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# VARIANT FCC TEST REPORT (BLUETOOTH)

**REPORT NO.:** RF120508C10A-1

**MODEL NO.:** TP00042A

**FCC ID:** GKR-TP00042AHJ

**RECEIVED:** May 21, 2012

**TESTED:** Jul. 28 ~ Aug. 06, 2012

**ISSUED:** Aug. 17, 2012

**APPLICANT:** COMPAL ELECTRONICS, INC.

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

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

**TEST LOCATION:** No. 19, Hwa Ya 2nd Rd, Wen Hwa Tsuen, Kwei  
Shan Hsiang, Taoyuan Hsien 333, Taiwan, R.O.C.

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## RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF120508C10A-1	Original release	Aug. 17, 2012



# 1. CERTIFICATION

**PRODUCT:** Convertible Tablet Computer  
**MODEL NO.:** TP00042A  
**BRAND:** Lenovo  
**APPLICANT:** COMPAL ELECTRONICS, INC.  
**TESTED:** Jul. 28 ~ Aug. 06, 2012  
**TEST SAMPLE:** ENGINEERING SAMPLE  
**STANDARDS:** **FCC Part 15, Subpart C (Section 15.247)**  
ANSI C63.10-2009

This report is issued as a supplementary report of BV ADT report no.: RF120508C10-1. This report shall be used by combining with its original report.

**PREPARED BY** : Ivonne Wu , **DATE** : Aug. 17, 2012  
Ivonne Wu / Senior Specialist

**APPROVED BY** : Gary Chang , **DATE** : Aug. 17, 2012  
Gary Chang / Technical Manager

## 2. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15, Subpart C (Bluetooth EDR)			
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT	REMARK
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -14.52dB at 0.57969MHz.
15.247(a)(1) (iii)	Number of Hopping Frequency Used	NA	Refer to NOTE
15.247(a)(1) (iii)	Dwell Time on Each Channel	NA	Refer to NOTE
15.247(a)(1)	1. Hopping Channel Separation 2. Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	NA	Refer to NOTE
15.247(b)	Maximum Peak Output Power	NA	Refer to NOTE
15.247(d)	Transmitter Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -4.7dB at 2398.00MHz.
15.247(d)	Band Edge Measurement	NA	Refer to NOTE
15.203	Antenna Requirement	NA	Refer to NOTE

**NOTE:** Only the conducted emission and radiated emission tests were performed for this addendum. Refer to original report for other test data.

APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.247) (Bluetooth LE 4.0)			
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT	REMARK
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -14.93dB at 0.59531MHz.
15.247(d) 15.209	Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -3.7dB at 2398.00MHz.
15.247(d)	Band Edge Measurement	NA	Refer to NOTE
15.247(a)(2)	6dB bandwidth	NA	Refer to NOTE
15.247(b)	Conducted power	NA	Refer to NOTE
15.247(e)	Power Spectral Density	NA	Refer to NOTE
15.203	Antenna Requirement	NA	Refer to NOTE

**NOTE:** Only the conducted emission and radiated emission tests were performed for this addendum. Refer to original report for other test data.

## 2.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

MEASUREMENT	FREQUENCY	UNCERTAINTY
Conducted emissions	9kHz~30MHz	2.44 dB
Radiated emissions	30MHz ~ 200MHz	3.34 dB
	200MHz ~1000MHz	3.35 dB
	1GHz ~ 18GHz	2.26 dB
	18GHz ~ 40GHz	1.94 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

### 3. GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

<b>EUT</b>	Convertible Tablet Computer	
<b>MODEL NO.</b>	TP00042A	
<b>MODULE MODE NO.</b>	Intel Jackson Peak1	
<b>POWER SUPPLY</b>	20Vdc (Adapter)	
<b>MODULATION TYPE</b>	<b>Bluetooth EDR</b>	GFSK, $\pi/4$ -DQPSK, 8DPSK
	<b>Bluetooth LE 4.0</b>	GFSK
<b>TRANSFER RATE</b>	<b>Bluetooth EDR</b>	1/2/3Mbps
	<b>Bluetooth LE 4.0</b>	1Mbps
<b>OPERATING FREQUENCY</b>	2402 ~ 2480MHz	
<b>NUMBER OF CHANNEL</b>	<b>Bluetooth EDR</b>	79
	<b>Bluetooth LE 4.0</b>	40
<b>CHANNEL SPACING</b>	<b>Bluetooth EDR</b>	1MHz
	<b>Bluetooth LE 4.0</b>	2MHz
<b>OUTPUT POWER</b>	<b>Bluetooth EDR</b>	4.9mW
	<b>Bluetooth LE 4.0</b>	4.6mW
<b>ANTENNA TYPE</b>	Refer to NOTE as below	
<b>ANTENNA CONNECTOR</b>	I-Pex	
<b>DATA CABLE</b>	NA	
<b>I/O PORTS</b>	Refer to user's manual	
<b>ACCESSORY DEVICES</b>	Adapter	

