.87 QP	30.00	-9.13	4.00 H	11	33.04	-12.17
5	245.19	27.27 QP	37.00	-9.73	3.82 H	117	37.64	-10.37
6	458.27	27.62 QP	37.00	-9.38	1.91 H	169	32.33	-4.71
7	690.30	28.03 QP	37.00	-8.97	1.33 H	332	28.44	-0.41

#### Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value

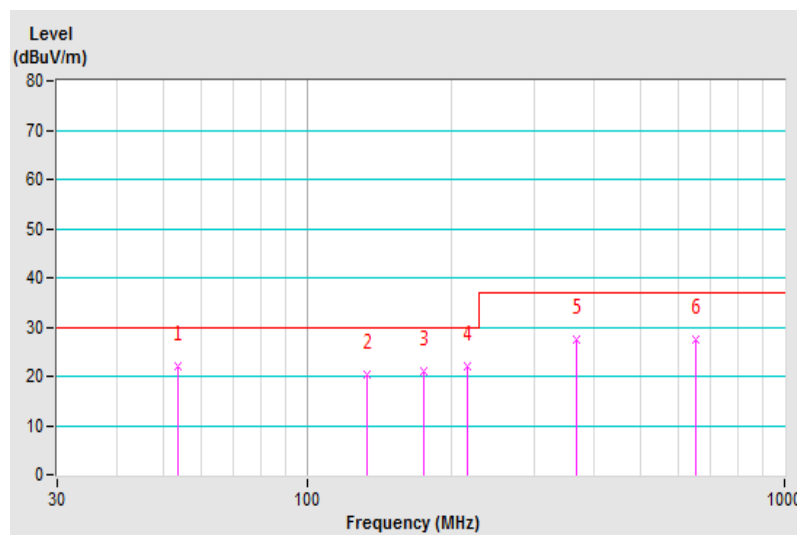


<b>Frequency Range</b>	30MHz ~ 1GHz	<b>Detector Function &amp; Resolution Bandwidth</b>	Quasi-Peak (QP), 120kHz
<b>Input Power</b>	3Vdc	<b>Environmental Conditions</b>	29°C, 62%RH
<b>Tested by</b>	Paul Chen		
<b>Test Mode</b>	Mode 1		

Antenna Polarity & Test Distance : Vertical at 10 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	53.73	22.05 QP	30.00	-7.95	1.32 V	104	30.91	-8.86
2	133.18	20.35 QP	30.00	-9.65	1.00 V	94	30.22	-9.87
3	176.24	21.05 QP	30.00	-8.95	1.00 V	106	30.90	-9.85
4	217.04	21.99 QP	30.00	-8.01	1.00 V	348	34.06	-12.07
5	366.15	27.41 QP	37.00	-9.59	1.00 V	228	34.24	-6.83
6	652.50	27.62 QP	37.00	-9.38	3.14 V	143	28.48	-0.86

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value

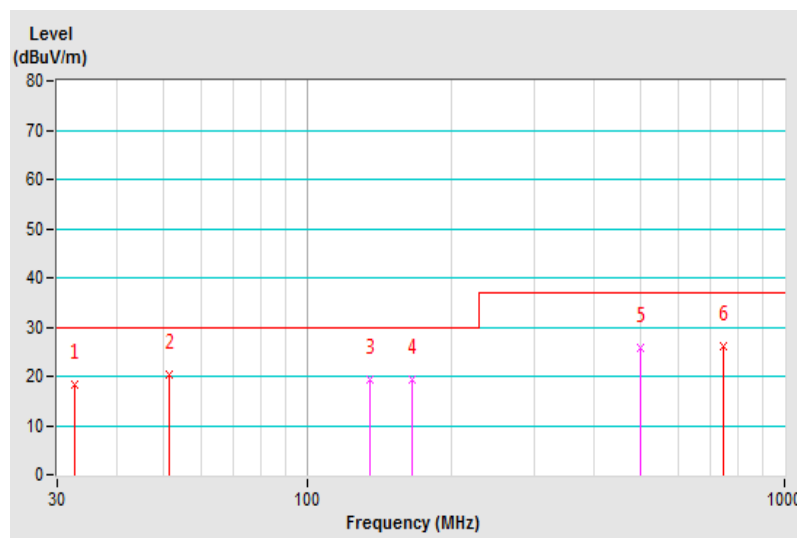


<b>Frequency Range</b>	30MHz ~ 1GHz	<b>Detector Function &amp; Resolution Bandwidth</b>	Quasi-Peak (QP), 120kHz
<b>Input Power</b>	120Vac, 60Hz (Adapter)	<b>Environmental Conditions</b>	24°C, 71%RH
<b>Tested by</b>	Vhenson Huang		
<b>Test Mode</b>	Mode 2		

