

## Partial FCC Test Report

**Report No.:** RF160316C18-1

**FCC ID:** VPYLB1EN

**Test Model:** LBEE5ZZ1EN

**Received Date:** Mar. 16, 2016

**Test Date:** Apr. 04, 2016 ~ Apr. 12, 2016

**Issued Date:** Apr. 26, 2016

**Applicant:** MURATA MANUFACTURING CO., LTD.

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

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### Release Control Record

Issue No.	Description	Date Issued
RF160316C18-1	Original Release	Apr. 26, 2016

## 1 Certificate of Conformity

**Product:** Communication Module

**Brand:** Murata

**Test Model:** LBEE5ZZ1EN

**Sample Status:** Identical Prototype

**Applicant:** MURATA MANUFACTURING CO., LTD.

**Test Date:** Apr. 04, 2016 ~ Apr. 12, 2016

**Standards:** 47 CFR FCC Part 15, Subpart C (Section 15.247)  
ANSI C63.10:2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, 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 EMC characteristics under the conditions specified in this report.

**Prepared by :** Gina Liu , **Date:** Apr. 26, 2016  
Gina Liu / Specialist

**Approved by :** David Huang , **Date:** Apr. 26, 2016  
David Huang / Project Engineer

## 2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	Pass	Meet the requirement of limit. Minimum passing margin is -15.31 dB at 2.506 MHz.
15.247(a)(1)(iii)	Number of Hopping Frequency Used	N/A	Refer to Note
15.247(a)(1)(iii)	Dwell Time on Each Channel	N/A	Refer to Note
15.247(a)(1)	1. Hopping Channel Separation 2. Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	N/A	Refer to Note
15.247(b)	Maximum Peak Output Power	N/A	Refer to Note
15.205 & 209	Radiated Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -2.72 dB at 2480 MHz.
15.247(d)	Band Edge Measurement	N/A	Refer to Note
15.247(d)	Antenna Port Emission	N/A	Refer to Note
15.203	Antenna Requirement	N/A	Refer to Note

Note: Only test item of Conducted and Radiated Emissions were performed for this report. Other testing data is referring to UL Japan, Inc. module report (Test Report No.: 10689818H-B, Issue Date: Jun. 17, 2015).

### 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) (±)
Radiated Emissions up to 1 GHz	30 MHz ~ 200 MHz	2.93 dB
	200 MHz ~ 1000 MHz	2.95 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	2.26 dB
	18 GHz ~ 40 GHz	1.94 dB

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

<b>Product</b>	Communication Module
<b>Brand</b>	Murata
<b>Test Model</b>	LBEE5ZZ1EN
<b>Status of EUT</b>	Identical Prototype
<b>Power Supply Rating</b>	19.5 Vdc (adapter)
<b>Modulation Type</b>	GFSK, $\pi/4$ -DQPSK, 8DPSK
<b>Transfer Rate</b>	1/2/3 Mbps
<b>Operating Frequency</b>	2402 ~ 2480 MHz
<b>Number of Channel</b>	79
<b>Antenna Type</b>	Refer to Note as below
<b>Antenna Connector</b>	N/A
<b>Accessory Device</b>	N/A
<b>Data Cable Supplied</b>	N/A

Note:

- The antenna information is listed as below.

Antenna Type	Brand Name	Parts Number	Antenna Gain (dBi)
			2.4GHz
Dipole	Laird	WLAN Main Antenna: PDV24515-DE1 WLAN Aux Antenna: PDV24515-DE1	Main: 2.9 Aux: 2.9
Monopole	Taoglas Antenna Solution Ltd.	WLAN Main Antenna: MA761.B.BICG.014 WLAN Aux Antenna: MA761.B.BICG.014	Main: 2.82 Aux: 2.79

- The EUT is authorized for use in specific End-product. Please refer to below table for more details.

Item	Brand	Model
Industrial Computer	Dell	N01PC

- The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

### 3.2 Description of Test Modes

79 channels are provided to this EUT:

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461		

### 3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To				Description
	RE $\geq$ 1G	RE $<$ 1G	PLC	APCM	
A	√	√	√	-	Dipol Antenna
B	√	√	√	-	Momopole Antenna

Where **RE $\geq$ 1G**: Radiated Emission above 1 GHz      **RE $<$ 1G**: Radiated Emission below 1 GHz  
**PLC**: Power Line Conducted Emission      **APCM**: Antenna Port Conducted Measurement

**NOTE:**

1. For Radiated emission test, pre-tested GFSK,  $\pi/4$ -DQPSK, 8DPSK modulation type and found 8DPSK was the worse, therefore chosen for the final test and presented in the test report.
2. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Z-plane** for mode A and **X-plane** for mode B.
3. "-" means no effect.