**NOTE:**

1. This report is issued as a supplementary report of BV ADT report no.: RF120508C10-1. The difference compared with original report is changing the antenna. Therefore, we re-tested conducted emission and radiated emission tests and presented in this report.
2. The antenna information is listed as below.

<b>WNC Antenna</b>		
<b>Antenna Type</b>	PIFA	
<b>Manufacturer</b>	Wistron Neweb Corp.	
<b>Model Name</b>	<b>Antenna Type</b>	<b>Model name</b>
	WLAN MAIN L	81.EG915.G34
	WLAN AUX R	81.EG915.G35
<b>Antenna Gain</b>	<b>WLAN/BT Main</b>	
	2.4~2.4835 GHz	-0.54
	<b>WLAN/BT Aux.</b>	
	2.4~2.4835 GHz	-1.09



3. The EUT consumes power from the following adapter.

ADAPTER	
<b>BRAND:</b>	lenovo
<b>MODEL:</b>	45N0185
<b>INPUT:</b>	100-240Vac, 50/60Hz, 1.5A
<b>OUTPUT:</b>	20Vdc, 3.25A
<b>POWER LINE:</b>	1.8m non-shielded cable with one core

4. 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

#### For Bluetooth EDR:

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		

#### For Bluetooth LE 4.0:

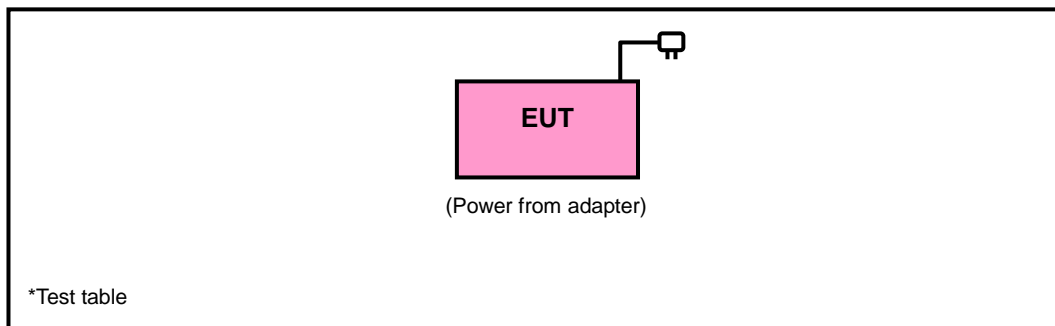
40 channels are provided to this EUT:

CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

### 3.2.1 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit.

### 3.2.2 CONFIGURATION OF SYSTEM UNDER TEST



### 3.2.3 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

#### For Bluetooth EDR:

EUT CONFIGURE MODE	APPLICABLE TO			DESCRIPTION
	RE $\geq$ 1G	RE $<$ 1G	PLC	
-	√	√	√	-

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

#### NOTE:

The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.

#### RADIATED EMISSION TEST (ABOVE 1 GHz):

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

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	PACKET TYPE
0 to 78	0	GFSK	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, antenna ports (if EUT with antenna diversity architecture) and packet type.
- Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	PACKET TYPE
0 to 78	0	GFSK	DH5

#### POWER LINE CONDUCTED EMISSION TEST:

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

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	PACKET TYPE
0 to 78	0	GFSK	DH5

#### TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
<b>RE<math>\geq</math>1G</b>	25deg. C, 65%RH	120Vac, 60Hz	Aska Huang
<b>RE<math>&lt;</math>1G</b>	25deg. C, 65%RH	120Vac, 60Hz	Aska Huang
<b>PLC</b>	22deg. C, 60%RH	120Vac, 60Hz	Pon Tsai

**FOR Bluetooth LE 4.0:**

EUT CONFIGURE MODE	APPLICABLE TO			DESCRIPTION
	RE≥1G	RE<1G	PLC	
-	√	√	√	-

Where **RE≥1G**: Radiated Emission above 1GHz      **RE<1G**: Radiated Emission below 1GHz  
**PLC**: Power Line Conducted Emission

**NOTE:**

The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.