Antenna Polarity & Test Distance : Horizontal at 10 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	32.59	18.37 QP	30.00	-11.63	4.00 H	127	28.53	-10.16
2	51.46	20.34 QP	30.00	-9.66	4.00 H	143	29.17	-8.83
3	135.31	19.24 QP	30.00	-10.76	4.00 H	120	28.85	-9.61
4	165.87	19.30 QP	30.00	-10.70	4.00 H	231	28.32	-9.02
5	499.19	25.65 QP	37.00	-11.35	2.13 H	181	29.32	-3.67
6	743.39	26.27 QP	37.00	-10.73	1.10 H	211	25.82	0.45

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value



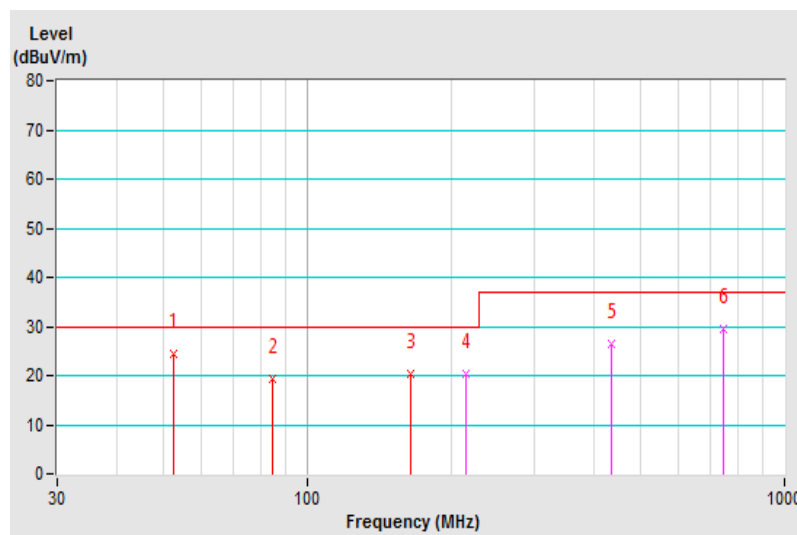


<b>Frequency Range</b>	30MHz ~ 1GHz	<b>Detector Function &amp; Resolution Bandwidth</b>	Quasi-Peak (QP), 120kHz
<b>Input Power</b>	120Vac, 60Hz (Adapter)	<b>Environmental Conditions</b>	24°C, 71%RH
<b>Tested by</b>	Vhenson Huang		
<b>Test Mode</b>	Mode 2		

Antenna Polarity & Test Distance : Vertical at 10 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	52.42	24.55 QP	30.00	-5.45	1.56 V	100	33.38	-8.83
2	84.81	19.37 QP	30.00	-10.63	1.68 V	136	33.98	-14.61
3	165.07	20.30 QP	30.00	-9.70	1.00 V	157	29.28	-8.98
4	214.81	20.37 QP	30.00	-9.63	1.00 V	118	32.49	-12.12
5	435.29	26.37 QP	37.00	-10.63	3.95 V	333	31.43	-5.06
6	745.81	29.34 QP	37.00	-7.66	2.57 V	48	28.83	0.51

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value



## 7 Radiated Emissions above 1 GHz

### 7.1 Limits

Emissions radiated outside of the specified bands, shall be according to the general radiated limits as following:

Radiated Emissions Limits at 10 meters (dB $\mu$ V/m)				
Frequencies (MHz)	FCC 15B/ ICES-003, Class A	FCC 15B / ICES-003, Class B	CISPR 22, Class A	CISPR 22, Class B
1000-3000	Avg: 49.5	Avg: 43.5	Not defined	Not defined
Above 3000	Peak: 69.5	Peak: 63.5	Not defined	Not defined

Radiated Emissions Limits at 3 meters (dB $\mu$ V/m)				
Frequencies (MHz)	FCC 15B / ICES-003, Class A	FCC 15B / ICES-003, Class B	CISPR 22, Class A	CISPR 22, Class B
1000-3000	Avg: 60	Avg: 54	Avg: 56 Peak: 76	Avg: 50 Peak: 70
Above 3000	Peak: 80	Peak: 74	Avg: 60 Peak: 80	Avg: 54 Peak: 74

