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FCC TEST REPORT (BLUETOOTH)

REPORT NO.: RF141104C08A

MODEL NO.: M2 AEBT, M2 OEBT
(Refer to item 3.1 for more details)

FCC ID: DMOM2AEBT

RECEIVED: Jun. 05, 2015

TESTED: Jun. 05 ~ Jun. 06, 2015

ISSUED: Jun. 22, 2015

APPLICANT: Sennheiser electronic GmbH & Co.KG

ADDRESS: Am Labor 1 D-30900 Wedemark, Germany

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

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TEST LOCATION: No.19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan
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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF141104C08	Original release.	Dec. 12, 2014
RF141104C08A	Original release. (Prepared for FCC class II permissive change)	Jun. 22, 2015

1. CERTIFICATION

PRODUCT: Bluetooth Headphone with NFC
MODEL NO.: M2 AEBT, M2 OEBT (Refer to item 3.1 for more details)
BRAND: Sennheiser
APPLICANT: Sennheiser electronic GmbH & Co.KG
TESTED: Jun. 05 ~ Jun. 06, 2015
TEST SAMPLE: ENGINEERING SAMPLE
STANDARDS: FCC Part 15, Subpart C (Section 15.247)

This report is issued as a supplementary report of RF141104C08. This report shall be used combined together with its original report.

PREPARED BY : Ivy Lin , **DATE :** Jun. 22, 2015
Ivy Lin / Specialist

APPROVED BY : Ken Liu , **DATE :** Jun. 22, 2015
Ken Liu / Senior Manager

NOTE: The radiated emission test was performed for the addendum. Refer to original report for the other test data.

2. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15, Subpart C			
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT	REMARK
15.207	AC Power Conducted Emission	N/A	Refer to Note
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 -8.6dB at 57.12MHz.
15.247(d)	Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -21.5dB at 2400.00MHz.
15.247(d)	Antenna Port Emission	N/A	Refer to Note
15.203	Antenna Requirement	N/A	Refer to Note

NOTE: The radiated emission test was performed for the addendum. Refer to original report for the 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
Radiated emissions	30MHz ~ 200MHz	3.86 dB
	200MHz ~1000MHz	3.87 dB
	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 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

EUT	Bluetooth Headphone with NFC
MODEL NO.	M2 AEBT, M2 OEBT (Refer to Note for more details)
POWER SUPPLY	3.7Vdc (Battery) 5Vdc (Host equipment)
MODULATION TYPE	GFSK, 1/4-DQPSK, 8DPSK
MODULATION TECHNOLOGY	FHSS
TRANSFER RATE	1/2/3Mbps
OPERATING FREQUENCY	2402 ~ 2480MHz
NUMBER OF CHANNEL	79
MAX. OUTPUT POWER	6.776mW
ANTENNA TYPE	Refer to Note for more details
ANTENNA CONNECTOR	NA
I/O PORTS	Refer to user's manual
DATA CABLE	Refer to Note for more details
ACCESSORY DEVICES	Refer to Note for more details

NOTE:

1. This report is prepared for FCC class II permissive change.
2. This report is issued as a supplementary report of BV ADT report no.: RF141104C08. This report shall be used combined together with its original report. The differences compared with the original report are PCB enlarged and some changes as below in components and re-position but this change is not affecting the RF portion of this product. Therefore, radiated emission test is re-tested in the test report.
 - a. C19 changed to 4u7 (applicable to both AEBT & OEBT)
 - b. C192 changed to DNI (Do not Install) (applicable to both AEBT & OEBT)
 - c. R264 new component: 2R2 (applicable to both AEBT & OEBT)
 - d. R55 changed to 2K55 (Change of value applicable to OEBT). R55 in AEBT is 3K
 - e. R64 changed to 7K15 (Change of value applicable to OEBT). R64 in AEBT is 6K65
 - f. Test points AT14, AT15, AT16 moved (applicable to both AEBT & OEBT)

3. All models are listed as below. The model: M2 AEBT is for final test

Brand	Model	Similarities	Differences
Sennheiser	M2 AEBT	<ul style="list-style-type: none"> - Main PCB - ANC PCB - Transducer - Headband structure - Bluetooth functionality - NFC functionality 	<ul style="list-style-type: none"> - 3 way switch control (AUX PCB) - filter's components (Resistors and Capacitors value)
Sennheiser	M2 OEBT	<ul style="list-style-type: none"> - Main PCB - ANC PCB - Transducer - Headband structure - Bluetooth functionality - NFC functionality 	<ul style="list-style-type: none"> - 3 way switch control (AUX PCB) - Smaller earcup - filter's components (Resistors and Capacitors value)

- The filter is of passive type. For more detail please refer to the schematic and block diagram.
- The 3 way switch is for "volume" and "play" control not affecting RF. For more detail please refer to the schematic.
- The feed-forward passive AF (Audio Frequency) filter is to cancel / reduce external noise to the mic (in the headphone) typically in the frequency 2 - 3 kHz.
- The feed-back passive AF (Audio Frequency) filter is to cancel / reduce internal noise to the mic (in the headphone) typically in the frequency 20Hz - 1 kHz.