#### **Radiated Emission Test (Above 1 GHz):**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
A, B	0 to 78	0, 39, 78	FHSS	8DPSK	DH5

#### **Radiated Emission Test (Below 1 GHz):**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
A, B	0 to 78	78	FHSS	8DPSK	DH5

#### **Power Line Conducted Emission Test:**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
A, B	0 to 78	78	FHSS	8DPSK	DH5

#### **Test Condition:**

Applicable To	Environmental Conditions	Input Power	Tested by
RE $\geq$ 1G	25 deg. C, 65 % RH	120 Vac, 60 Hz	Gavin Wu
RE $<$ 1G	25 deg. C, 65 % RH	120 Vac, 60 Hz	Toby Tian
PLC	25 deg. C, 65 % RH	120 Vac, 60 Hz	Toby Tian



### 3.3 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.

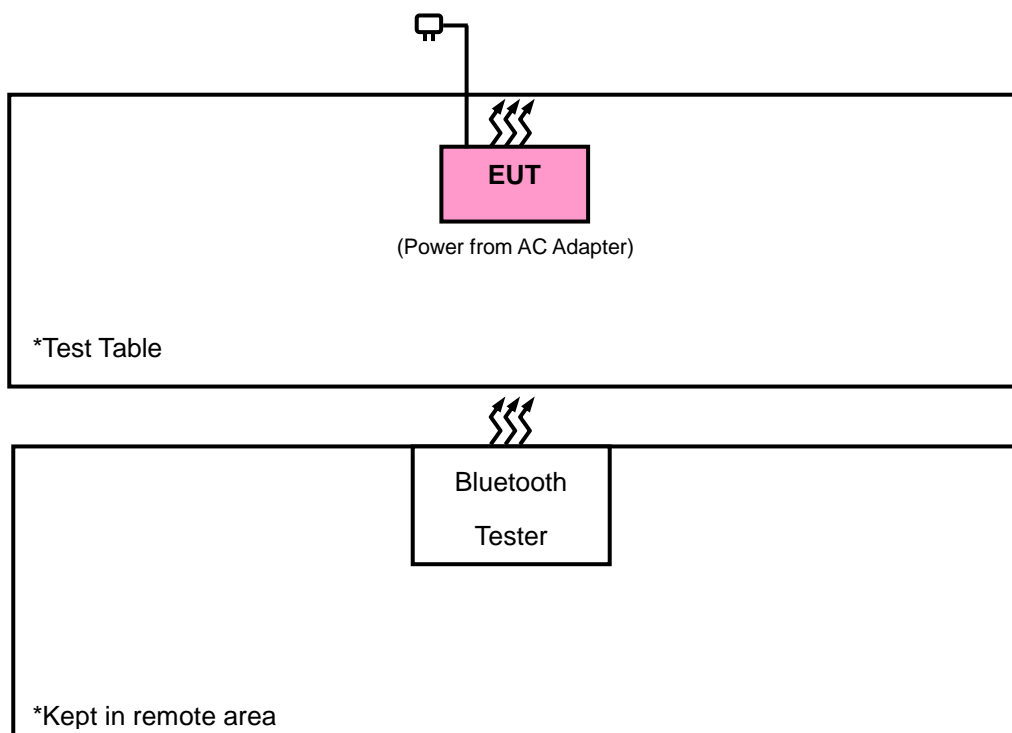
No.	Product	Brand	Model No.	Serial No.	FCC ID
1.	Bluetooth Tester	R&S	CBT	100980	N/A

No.	Signal Cable Description Of The Above Support Units
1.	N/A

Note:

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

#### 3.3.1 Configuration of System under Test



### 3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**FCC Part 15, Subpart C (15.247)**

**FCC Public Notice DA 00-705**

ANSI C63.10-2013

All test items have been performed and recorded as per the above standards.

**NOTE:** The EUT has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC).  
The test report has been issued separately.

## 4 Test Types and Results

### 4.1 Radiated Emission and Bandedge Measurement

#### 4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20 dB below the highest level of the desired power:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F (kHz)	300
0.490 ~ 1.705	24000/F (kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

**NOTE:**

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000 MHz, 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 20 dB under any condition of modulation.