- Notes:
1. The lower limit shall apply at the transition frequencies.
  2. Emission level (dB $\mu$ V/m) = 20 log Emission level (uV/m).
  3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

Frequency Range (For unintentional radiators)

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705-108	1000
108-500	2000
500-1000	5000
Above 1000	5th harmonic of the highest frequency or 40GHz, whichever is lower

## 7.2 Test Instruments

### Mode 1:

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Agilent Spectrum	E4446A	MY51100009	Jun. 4, 2018	Jun. 3, 2019
Agilent Test Receiver	N9038A	MY51210137	Jun. 19, 2018	Jun. 18, 2019
Agilent Preamplifier	8449B	3008A01292	Feb. 22, 2018	Feb. 21, 2019
MITEQ Preamplifier	AMF-6F-260400-33-8P	892164	Feb. 21, 2018	Feb. 20, 2019
EMCI Preamplifier	EMC184045B	980235	Feb. 22, 2018	Feb. 21, 2019
Schwarzbeck Horn Antenna	BBHA-9170	212	Dec. 1, 2017	Nov. 30, 2018
EMCO Horn Antenna	3115	6714	Dec. 12, 2017	Dec. 11, 2018
Max Full. Turn Table	MF7802	MF780208216	NA	NA
Software	Radiated_V8.7.08	NA	NA	NA
SUHNER RF cable With 3/4dB PAD	SF102	Cable-CH10-3.6m	Aug. 14, 2017	Aug. 13, 2018
MICRO-TRONICS Notch filter	BRC50703-01	010	May 31, 2018	May 30, 2019
MICRO-TRONICS Band Pass Filter	BRM17690	005	May 31, 2018	May 30, 2019

- Notes: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.  
 2. The test was performed in Chamber No. 10.  
 3. The Industry Canada Reference No. IC 7450E-11.  
 4. The VCCI Site Registration No. G-10427  
 5. Tested Date: Jul. 5, 2018

### Mode 2:

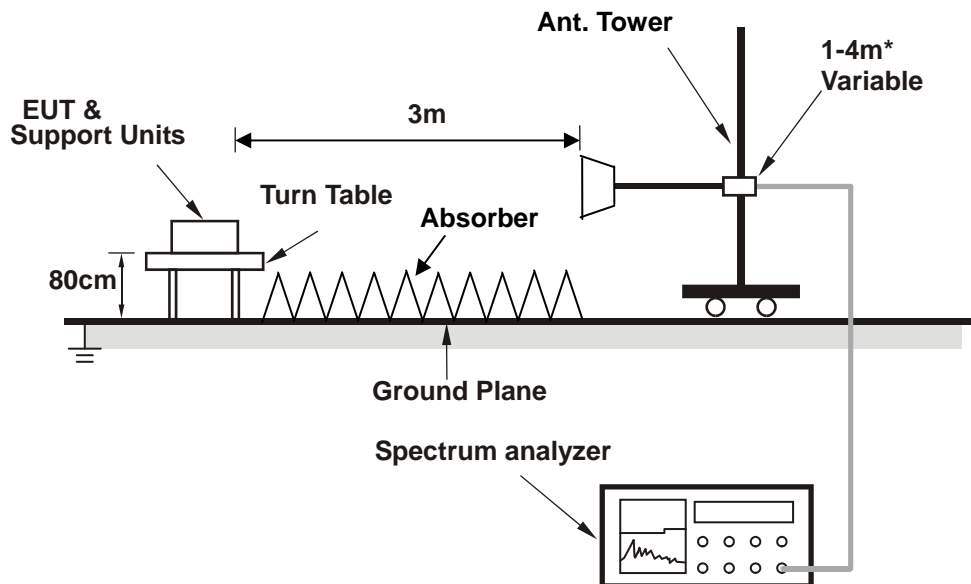
Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Agilent Spectrum	E4446A	MY51100009	Jun. 4, 2018	Jun. 3, 2019
Agilent Test Receiver	N9038A	MY51210137	Jun. 19, 2018	Jun. 18, 2019
Agilent Preamplifier	8449B	3008A01292	Feb. 22, 2018	Feb. 21, 2019
MITEQ Preamplifier	AMF-6F-260400-33-8P	892164	Feb. 21, 2018	Feb. 20, 2019
EMCI Preamplifier	EMC184045B	980235	Feb. 22, 2018	Feb. 21, 2019
Schwarzbeck Horn Antenna	BBHA-9170	212	Dec. 1, 2017	Nov. 30, 2018
EMCO Horn Antenna	3115	6714	Dec. 12, 2017	Dec. 11, 2018
Max Full. Turn Table	MF7802	MF780208216	NA	NA
Software	Radiated_V8.7.08	NA	NA	NA
SUHNER RF cable With 3/4dB PAD	SF102	Cable-CH10-3.6m	Aug. 13, 2018	Aug. 12, 2019
MICRO-TRONICS Notch filter	BRC50703-01	010	May 31, 2018	May 30, 2019
MICRO-TRONICS Band Pass Filter	BRM17690	005	May 31, 2018	May 30, 2019