**RADIATED EMISSION TEST (ABOVE 1GHz):**

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

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	0	GFSK	1.0

**RADIATED EMISSION TEST (BELOW 1GHz):**

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

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	0	GFSK	1.0

**POWER LINE CONDUCTED EMISSION TEST:**

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

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	0	GFSK	1.0

**TEST CONDITION:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
<b>RE≥1G</b>	25deg. C, 65%RH	120Vac, 60Hz	Aska Huang
<b>PLC</b>	22deg. C, 60%RH	120Vac, 60Hz	Pon Tsai

### **3.3 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)**

**558074 D01 DTS Meas Guidance v01**

**FCC Public Notice DA 00-705**

ANSI C63.10-2009

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

**NOTE:** The EUT is also considered as a kind of computer peripheral, because the connection to computer is necessary for typical use. It 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 (FOR Bluetooth EDR)

### 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 20dB 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 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.

#### 4.1.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver ROHDE & SCHWARZ	ESIB7	100212	Aug. 06, 2012	Aug. 05, 2013
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100039	Feb. 03, 2012	Feb. 02, 2013
BILOG Antenna SCHWARZBECK	VULB9168	9168-160	Apr. 06, 2012	Apr. 05, 2013
HORN Antenna SCHWARZBECK	9120D	209	Aug. 25, 2011	Aug. 24, 2012
HORN Antenna SCHWARZBECK	BBHA 9170	148	Jul. 11, 2012	Jul. 10, 2013
Loop Antenna	HFH2-Z2	100070	Jan. 31, 2012	Jan. 30, 2014
Preamplifier Agilent	8447D	2944A10633	Oct. 29, 2011	Oct. 28, 2012
Preamplifier Agilent	8449B	3008A01964	Oct. 29, 2011	Oct. 28, 2012
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	250723/4	Aug. 30, 2011	Aug. 29, 2012
RF signal cable HUBER+SUHNNER	SUCOFLEX 106	12738/6+309224/ 4	Aug. 30, 2011	Aug. 29, 2012
Software ADT.	ADT_Radiated_ V7.6.15.9.2	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	013303	NA	NA
Antenna Tower Controller inn-co GmbH	CO2000	017303	NA	NA
Turn Table ADT.	TT100	TT93021703	NA	NA
Turn Table Controller ADT.	SC100	SC93021703	NA	NA

- NOTE:**
1. The calibration interval of the above test instruments except loop antenna is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
  2. The calibration interval of loop antenna is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
  3. The test was performed in HwaYa Chamber 3.
  4. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
  5. The FCC Site Registration No. is 988962.
  6. The IC Site Registration No. is IC 7450F-3.



#### 4.1.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. 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 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.
- 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 Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

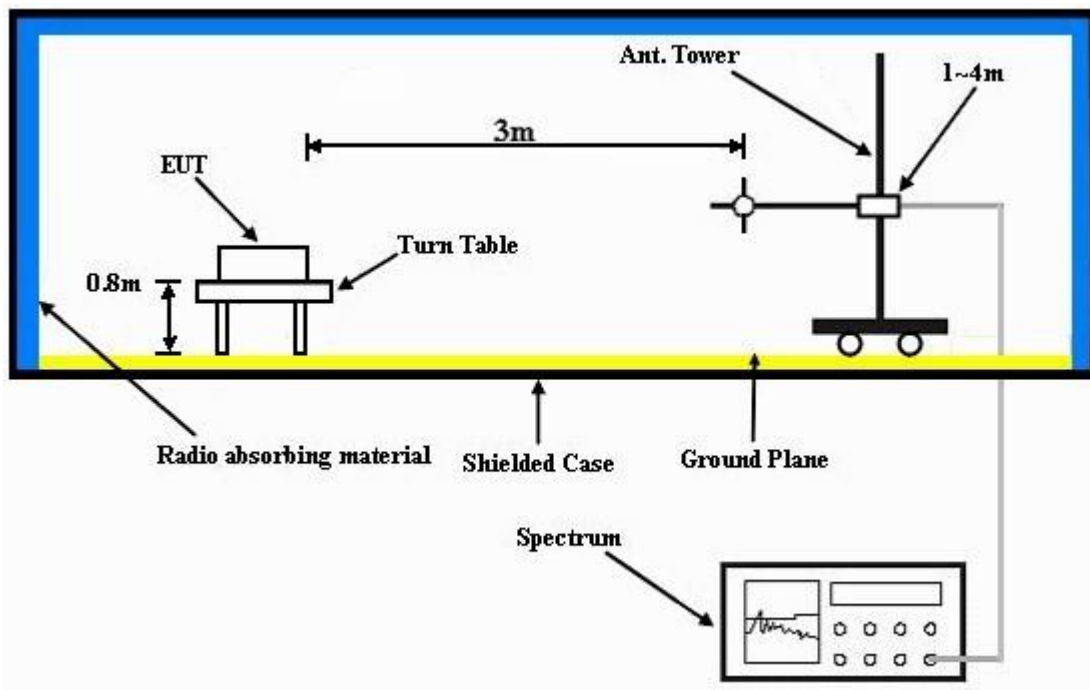
**NOTE:**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. 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 SETUP