#### 4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver Agilent	N9038A	MY51210203	Jan. 21, 2016	Jan. 20, 2017
Spectrum Analyzer Agilent	N9010A	MY52220314	Sep. 03, 2015	Sep. 02, 2016
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Dec. 17, 2015	Dec. 16, 2016
BILOG Antenna SCHWARZBECK	VULB9168	9168-472	Jan. 07, 2016	Jan. 06, 2017
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-969	Jan. 18, 2016	Jan. 17, 2017
HORN Antenna SCHWARZBECK	BBHA 9170	9170-480	Jan. 08, 2016	Jan. 07, 2017
Loop Antenna	EM-6879	269	Jul. 31, 2015	Jul. 30, 2016
Preamplifier EMCI	EMC 012645	980115	Dec. 21, 2015	Dec. 20, 2016
Preamplifier EMCI	EMC 184045	980116	Dec. 21, 2015	Dec. 20, 2016
Preamplifier EMCI	EMC 330H	980112	Dec. 28, 2015	Dec. 27, 2016
Power Meter Anritsu	ML2495A	1232002	Sep. 21, 2015	Sep. 20, 2016
Power Sensor Anritsu	MA2411B	1207325	Sep. 21, 2015	Sep. 20, 2016
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	309219/4 2950114	Oct. 12, 2015	Oct. 11, 2016
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	250130/4	Oct. 12, 2015	Oct. 11, 2016
RF Coaxial Cable Worken	8D-FB	Cable-Ch10-01	Oct. 12, 2015	Oct. 11, 2016
Software BV ADT	E3 6.120103	NA	NA	NA
Antenna Tower MF	MFA-440H	NA	NA	NA
Turn Table MF	MFT-201SS	NA	NA	NA
Antenna Tower & Turn Table Controller MF	MF-7802	NA	NA	NA

- Note: 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 HwaYa Chamber 10.
3. The horn antenna and preamplifier (model: EMC 184045) are used only for the measurement of emission frequency above 1 GHz if tested.
4. The FCC Site Registration No. is 690701.
5. The IC Site Registration No. is IC7450F-10.

#### 4.1.3 Test Procedures

- a. The EUT was placed on the top of a rotating table 0.8 meters (for below 1 GHz) / 1.5 meters (for above 1 GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna 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.
- d. 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.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

**Note:**

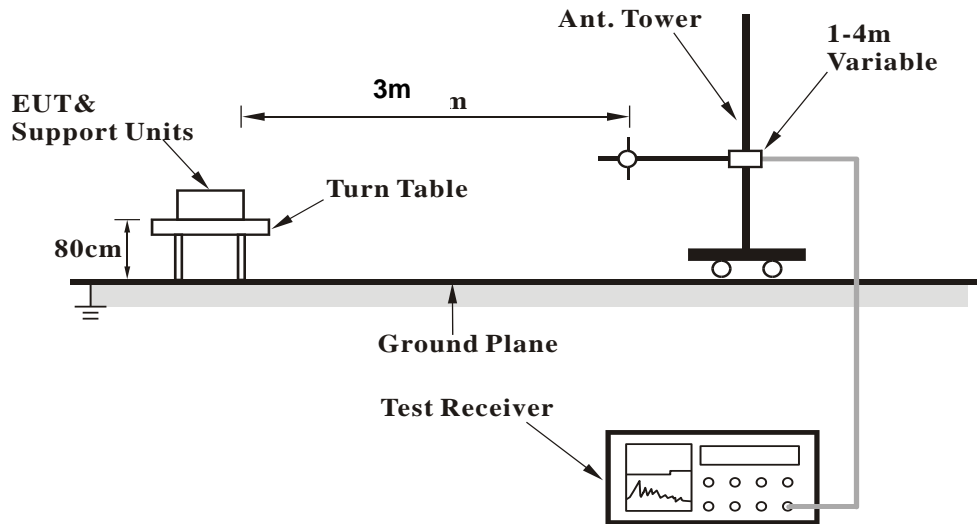
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for RMS Average (Duty cycle < 98 %) for Average detection (AV) at frequency above 1 GHz, then the measurement results was added to a correction factor ( $10 \log(1/\text{duty cycle})$ ).
4. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz (Duty cycle  $\geq 98$  %) for Average detection (AV) at frequency above 1 GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