- Notes: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.  
 2. The test was performed in Chamber No. 10.  
 3. The Industry Canada Reference No. IC 7450E-11.  
 4. The VCCI Site Registration No. G-10427  
 5. Tested Date: Sep. 28, 2018

### 7.3 Test Arrangement

- The EUT was placed on the horizontal metal ground plane at an accredited test facility, orientated for normal use, but separated from metallic contact with the reference metal ground plane by insulation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The height of antenna can be varied from one meter to four meters, the height of adjustment depends on the EUT height and the antenna 3dB beamwidth both, to detect the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The spectrum analyzer system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.

Note: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection (PK) at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz for Average detection (AV) at frequency above 1GHz.



\* :depends on the EUT height and the antenna 3dB beamwidth both.

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

### 7.4 Test Results

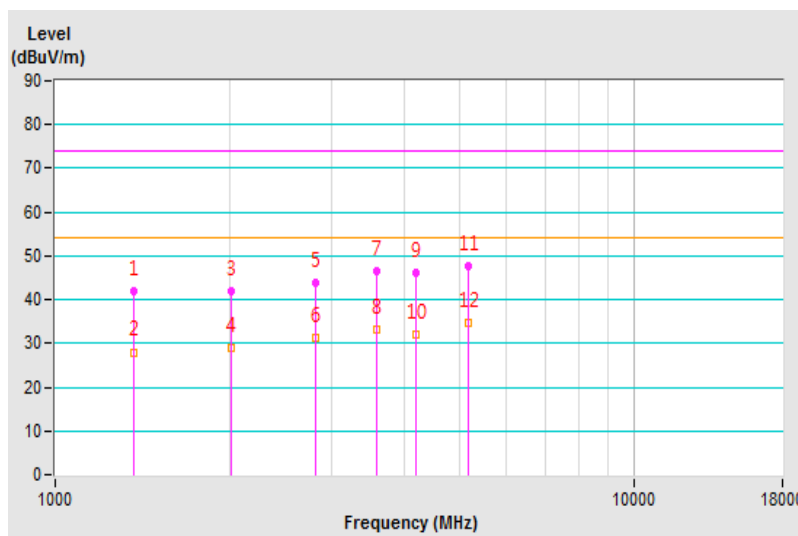
<b>Frequency Range</b>	1GHz ~ 12.5GHz	<b>Detector Function &amp; Resolution Bandwidth</b>	Peak (PK) / Average (AV), 1MHz
<b>Input Power</b>	3Vdc	<b>Environmental Conditions</b>	25°C, 75%RH
<b>Tested by</b>	Vhenson Huang		
<b>Test Mode</b>	Mode 1		

#### Antenna Polarity & Test Distance : Horizontal at 3 m

No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1368.00	41.86 PK	74.00	-32.14	1.11 H	238	46.27	-4.41
2	1368.00	28.01 AV	54.00	-25.99	1.11 H	238	32.42	-4.41
3	2009.87	42.07 PK	74.00	-31.93	1.00 H	360	44.49	-2.42
4	2009.87	28.96 AV	54.00	-25.04	1.00 H	360	31.38	-2.42
5	2813.12	44.00 PK	74.00	-30.00	2.05 H	235	44.35	-0.35
6	2813.12	31.34 AV	54.00	-22.66	2.05 H	235	31.69	-0.35
7	3590.37	46.55 PK	74.00	-27.45	1.00 H	3	43.86	2.69
8	3590.37	33.29 AV	54.00	-20.71	1.00 H	3	30.60	2.69
9	4183.37	46.14 PK	74.00	-27.86	2.55 H	342	42.52	3.62
10	4183.37	32.15 AV	54.00	-21.85	2.55 H	342	28.53	3.62
11	5161.87	47.75 PK	74.00	-26.25	1.00 H	87	42.25	5.50
<b>12</b>	<b>5161.87</b>	<b>34.61 AV</b>	<b>54.00</b>	<b>-19.39</b>	<b>1.00 H</b>	<b>87</b>	<b>29.11</b>	<b>5.50</b>