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

#### 4.1.6 EUT OPERATING CONDITIONS

- a. Placed the EUT on a testing table.
- b. Use the software to control the EUT under transmission condition continuously at specific channel frequency.

### 4.1.7 TEST RESULTS

#### ABOVE 1GHz DATA

#### BT\_GFSK

<b>CHANNEL</b>	TX Channel 0	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	51.8 PK	74.0	-22.2	1.32 H	318	20.50	31.30
2	2390.00	44.7 AV	54.0	-9.3	1.32 H	318	13.40	31.30
3	2398.00	57.0 PK	74.0	-17.0	1.32 H	318	25.70	31.30
<b>4</b>	<b>2398.00</b>	<b>49.3 AV</b>	<b>54.0</b>	<b>-4.7</b>	<b>1.32 H</b>	<b>318</b>	<b>18.00</b>	<b>31.30</b>
5	2400.00	44.1 PK	74.0	-29.9	1.32 H	318	12.80	31.30
6	2400.00	14.0 AV	54.0	-40.0	1.32 H	318	-17.30	31.30
7	*2402.00	104.1 PK			1.32 H	318	72.80	31.30
8	*2402.00	74.0 AV			1.32 H	318	42.70	31.30
9	4804.00	47.8 PK	74.0	-26.2	1.00 H	122	10.60	37.20
10	4804.00	17.7 AV	54.0	-36.3	1.00 H	122	-19.50	37.20
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	51.9 PK	74.0	-22.1	1.96 V	166	20.60	31.30
2	2390.00	41.6 AV	54.0	-12.4	1.96 V	166	10.30	31.30
3	2398.00	53.5 PK	74.0	-20.5	1.96 V	166	22.20	31.30
4	2398.00	44.8 AV	54.0	-9.2	1.96 V	166	13.50	31.30
5	2400.00	45.4 PK	74.0	-28.6	1.96 V	166	14.10	31.30
6	2400.00	15.3 AV	54.0	-38.7	1.96 V	166	-16.00	31.30
7	*2402.00	99.4 PK			1.96 V	166	68.10	31.30
8	*2402.00	69.3 AV			1.96 V	166	38.00	31.30
9	4804.00	47.7 PK	74.0	-26.3	1.00 V	163	10.50	37.20
10	4804.00	17.6 AV	54.0	-36.4	1.00 V	163	-19.60	37.20

#### 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).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. " \* " : Fundamental frequency.
6. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 \* 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to:  $20\log(3.125 / 100) = -30.1$  dB.
7. Average value = peak reading +  $20\log(\text{duty cycle})$ .

**BELOW 1GHz WORST-CASE DATA**

**BT\_GFSK**

<b>CHANNEL</b>	TX Channel 0	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
<b>FREQUENCY RANGE</b>	30MHz ~ 1GHz		

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	187.39	32.1 QP	43.5	-11.4	1.25 H	287	20.10	12.00
2	333.21	26.8 QP	46.0	-19.2	1.00 H	54	11.00	15.80
3	498.47	34.2 QP	46.0	-11.8	1.99 H	15	14.30	19.90
4	663.74	29.6 QP	46.0	-16.4	1.25 H	193	6.90	22.70
5	747.34	28.4 QP	46.0	-17.6	1.00 H	195	4.20	24.20
6	830.95	28.5 QP	46.0	-17.5	1.99 H	69	2.50	26.00