#### 4.1.4 Deviation from Test Standard

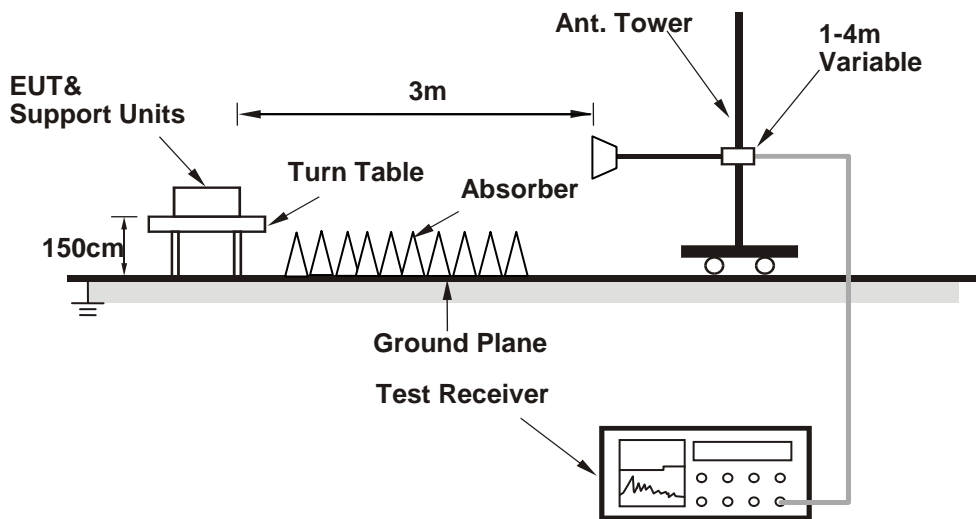
No deviation.

#### 4.1.5 Test Set Up

##### <Frequency Range below 1 GHz>



##### <Frequency Range above 1 GHz>



For the actual test configuration, please refer to the attached file (Test Setup Photo).

#### 4.1.6 EUT Operating Conditions

Set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

**ABOVE 1 GHz DATA :**

**8DPSK**

**Mode A**

EUT Test Condition		Measurement Detail	
Channel	Channel 0	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Gavin Wu

Antenna Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2386	33.83	40.34	54	-20.17	26.91	4.08	37.5	200	62	Average
2386	58.55	65.06	74	-15.45	26.91	4.08	37.5	200	62	Peak
2402	86.5	93.02			26.91	4.09	37.52	200	62	Average
2402	98.22	104.74			26.91	4.09	37.52	200	62	Peak
2498	33.85	39.74	54	-20.15	27.2	4.16	37.25	200	62	Average
2498	56.64	62.53	74	-17.36	27.2	4.16	37.25	200	62	Peak

Antenna Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2390	33.42	39.95	54	-20.58	26.91	4.08	37.52	225	62	Average
2390	56.76	63.29	74	-17.24	26.91	4.08	37.52	225	62	Peak
2402	82.61	89.13			26.91	4.09	37.52	225	62	Average
2402	93.36	99.88			26.91	4.09	37.52	225	62	Peak
2490	33.83	39.79	54	-20.17	27.2	4.16	37.32	225	62	Average
2490	56.69	62.65	74	-17.31	27.2	4.16	37.32	225	62	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2402 MHz: Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 39	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Gavin Wu

Antenna Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2348	33.84	40.51	54	-20.16	26.77	4.05	37.49	196	60	Average
2348	56.41	63.08	74	-17.59	26.77	4.05	37.49	196	60	Peak
2441	87.02	93.23			27.06	4.12	37.39	196	60	Average
2441	98.84	105.05			27.06	4.12	37.39	196	60	Peak
2488	34.71	40.67	54	-19.29	27.2	4.16	37.32	196	60	Average
2488	56.71	62.67	74	-17.29	27.2	4.16	37.32	196	60	Peak
Antenna Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2374	33.44	40.01	54	-20.56	26.86	4.07	37.5	220	61	Average
2374	57.16	63.73	74	-16.84	26.86	4.07	37.5	220	61	Peak
2441	82.34	88.55	54		27.06	4.12	37.39	220	61	Average
2441	92.9	99.11	74		27.06	4.12	37.39	220	61	Peak
2500	34.19	40.08	54	-19.81	27.2	4.16	37.25	220	61	Average
2500	57.48	63.37	74	-16.52	27.2	4.16	37.25	220	61	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2441 MHz: Fundamental frequency.