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value



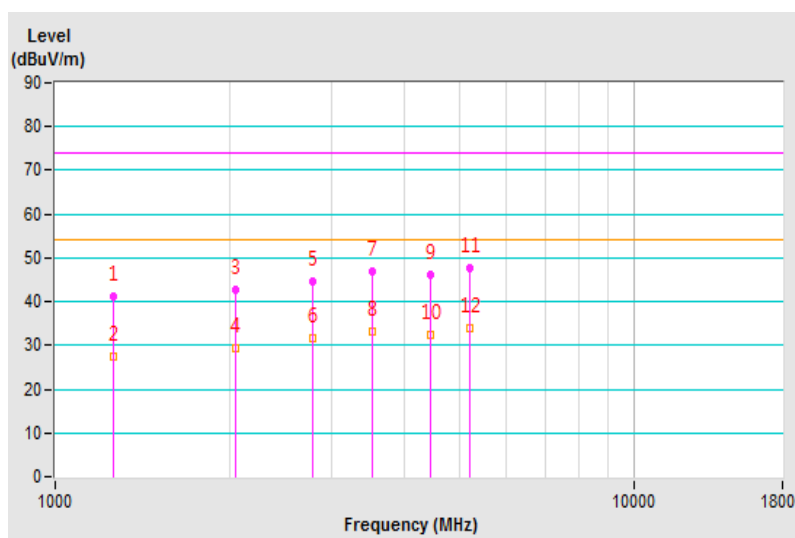
<b>Frequency Range</b>	1GHz ~ 12.5GHz	<b>Detector Function &amp; Resolution Bandwidth</b>	Peak (PK) / Average (AV), 1MHz
<b>Input Power</b>	3Vdc	<b>Environmental Conditions</b>	25°C, 75%RH
<b>Tested by</b>	Vhenson Huang		
<b>Test Mode</b>	Mode 1		

**Antenna Polarity & Test Distance : Vertical at 3 m**

No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1259.50	41.13 PK	74.00	-32.87	1.71 V	112	46.05	-4.92
2	1259.50	27.38 AV	54.00	-26.62	1.71 V	112	32.30	-4.92
3	2053.37	42.63 PK	74.00	-31.37	1.28 V	264	44.84	-2.21
4	2053.37	29.28 AV	54.00	-24.72	1.28 V	264	31.49	-2.21
5	2784.12	44.65 PK	74.00	-29.35	1.88 V	218	45.09	-0.44
6	2784.12	31.64 AV	54.00	-22.36	1.88 V	218	32.08	-0.44
7	3533.12	46.99 PK	74.00	-27.01	1.00 V	36	44.73	2.26
8	3533.12	32.99 AV	54.00	-21.01	1.00 V	36	30.73	2.26
9	4451.37	46.10 PK	74.00	-27.90	1.43 V	61	42.27	3.83
10	4451.37	32.28 AV	54.00	-21.72	1.43 V	61	28.45	3.83
11	5184.75	47.67 PK	74.00	-26.33	2.47 V	261	42.12	5.55
12	5184.75	33.85 AV	54.00	-20.15	2.47 V	261	28.30	5.55