4. The EUT use the following antenna.

Brand	Model	Antenna Type	Antenna Gain (dBi)	Antenna Connector
Sennheiser	M2 AEBT	PCB	1.8	N/A
Sennheiser	M2 OEBT	PCB	1.5	N/A

5. The EUT contains the following accessories.

No.	Product	Description
1	Audio cable	1.4mm non-shield cable with 3.5mm Angled plug
2	USB Cable	1.2m shielded cable
3	Inflight adapter	-

6. The EUT consumes power from the following battery.

BRAND	SYNergy
MODEL	AHB622540PCT-02
RATING	3.7Vdc

7. 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	
-	√	√	-

Where RE \geq 1G: Radiated Emission above 1GHz RE<1G: Radiated Emission below 1GHz

NOTE: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on Z-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.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 78	0, 39, 78	FHSS	GFSK	DH5
-	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, antenna ports (if EUT with antenna diversity architecture) and packet type.
- ☒ 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
-	0 to 78	0	FHSS	GFSK	DH5

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
RE \geq 1G	17deg. C, 70%RH	120Vac, 60Hz	Nick Hsu
RE<1G	17deg. C, 70%RH	120Vac, 60Hz	Nick Hsu

3.3 DESCRIPTION OF SUPPORT UNITS

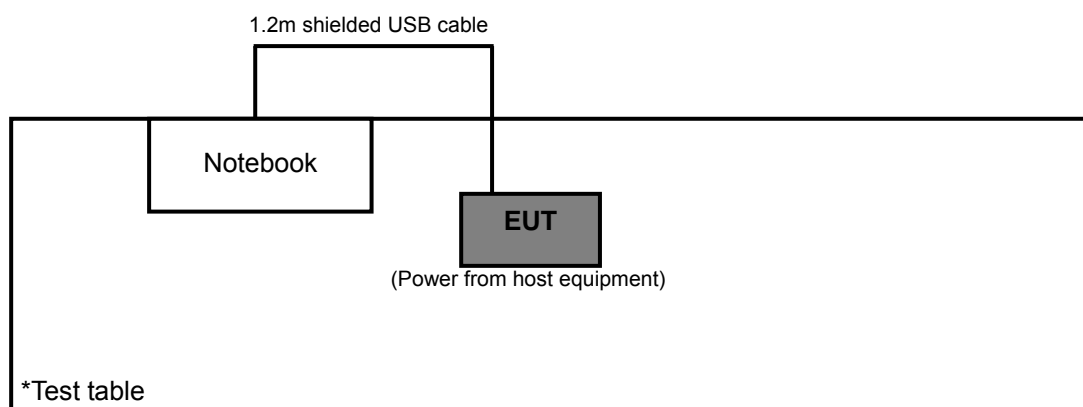
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	Notebook	DELL	D531	CN-0XM006-486 43-81U-2973	QDS-BRCM1020

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	1.2m shielded USB cable (Accessory)

NOTE: All power cords of the above support units are non-shielded (1.8m).

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 C63.10-2009

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

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.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESIB7	100187	Apr. 10, 2015	Apr. 09, 2016
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100041	Aug. 29, 2014	Aug. 28, 2015
BILOG Antenna SCHWARZBECK	VULB9168	9168-160	Feb. 05, 2015	Feb. 04, 2016
HORN Antenna SCHWARZBECK	9120D	209	Feb. 09, 2015	Feb. 08, 2016
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Feb. 09, 2015	Feb. 08, 2016
Preamplifier Agilent	8447D	2944A10738	Oct. 18, 2014	Oct. 17, 2015
Preamplifier Agilent	8449B	3008A01964	Aug. 22, 2014	Aug. 21, 2015
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	214378/4	Aug. 22, 2014	Aug. 21, 2015
RF signal cable HUBER+SUHNNER	SUCOFLEX 106	12738/6 +309224/4	Aug. 22, 2014	Aug. 21, 2015
Software BV ADT	ADT_Radiated_ V7.6.15.9.4	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	013303	NA	NA
Antenna Tower Controller BV ADT	AT100	AT93021702	NA	NA
Turn Table BV ADT	TT100	TT93021702	NA	NA
Turn Table Controller BV ADT	SC100	SC93021702	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 3.
3. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
4. The FCC Site Registration No. is 988962.
5. 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 (for below 1GHz) / 1.5 meters (for above 1GHz) 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 detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.