EUT Test Condition		Measurement Detail	
Channel	Channel 78	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Gavin Wu

Antenna Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2348	33.13	39.8	54	-20.87	26.77	4.05	37.49	197	62	Average
2348	57.36	64.03	74	-16.64	26.77	4.05	37.49	197	62	Peak
2480	86.64	92.66			27.15	4.15	37.32	197	62	Average
2480	98.51	104.53			27.15	4.15	37.32	197	62	Peak
2484	35.6	41.62	54	-18.4	27.15	4.15	37.32	197	62	Average
2484	71.28	77.3	74	-2.72	27.15	4.15	37.32	197	62	Peak
Antenna Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2338	33.08	39.74	54	-20.92	26.77	4.04	37.47	219	68	Average
2338	56.2	62.86	74	-17.8	26.77	4.04	37.47	219	68	Peak
2480	81.45	87.47			27.15	4.15	37.32	219	68	Average
2480	91.86	97.88			27.15	4.15	37.32	219	68	Peak
2492	34.61	40.5	54	-19.39	27.2	4.16	37.25	219	68	Average
2492	56.66	62.55	74	-17.34	27.2	4.16	37.25	219	68	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2480 MHz: Fundamental frequency.

### Mode B

EUT Test Condition		Measurement Detail	
Channel	Channel 0	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Gavin Wu

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

Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2386	34.16	40.67	54	-19.84	26.91	4.08	37.5	250	225	Average
2386	60.79	67.3	74	-13.21	26.91	4.08	37.5	250	225	Peak
2402	87.62	94.14			26.91	4.09	37.52	250	225	Average
2402	99.3	105.82			26.91	4.09	37.52	250	225	Peak
2500	33.41	39.3	54	-20.59	27.2	4.16	37.25	250	225	Average
2500	56.52	62.41	74	-17.48	27.2	4.16	37.25	250	225	Peak

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

Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2390	33.33	39.86	54	-20.67	26.91	4.08	37.52	100	9	Average
2390	59.24	65.77	74	-14.76	26.91	4.08	37.52	100	9	Peak
2402	84.91	91.43			26.91	4.09	37.52	100	9	Average
2402	95.69	102.21			26.91	4.09	37.52	100	9	Peak
2500	33.44	39.33	54	-20.56	27.2	4.16	37.25	100	9	Average
2500	56.89	62.78	74	-17.11	27.2	4.16	37.25	100	9	Peak

#### Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2402 MHz: Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 39	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Gavin Wu

Antenna Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2384	33.87	40.43	54	-20.13	26.86	4.08	37.5	220	212	Average
2384	56.71	63.27	74	-17.29	26.86	4.08	37.5	220	212	Peak
2441	87.96	94.17			27.06	4.12	37.39	220	212	Average
2441	99.29	105.5			27.06	4.12	37.39	220	212	Peak
2496	34.98	40.87	54	-19.02	27.2	4.16	37.25	220	212	Average
2496	56.34	62.23	74	-17.66	27.2	4.16	37.25	220	212	Peak
Antenna Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2326	33.49	40.21	54	-20.51	26.72	4.03	37.47	100	13	Average
2326	56.06	62.78	74	-17.94	26.72	4.03	37.47	100	13	Peak
2441	85.11	91.32			27.06	4.12	37.39	100	13	Average
2441	95.64	101.85			27.06	4.12	37.39	100	13	Peak
2484	33.62	39.64	54	-20.38	27.15	4.15	37.32	100	13	Average
2484	56.67	62.69	74	-17.33	27.15	4.15	37.32	100	13	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2441 MHz: Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 78	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Gavin Wu

Antenna Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2326	32.81	39.53	54	-21.19	26.72	4.03	37.47	240	219	Average
2326	56.09	62.81	74	-17.91	26.72	4.03	37.47	240	219	Peak
2480	87.97	93.99			27.15	4.15	37.32	240	219	Average
2480	99.35	105.37			27.15	4.15	37.32	240	219	Peak
2484	35.55	41.57	54	-18.45	27.15	4.15	37.32	240	219	Average
2484	70.67	76.69	74	-3.33	27.15	4.15	37.32	240	219	Peak
Antenna Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2390	32.82	39.35	54	-21.18	26.91	4.08	37.52	111	5	Average
2390	57.52	64.05	74	-16.48	26.91	4.08	37.52	111	5	Peak
2480	85.23	91.25			27.15	4.15	37.32	111	5	Average
2480	95.67	101.69			27.15	4.15	37.32	111	5	Peak
2488	34.05	40.01	54	-19.95	27.2	4.16	37.32	111	5	Average
2488	57.34	63.3	74	-16.66	27.2	4.16	37.32	111	5	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value
- 2480 MHz: Fundamental frequency.