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	68.79	20.7 QP	40.0	-19.3	1.00 V	19	8.20	12.50
2	94.06	20.4 QP	43.5	-23.1	1.24 V	162	11.70	8.70
3	191.28	28.1 QP	43.5	-15.4	1.00 V	279	16.40	11.70
4	498.47	31.9 QP	46.0	-14.1	2.00 V	19	12.00	19.90
5	667.63	26.0 QP	46.0	-20.0	1.49 V	342	3.30	22.70
6	830.95	28.1 QP	46.0	-17.9	1.24 V	359	2.10	26.00

**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).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.

## 4.2 CONDUCTED EMISSION MEASUREMENT

### 4.2.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB $\mu$ V)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56	56 to 46
0.5 ~ 5	56	46
5 ~ 30	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	ESCS30	100289	Nov. 19, 2011	Nov. 18, 2012
RF signal cable Woken	5D-FB	Cable-HYCO2-01	Dec. 29, 2011	Dec. 28, 2012
LISN ROHDE & SCHWARZ (EUT)	ESH2-Z5	100100	Dec. 30, 2011	Dec. 29, 2012
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Jul. 06, 2012	Jul. 05, 2013
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 2.
  3. The VCCI Site Registration No. is C-2047.

### 4.2.3 TEST PROCEDURES

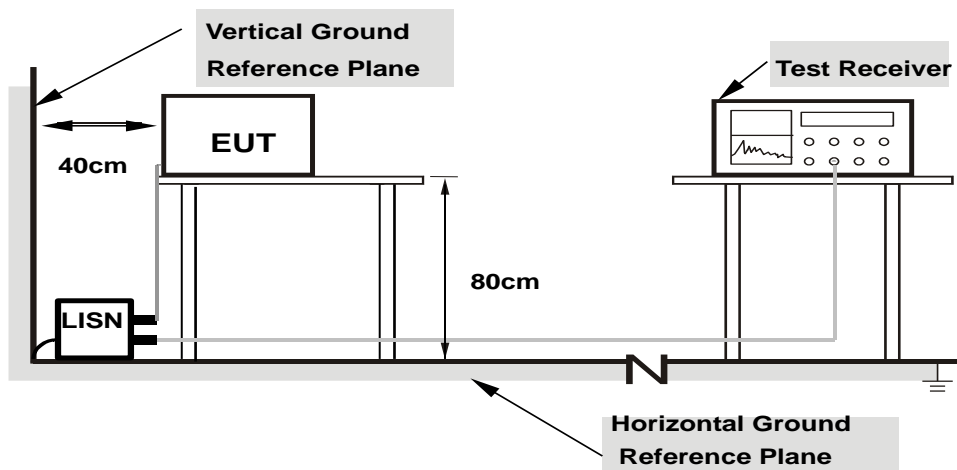
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling 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 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) 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 CONDITIONS

Same as 4.1.6.

## 4.2.7 TEST RESULTS

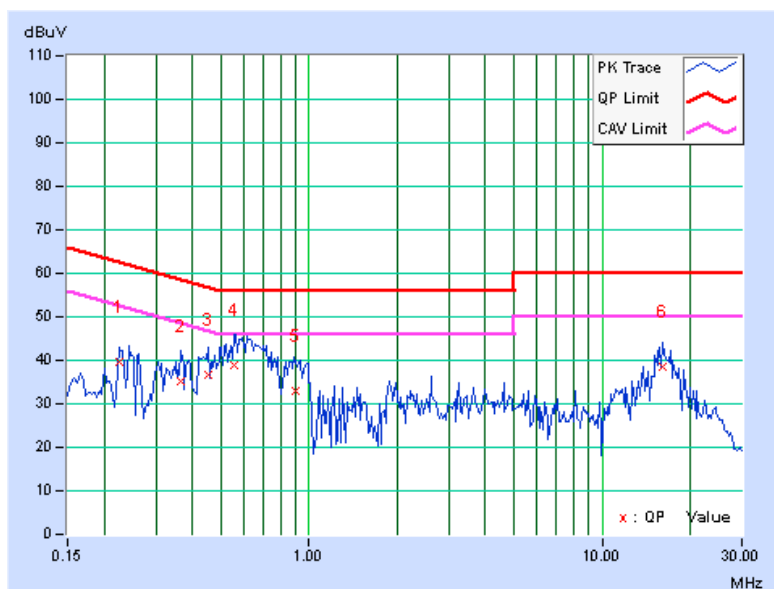
### CONDUCTED WORST CASE DATA: GFSK

PHASE	Line 1	6dB BANDWIDTH	9kHz
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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	0.22422	0.15	39.55	24.38	39.70	24.53	62.66
2	0.36484	0.17	35.02	27.15	35.19	27.32	58.62	48.62	-23.43	-21.30
3	0.45078	0.17	36.60	19.90	36.77	20.07	56.86	46.86	-20.09	-26.79
4	0.55625	0.18	38.54	20.86	38.72	21.04	56.00	46.00	-17.28	-24.96
5	0.90000	0.19	32.88	24.57	33.07	24.76	56.00	46.00	-22.93	-21.24
6	16.17188	0.55	38.11	27.41	38.66	27.96	60.00	50.00	-21.34	-22.04