Note:

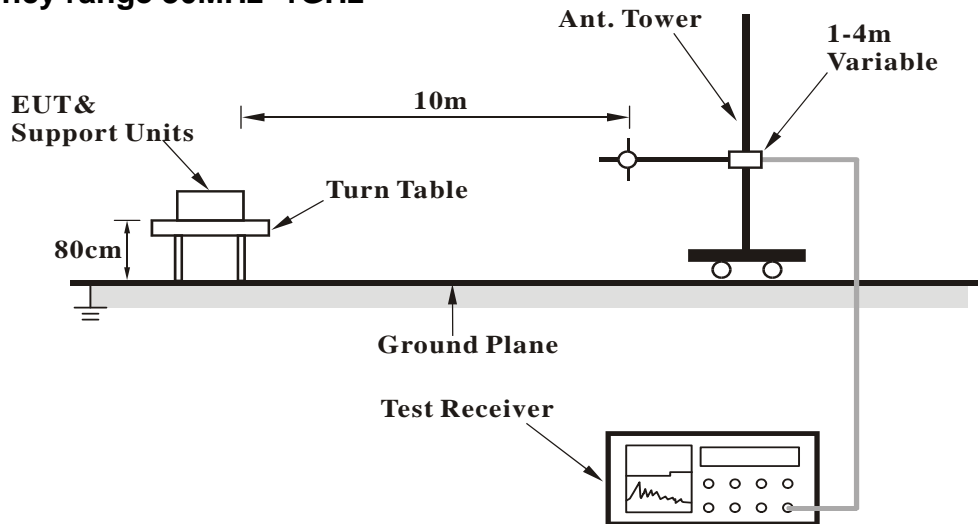
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. For Average measurement, due to 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, therefore Average value = peak reading + $20\log(\text{duty cycle})$.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 DEVIATION FROM TEST STANDARD

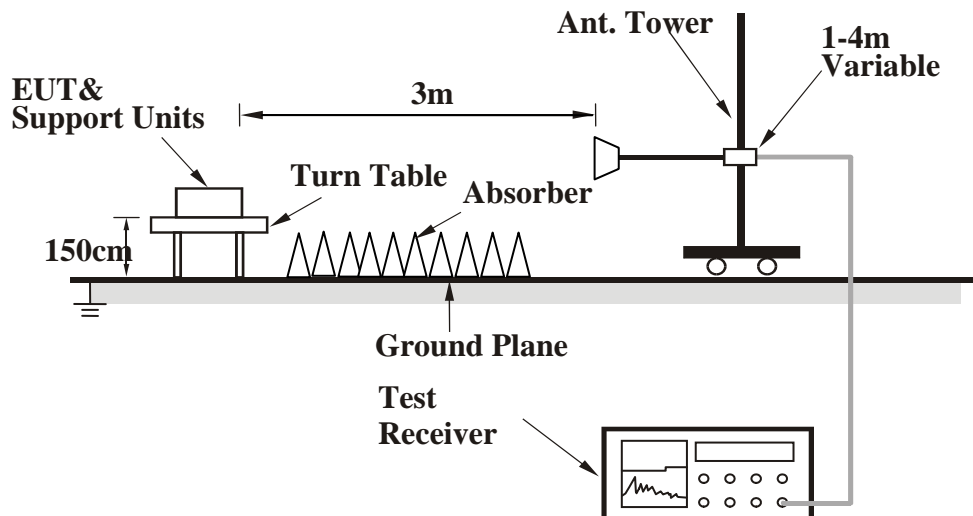
No deviation.

4.1.5 TEST SETUP

Frequency range 30MHz~1GHz



Frequency range above 1GHz



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.