### 9 kHz ~ 30 MHz DATA:

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

### 30 MHz ~ 1 GHz WORST-CASE DATA:

#### Mode A

EUT Test Condition		Measurement Detail	
Channel	Channel 78	Frequency Range	30 MHz ~ 1 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Quasi-peak (QP)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Toby Tian

Antenna Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
33.88	26.68	44.53	40	-13.32	12.63	0.6	31.08	139	337	Peak
127	39.72	58.99	43.5	-3.78	11.48	1.14	31.89	114	145	Peak
184.23	23.11	43.19	43.5	-20.39	10.46	1.23	31.77	134	112	Peak
359.8	16.43	32.23	46	-29.57	14.38	1.79	31.97	140	305	Peak
480.08	20.03	32.9	46	-25.97	16.93	2.05	31.85	139	185	Peak
621.7	23.17	33.16	46	-22.83	19.87	2.3	32.16	123	46	Peak
Antenna Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
33.88	36.81	54.66	40	-3.19	12.63	0.6	31.08	106	296	Peak
121.18	37.14	56.79	43.5	-6.36	11.09	1.16	31.9	137	164	Peak
222.06	17.98	38.04	46	-28.02	10.3	1.38	31.74	124	287	Peak
363.68	17.3	32.97	46	-28.7	14.47	1.81	31.95	117	59	Peak
515	21.2	33	46	-24.8	17.66	2.12	31.58	125	360	Peak
624.61	22.61	32.57	46	-23.39	19.9	2.3	32.16	135	4	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value

### Mode B

EUT Test Condition		Measurement Detail	
Channel	Channel 78	Frequency Range	30 MHz ~ 1 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Quasi-peak (QP)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Toby Tian

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

Frequency (MHz)	Emission Level (dBUV/m)	Read Level (dBUV)	Limit (dBUV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
34.85	26.69	44.36	40	-13.31	12.79	0.6	31.06	136	335	Peak
126.03	39.17	58.5	43.5	-4.33	11.42	1.14	31.89	106	72	Peak
182.29	23.49	43.48	43.5	-20.01	10.6	1.22	31.81	105	22	Peak
336.52	16.7	32.97	46	-29.3	13.82	1.73	31.82	138	20	Peak
458.74	19.45	32.94	46	-26.55	16.5	2	31.99	101	139	Peak
534.4	22.14	33.6	46	-23.86	18.1	2.15	31.71	107	240	Peak

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

Frequency (MHz)	Emission Level (dBUV/m)	Read Level (dBUV)	Limit (dBUV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
32.91	36.98	55	40	-3.02	12.47	0.6	31.09	118	268	Peak
127	37.07	56.34	43.5	-6.43	11.48	1.14	31.89	138	255	Peak
223.03	18.16	38.18	46	-27.84	10.34	1.39	31.75	108	38	Peak
447.1	20.1	33.84	46	-25.9	16.27	1.98	31.99	130	235	Peak
515.97	21.04	32.82	46	-24.96	17.68	2.12	31.58	131	253	Peak
648.86	22.95	32.43	46	-23.05	20.2	2.35	32.03	117	126	Peak

#### Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor  
Margin value = Emission level – Limit value

## 4.2 Conducted Emission Measurement

### 4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

- Note: 1. The lower limit shall apply at the transition frequencies.  
 2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.  
 3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

### 4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date Of Calibration	Due Date Of Calibration
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Nov. 16, 2015	Nov. 15, 2016
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond1-01	Dec. 26, 2015	Dec. 25, 2016
LISN ROHDE & SCHWARZ (EUT)	ESH3-Z5	835239/001	Feb. 26, 2016	Feb. 25, 2017
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Jul. 24, 2015	Jul. 23, 2016
Software ADT	BV ADT_Cond_ V7.3.7.3	NA	NA	NA

- Note: 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 HwaYa Shielded Room 1.  
 3. The VCCI Site Registration No. is C-2040.