#### 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.

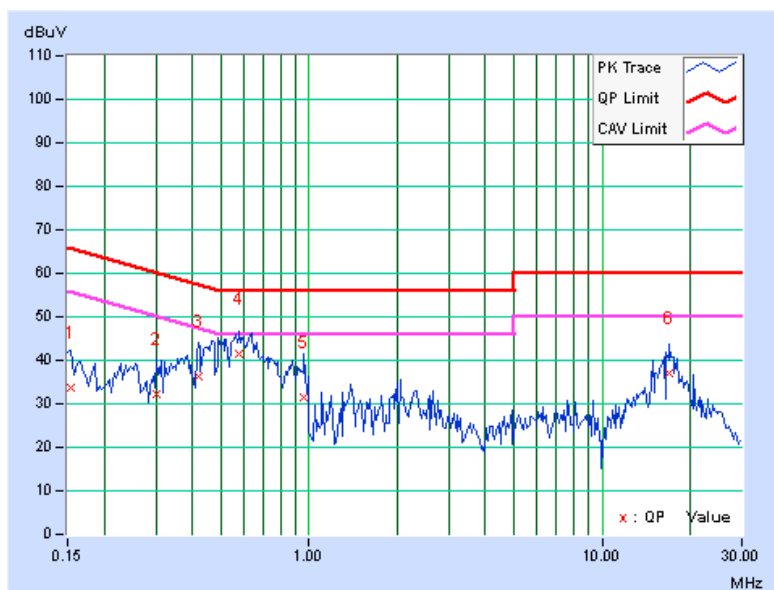


PHASE	Line 2	6dB BANDWIDTH	9kHz
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	0.13	33.48	27.78	33.61	27.91	65.79	55.79	-32.18	-27.88
2	0.30234	0.15	32.23	26.20	32.38	26.35	60.18	50.18	-27.80	-23.83
3	0.41953	0.16	36.26	31.18	36.42	31.34	57.46	47.46	-21.04	-16.12
<b>4</b>	<b>0.57969</b>	<b>0.17</b>	<b>41.31</b>	<b>24.38</b>	<b>41.48</b>	<b>24.55</b>	<b>56.00</b>	<b>46.00</b>	<b>-14.52</b>	<b>-21.45</b>
5	0.96250	0.19	31.17	17.69	31.36	17.88	56.00	46.00	-24.64	-28.12
6	17.02734	0.65	36.27	23.36	36.92	24.01	60.00	50.00	-23.08	-25.99

**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. TEST TYPES AND RESULTS (FOR Bluetooth LE 4.0)**

### **5.1 RADIATED EMISSION AND BANDEDGE MEASUREMENT**

#### **5.1.1 LIMITS OF RADIATED EMISSION AND BANDEDGE MEASUREMENT**

Same as 4.1.1.

#### **5.1.2 TEST INSTRUMENTS**

Same as 4.1.2.

#### **5.1.3 TEST PROCEDURES**

Same as 4.1.3.

#### **5.1.4 DEVIATION FROM TEST STANDARD**

No deviation.

#### **5.1.5 TEST SETUP**

Same as 4.1.5.

#### **5.1.6 EUT OPERATING CONDITIONS**

Same as 4.1.6.