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4.1.7 TEST RESULTS

ABOVE 1GHz WORST-CASE DATA:
GFSK

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	17deg. C, 70%RH	TESTED BY	Nick Hsu

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	49.3 PK	74.0	-24.7	1.14 H	182	50.90	-1.60
2	2390.00	36.8 AV	54.0	-17.2	1.14 H	182	38.40	-1.60
3	#2400.00	52.0 PK	78.1	-26.1	1.36 H	211	53.60	-1.60
4	#2400.00	21.9 AV	48.0	-26.1	1.36 H	211	23.50	-1.60
5	*2402.00	98.1 PK			1.36 H	211	65.50	32.60
6	*2402.00	68.0 AV			1.36 H	211	35.40	32.60
7	4804.00	53.5 PK	74.0	-20.5	1.93 H	65	47.60	5.90
8	4804.00	23.4 AV	54.0	-30.6	1.93 H	65	17.50	5.90
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	48.5 PK	74.0	-25.5	1.16 V	354	50.10	-1.60
2	2390.00	37.3 AV	54.0	-16.7	1.16 V	354	38.90	-1.60
3	#2400.00	62.6 PK	84.1	-21.5	1.29 V	352	64.20	-1.60
4	#2400.00	32.5 AV	54.0	-21.5	1.29 V	352	34.10	-1.60
5	*2402.00	104.1 PK			1.29 V	352	71.50	32.60
6	*2402.00	74.0 AV			1.29 V	352	41.40	32.60
7	4804.00	53.6 PK	74.0	-20.4	1.23 V	178	47.70	5.90
8	4804.00	23.5 AV	54.0	-30.5	1.23 V	178	17.60	5.90

REMARKS:

- Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
– Pre-Amplifier Factor(dB)
- The other emission levels were very low against the limit.
- Margin value = Emission Level – Limit value
- " * ": Fundamental frequency.
- 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
- Average value = peak reading + $20\log(\text{duty cycle})$
- "#": The radiated frequency is out the restricted band.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 39	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	17deg. C, 70%RH	TESTED BY	Nick Hsu

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	*2441.00	99.8 PK			1.19 H	268	67.10	32.70
2	*2441.00	69.7 AV			1.19 H	268	37.00	32.70
3	4882.00	54.2 PK	74.0	-19.8	1.37 H	329	48.40	5.80
4	4882.00	24.1 AV	54.0	-29.9	1.37 H	329	18.30	5.80
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	*2441.00	104.2 PK			1.42 V	357	71.50	32.70
2	*2441.00	74.1 AV			1.42 V	357	41.40	32.70
3	4882.00	54.5 PK	74.0	-19.5	1.65 V	176	48.70	5.80
4	4882.00	24.4 AV	54.0	-29.6	1.65 V	176	18.60	5.80

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
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 + $20\log(\text{duty cycle})$



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 78	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	17deg. C, 70%RH	TESTED BY	Nick Hsu

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	*2480.00	102.1 PK			1.01 H	229	69.40	32.70
2	*2480.00	72.0 AV			1.01 H	229	39.30	32.70
3	2483.50	45.7 PK	74.0	-28.3	1.01 H	229	47.20	-1.50
4	2483.50	15.6 AV	54.0	-38.4	1.01 H	229	17.10	-1.50
5	4960.00	54.1 PK	74.0	-19.9	1.68 H	328	48.00	6.10
6	4960.00	24.0 AV	54.0	-30.0	1.68 H	328	17.90	6.10
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	*2480.00	103.2 PK			1.77 V	357	70.50	32.70
2	*2480.00	73.1 AV			1.77 V	357	40.40	32.70
3	2483.50	44.7 PK	74.0	-29.3	1.77 V	357	46.20	-1.50
4	2483.50	14.6 AV	54.0	-39.4	1.77 V	357	16.10	-1.50
5	4960.00	53.3 PK	74.0	-20.7	1.20 V	143	47.20	6.10
6	4960.00	23.2 AV	54.0	-30.8	1.20 V	143	17.10	6.10

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
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: $20\log(3.125 / 100) = -30.1 \text{ dB}$
7. Average value = peak reading + $20\log(\text{duty cycle})$



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8DPSK

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	17deg. C, 70%RH	TESTED BY	Nick Hsu

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	48.6 PK	74.0	-25.4	1.02 H	184	50.20	-1.60
2	2390.00	36.5 AV	54.0	-17.5	1.02 H	184	38.10	-1.60
3	#2400.00	48.2 PK	76.8	-28.6	1.19 H	275	49.80	-1.60
4	#2400.00	18.1 AV	46.7	-28.6	1.19 H	275	19.70	-1.60
5	*2402.00	96.8 PK			1.19 H	275	64.20	32.60
6	*2402.00	66.7 AV			1.19 H	275	34.10	32.60
7	4804.00	51.4 PK	74.0	-22.6	1.12 H	90	45.50	5.90
8	4804.00	21.3 AV	54.0	-32.7	1.12 H	90	15.40	5.90
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	48.9 PK	74.0	-25.1	1.32 V	282	50.50	-1.60
2	2390.00	36.6 AV	54.0	-17.4	1.32 V	282	38.20	-1.60
3	#2400.00	54.0 PK	82.7	-28.7	1.63 V	353	55.60	-1.60
4	#2400.00	23.9 AV	52.6	-28.7	1.63 V	353	25.50	-1.60
5	*2402.00	102.7 PK			1.63 V	353	70.10	32.60
6	*2402.00	72.6 AV			1.63 V	353	40.00	32.60
7	4804.00	51.5 PK	74.0	-22.5	1.23 V	53	45.60	5.90
8	4804.00	21.4 AV	54.0	-32.6	1.23 V	53	15.50	5.90