#### 4.2.3 Test Procedures

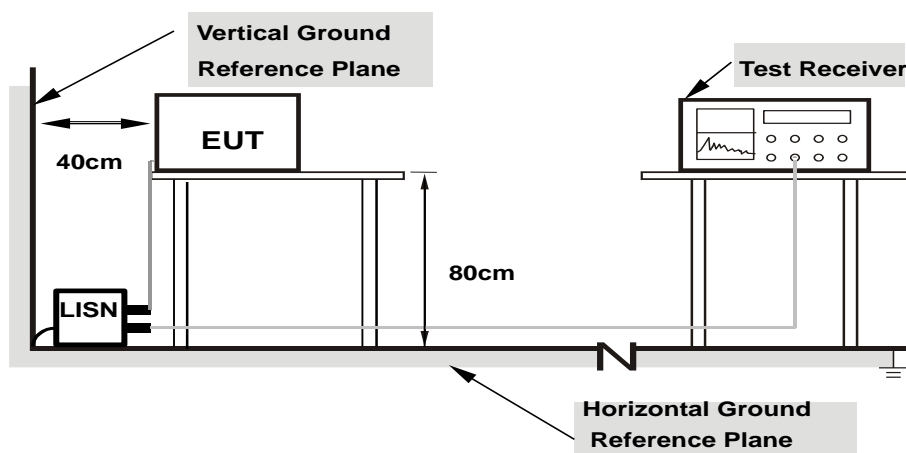
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50 uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) was not recorded.

**NOTE:** All modes of operation were investigated and the worst-case emissions are reported.

#### 4.2.4 Deviation from Test Standard

No deviation.

#### 4.2.5 Test Setup



- Note:**
- 1.Support units were connected to second LISN.
  - 2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

For the actual test configuration, please refer to the attached file (Test Setup Photo).

#### 4.2.6 EUT Operating Condition

Set the EUT under transmission condition continuously at specific channel frequency.



#### 4.2.7 Test Results

#### CONDUCTED WORST-CASE DATA : 8DPSK

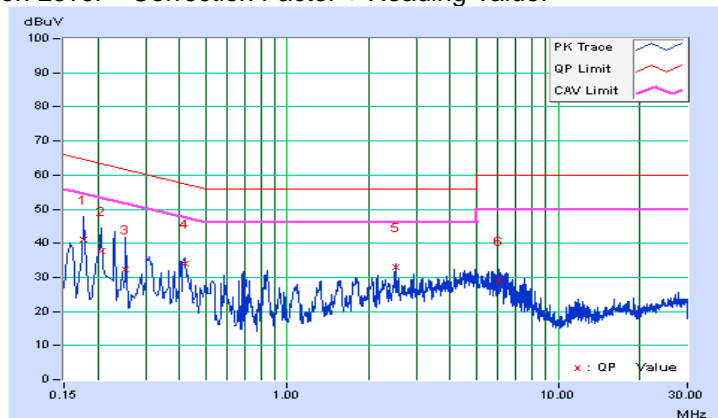
#### Mode A

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
	1	0.17801	10.02	31.08	9.24	41.10	19.26	64.58	54.58	-23.47
2	0.20600	10.03	27.69	13.92	37.72	23.95	63.37	53.37	-25.64	-29.41
3	0.25400	10.05	22.25	3.29	32.30	13.34	61.63	51.63	-29.32	-38.28
4	0.41799	10.12	23.76	11.71	33.88	21.83	57.49	47.49	-23.61	-25.66
<b>5</b>	<b>2.50600</b>	<b>10.31</b>	<b>22.85</b>	<b>20.38</b>	<b>33.16</b>	<b>30.69</b>	<b>56.00</b>	<b>46.00</b>	<b>-22.84</b>	<b>-15.31</b>
6	6.04600	10.52	18.49	16.25	29.01	26.77	60.00	50.00	-30.99	-23.23

#### 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.

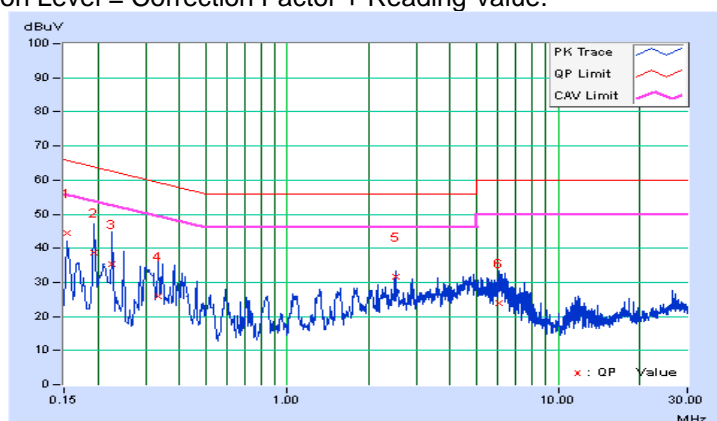


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr.	Reading Value		Emission Level		Limit		Margin	
		Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15400	10.03	34.35	13.68	44.38	23.71	65.78	55.78	-21.41	-32.08
2	0.19400	10.04	28.64	7.88	38.68	17.92	63.86	53.86	-25.19	-35.95
3	0.22600	10.05	25.19	6.46	35.24	16.51	62.60	52.60	-27.35	-36.08
4	0.33400	10.10	15.98	4.92	26.08	15.02	59.35	49.35	-33.27	-34.33
5	2.50733	10.32	21.38	17.34	31.70	27.66	56.00	46.00	-24.30	-18.34
6	6.03800	10.56	13.32	5.97	23.88	16.53	60.00	50.00	-36.12	-33.47