## 5.1.7 TEST RESULTS

### ABOVE 1GHz DATA

#### BT\_LE 4.0

<b>CHANNEL</b>	TX Channel 0	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	56.5 PK	74.0	-17.5	1.62 H	320	25.20	31.30
2	2390.00	46.3 AV	54.0	-7.7	1.62 H	320	15.00	31.30
3	2398.00	57.6 PK	74.0	-16.4	1.62 H	320	26.30	31.30
4	<b>2398.00</b>	<b>50.3 AV</b>	<b>54.0</b>	<b>-3.7</b>	<b>1.62 H</b>	<b>320</b>	<b>19.00</b>	<b>31.30</b>
5	2400.00	51.3 PK	74.0	-22.7	1.62 H	320	20.00	31.30
6	2400.00	50.2 AV	54.0	-3.8	1.62 H	320	18.90	31.30
7	*2402.00	103.3 PK			1.62 H	320	72.00	31.30
8	*2402.00	102.2 AV			1.62 H	320	70.90	31.30
9	4804.00	48.0 PK	74.0	-26.0	1.00 H	185	10.80	37.20
10	4804.00	35.2 AV	54.0	-18.8	1.00 H	185	-2.00	37.20
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	56.0 PK	74.0	-18.0	1.99 V	167	24.70	31.30
2	2390.00	45.8 AV	54.0	-8.2	1.99 V	167	14.50	31.30
3	2398.00	51.9 PK	74.0	-22.1	1.99 V	167	20.60	31.30
4	2398.00	45.3 AV	54.0	-8.7	1.99 V	167	14.00	31.30
5	2400.00	48.8 PK	74.0	-25.2	1.99 V	167	17.50	31.30
6	2400.00	47.7 AV	54.0	-6.3	1.99 V	167	16.40	31.30
7	*2402.00	98.8 PK			1.99 V	167	67.50	31.30
8	*2402.00	97.7 AV			1.99 V	167	66.40	31.30
9	4804.00	48.4 PK	74.0	-25.6	1.00 V	168	11.20	37.20
10	4804.00	35.2 AV	54.0	-18.8	1.00 V	168	-2.00	37.20

#### 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).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. " \* ": Fundamental frequency.
6. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 \* 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to:  $20\log(3.125 / 100) = -30.1$  dB.
7. Average value = peak reading +  $20\log(\text{duty cycle})$ .

**BELOW 1GHz DATA**

**BT\_LE-GFSK**

<b>CHANNEL</b>	TX Channel 0	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
<b>FREQUENCY RANGE</b>	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	187.41	32.9 QP	43.5	-10.6	1.25 H	284	20.90	12.00
2	333.36	27.8 QP	46.0	-18.2	1.00 H	68	12.00	15.80
3	498.52	34.7 QP	46.0	-11.3	1.50 H	21	14.80	19.90
4	663.79	30.1 QP	46.0	-15.9	1.25 H	199	7.40	22.70
5	747.22	28.1 QP	46.0	-17.9	1.25 H	196	3.90	24.20
6	830.89	29.4 QP	46.0	-16.6	2.00 H	71	3.40	26.00

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	68.82	20.9 QP	40.0	-19.1	1.00 V	27	8.40	12.50
2	94.18	21.2 QP	43.5	-22.3	1.00 V	194	12.50	8.70
3	191.27	28.6 QP	43.5	-14.9	1.25 V	268	16.90	11.70
4	498.41	32.0 QP	46.0	-14.0	1.50 V	36	12.10	19.90
5	667.87	26.8 QP	46.0	-19.2	1.50 V	317	4.10	22.70
6	830.68	28.4 QP	46.0	-17.6	1.00 V	357	2.40	26.00

**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).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.

## **5.2 CONDUCTED EMISSION MEASUREMENT**

### **5.2.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT**

Same as 4.2.1.

### **5.2.2 TEST INSTRUMENTS**

Same as 4.2.2.

### **5.2.3 TEST PROCEDURES**

Same as 4.2.3.

### **5.2.4 DEVIATION FROM TEST STANDARD**

No deviation.

### **5.2.5 TEST SETUP**

Same as 4.2.5.

### **5.2.6 EUT OPERATING CONDITIONS**

Same as 4.2.6.

### 5.2.7 TEST RESULTS

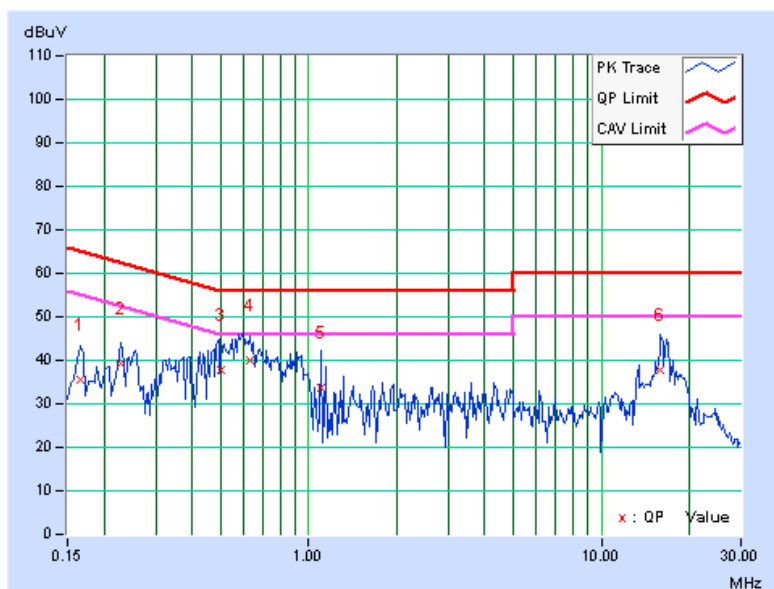
#### CONDUCTED WORST CASE DATA:

PHASE	Line 1	6dB BANDWIDTH	9kHz
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16562	0.15	35.43	26.83	35.58	26.98	65.18	55.18	-29.60	-28.20
2	0.22812	0.15	39.20	28.04	39.35	28.19	62.52	52.52	-23.17	-24.33
3	0.50000	0.17	37.59	25.14	37.76	25.31	56.00	46.00	-18.24	-20.69
4	0.63438	0.18	39.66	22.92	39.84	23.10	56.00	46.00	-16.16	-22.90
5	1.09766	0.20	33.57	18.69	33.77	18.89	56.00	46.00	-22.23	-27.11
6	15.88672	0.55	37.31	26.72	37.86	27.27	60.00	50.00	-22.14	-22.73

#### 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.





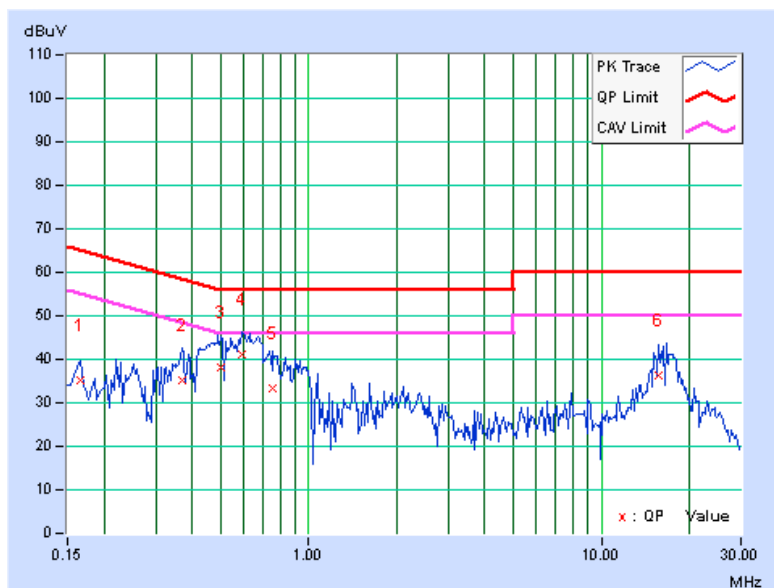
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PHASE	Line 2	6dB BANDWIDTH	9kHz
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No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
	[MHz]		[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16562	0.13	34.99	26.63	35.12	26.76	65.18	55.18	-30.05	-28.41
2	0.36875	0.16	34.85	24.53	35.01	24.69	58.53	48.53	-23.52	-23.84
3	0.50000	0.17	38.06	22.54	38.23	22.71	56.00	46.00	-17.77	-23.29
4	<b>0.59531</b>	<b>0.17</b>	<b>40.90</b>	<b>23.81</b>	<b>41.07</b>	<b>23.98</b>	<b>56.00</b>	<b>46.00</b>	<b>-14.93</b>	<b>-22.02</b>
5	0.75547	0.18	33.29	18.39	33.47	18.57	56.00	46.00	-22.53	-27.43
6	15.78125	0.62	35.51	23.66	36.13	24.28	60.00	50.00	-23.87	-25.72

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.





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## 6. PHOTOGRAPHS OF THE TEST CONFIGURATION

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



## 7. 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:

**Linko EMC/RF Lab:**

Tel: 886-2-26052180

Fax: 886-2-26051924

**Hsin Chu EMC/RF Lab:**

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**Email:** [service.adt@tw.bureauveritas.com](mailto:service.adt@tw.bureauveritas.com)

**Web Site:** [www.adt.com.tw](http://www.adt.com.tw)

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



## **8. APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB**

No modifications were made to the EUT by the lab during the test.

**--- END ---**