REMARKS:

- Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
– Pre-Amplifier Factor(dB)
- The other emission levels were very low against the limit.
- Margin value = Emission Level – Limit value
- "*": Fundamental frequency.
- 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
- Average value = peak reading + $20\log(\text{duty cycle})$
- "#": The radiated frequency is out the restricted band.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 39	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	17deg. C, 70%RH	TESTED BY	Nick Hsu

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	*2441.00	99.2 PK			1.05 H	267	66.50	32.70
2	*2441.00	69.1 AV			1.05 H	267	36.40	32.70
3	4882.00	52.3 PK	74.0	-21.7	1.41 H	251	46.50	5.80
4	4882.00	22.2 AV	54.0	-31.8	1.41 H	251	16.40	5.80
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	*2441.00	103.1 PK			1.43 V	357	70.40	32.70
2	*2441.00	73.0 AV			1.43 V	357	40.30	32.70
3	4882.00	50.3 PK	74.0	-23.7	1.00 V	138	44.50	5.80
4	4882.00	20.2 AV	54.0	-33.8	1.00 V	138	14.40	5.80

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
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 + $20\log(\text{duty cycle})$



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 78	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	17deg. C, 70%RH	TESTED BY	Nick Hsu

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	*2480.00	101.2 PK			1.02 H	236	68.50	32.70
2	*2480.00	71.1 AV			1.02 H	236	38.40	32.70
3	2483.50	45.9 PK	74.0	-28.1	1.00 H	236	47.40	-1.50
4	2483.50	15.8 AV	54.0	-38.2	1.00 H	236	17.30	-1.50
5	4960.00	52.4 PK	74.0	-21.6	1.36 H	326	46.30	6.10
6	4960.00	22.3 AV	54.0	-31.7	1.36 H	326	16.20	6.10
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	*2480.00	102.3 PK			1.77 V	10	69.60	32.70
2	*2480.00	72.2 AV			1.77 V	10	39.50	32.70
3	2483.50	46.2 PK	74.0	-27.8	1.77 V	10	47.70	-1.50
4	2483.50	16.1 AV	54.0	-37.9	1.77 V	10	17.60	-1.50
5	4960.00	51.2 PK	74.0	-22.8	1.00 V	142	45.10	6.10
6	4960.00	21.1 AV	54.0	-32.9	1.00 V	142	15.00	6.10

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
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 + $20\log(\text{duty cycle})$



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BELOW 1GHz WORST-CASE DATA : GFSK

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	FREQUENCY RANGE	Below 1000MHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Quasi-Peak
ENVIRONMENTAL CONDITIONS	17deg. C, 70%RH	TESTED BY	Nick Hsu

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	57.12	31.4 QP	40.0	-8.6	1.99 H	141	46.00	-14.60
2	70.73	20.5 QP	40.0	-19.5	1.99 H	3	36.70	-16.20
3	86.28	19.0 QP	40.0	-21.0	1.99 H	90	38.60	-19.60
4	111.56	15.4 QP	43.5	-28.1	1.00 H	92	32.70	-17.30
5	171.83	14.7 QP	43.5	-28.8	1.00 H	6	29.10	-14.40
6	307.93	20.1 QP	46.0	-25.9	1.00 H	290	32.40	-12.30
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	49.34	20.7 QP	40.0	-19.3	1.01 V	3	35.10	-14.40
2	57.12	25.4 QP	40.0	-14.6	1.01 V	336	40.00	-14.60
3	111.56	21.5 QP	43.5	-22.0	1.01 V	279	38.80	-17.30
4	152.39	14.4 QP	43.5	-29.1	1.50 V	9	28.40	-14.00
5	183.50	13.0 QP	43.5	-30.5	1.50 V	130	28.80	-15.80
6	304.04	15.1 QP	46.0	-30.9	1.50 V	119	27.50	-12.40

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



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5. PHOTOGRAPHS OF THE TEST CONFIGURATION

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

6. 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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7. APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications are made to the EUT by the lab during the test.

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