**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.



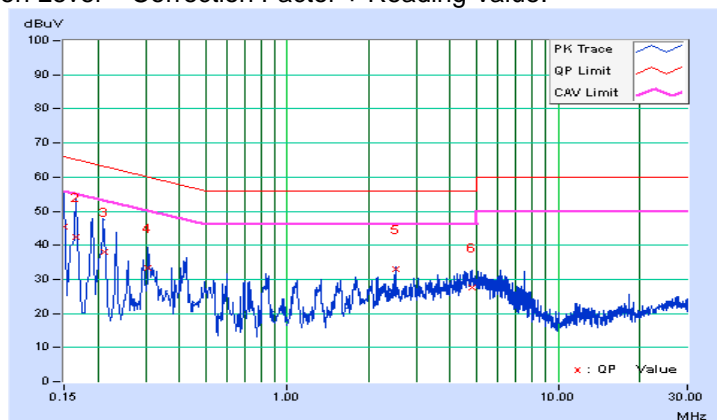
**Mode B**

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr.	Reading Value		Emission Level		Limit		Margin	
		Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.01	35.52	15.17	45.53	25.18	66.00	56.00	-20.47	-30.82
2	0.16600	10.02	32.36	11.29	42.38	21.31	65.16	55.16	-22.78	-33.85
3	0.21015	10.03	28.14	14.88	38.17	24.91	63.20	53.20	-25.02	-28.28
4	0.30630	10.08	23.09	9.99	33.17	20.07	60.07	50.07	-26.90	-30.00
<b>5</b>	<b>2.50600</b>	<b>10.31</b>	<b>22.78</b>	<b>20.38</b>	<b>33.09</b>	<b>30.69</b>	<b>56.00</b>	<b>46.00</b>	<b>-22.91</b>	<b>-15.31</b>
6	4.82200	10.45	17.28	11.45	27.73	21.90	56.00	46.00	-28.27	-24.10

**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.

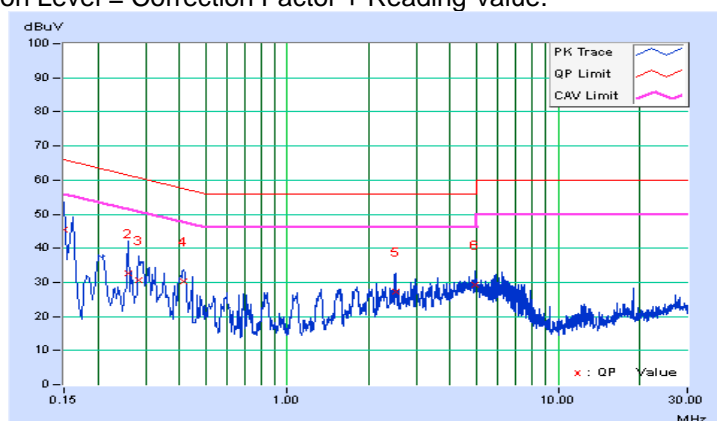


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr.	Reading Value		Emission Level		Limit		Margin	
		Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.03	35.46	15.12	45.49	25.15	66.00	56.00	-20.51	-30.85
2	0.25800	10.07	22.50	2.79	32.57	12.86	61.50	51.50	-28.93	-38.64
3	0.28200	10.08	20.64	3.82	30.72	13.90	60.76	50.76	-30.04	-36.86
4	0.41252	10.13	20.02	7.86	30.15	17.99	57.60	47.60	-27.45	-29.61
5	2.50600	10.32	17.04	12.81	27.36	23.13	56.00	46.00	-28.64	-22.87
6	4.96085	10.49	18.77	13.34	29.26	23.83	56.00	46.00	-26.74	-22.17

**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.



## 5 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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**Web Site:** [www.bureauveritas-adt.com](http://www.bureauveritas-adt.com)

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

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