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value

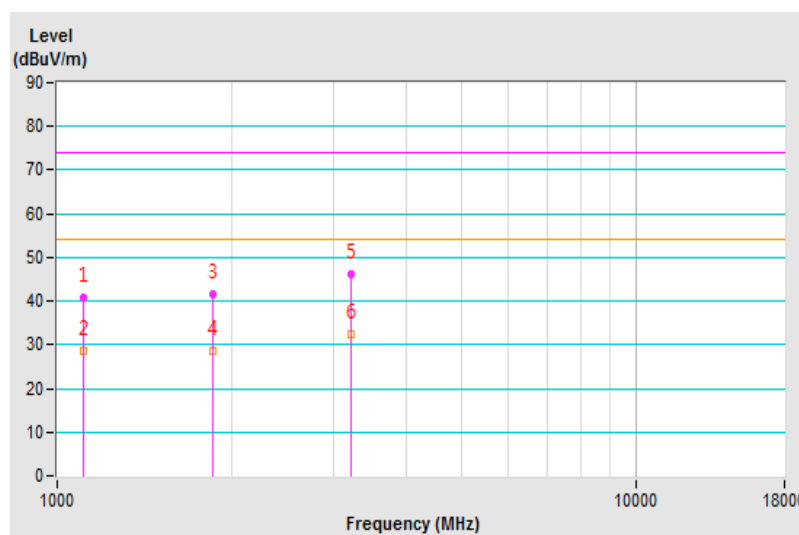


<b>Frequency Range</b>	1GHz ~ 12.5GHz	<b>Detector Function &amp; Resolution Bandwidth</b>	Peak (PK) / Average (AV), 1MHz
<b>Input Power</b>	120Vac, 60Hz (Adapter)	<b>Environmental Conditions</b>	25°C, 69%RH
<b>Tested by</b>	Jary Huang		
<b>Test Mode</b>	Mode 2		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1110.08	40.82 PK	74.00	-33.18	2.20 H	356	45.50	-4.68
2	1110.08	28.64 AV	54.00	-25.36	2.20 H	356	33.32	-4.68
3	1855.53	41.47 PK	74.00	-32.53	1.13 H	264	44.73	-3.26
4	1855.53	28.48 AV	54.00	-25.52	1.13 H	264	31.74	-3.26
5	3213.40	45.97 PK	74.00	-28.03	1.66 H	38	44.86	1.11
6	3213.40	32.29 AV	54.00	-21.71	1.66 H	38	31.18	1.11

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value

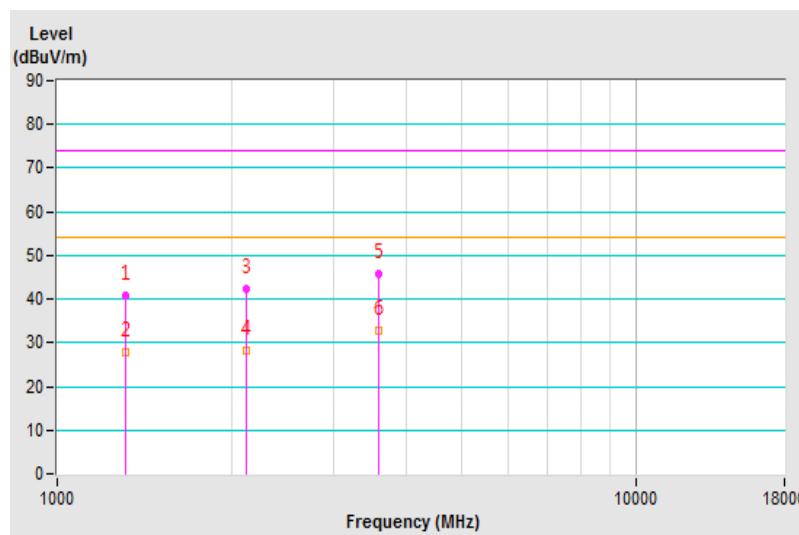


<b>Frequency Range</b>	1GHz ~ 12.5GHz	<b>Detector Function &amp; Resolution Bandwidth</b>	Peak (PK) / Average (AV), 1MHz
<b>Input Power</b>	120Vac, 60Hz (Adapter)	<b>Environmental Conditions</b>	25°C, 69%RH
<b>Tested by</b>	Jary Huang		
<b>Test Mode</b>	Mode 2		

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1313.65	40.78 PK	74.00	-33.22	2.04 V	98	45.72	-4.94
2	1313.65	27.71 AV	54.00	-26.29	2.04 V	98	32.65	-4.94
3	2121.15	42.17 PK	74.00	-31.83	1.16 V	292	44.66	-2.49
4	2121.15	28.32 AV	54.00	-25.68	1.16 V	292	30.81	-2.49
5	3578.47	45.58 PK	74.00	-28.42	1.75 V	313	43.15	2.43
6	3578.47	32.61 AV	54.00	-21.39	1.75 V	313	30.18	2.43

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value





## 8 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

## Appendix – Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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The address and road map of all our labs can be found in our web site also.

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