

## FCC Test Report

**Report No.:** RF150727E05

**FCC ID:** JNZS00151

**Test Model:** S-00151

**Received Date:** July 27, 2015

**Test Date:** July 30 to Aug. 04, 2015

**Issued Date:** Aug. 10, 2015

**Applicant:** LOGITECH FAR EAST LTD.

**Address:** #2 Creation Rd. 4, Science-Based Ind. Park Hsinchu Taiwan, R.O.C.

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

**Lab Address:** No. 81-1, Lu Liao Keng, 9th Ling, Wu Lung Tsuen, Chiung Lin Hsiang, Hsin  
Chu Hsien 307, Taiwan R.O.C.

**Test Location (1):** No. 81-1, Lu Liao Keng, 9th Ling, Wu Lung Tsuen, Chiung Lin Hsiang, Hsin  
Chu Hsien 307, Taiwan R.O.C.

**Test Location (2):** No. 49, Ln. 206, Wende Rd., Shangshan Tsuen, Chiung Lin Hsiang, Hsin  
Chu Hsien 307, Taiwan R.O.C.

**Test Location (3):** E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City, Taiwan  
R.O.C.



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A D T

### Release Control Record

Issue No.	Description	Date Issued
RF150727E05	Original release.	Aug. 10, 2015



## 1 Certificate of Conformity

**Product:** Bluetooth speaker

**Brand:** Ue

**Test Model:** S-00151

**Sample Status:** ENGINEERING SAMPLE

**Applicant:** LOGITECH FAR EAST LTD.

**Test Date:** July 30 to Aug. 04, 2015

**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 :** Phoenix Huang , **Date:** Aug. 10, 2015  
Phoenix Huang / Specialist

**Approved by :** May Chen , **Date:** Aug. 10, 2015  
May Chen / Manager

## 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 -7.16dB at 0.63047MHz.
15.247(a)(1)(iii)	Number of Hopping Frequency Used	PASS	Meet the requirement of limit.
15.247(a)(1)(iii)	Dwell Time on Each Channel	PASS	Meet the requirement of limit.
15.247(a)(1)	1. Hopping Channel Separation 2. Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	PASS	Meet the requirement of limit.
15.247(b)	Maximum Peak Output Power	PASS	Meet the requirement of limit.
15.205 / 15.209 / 15.247(d)	Radiated Emissions & Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -3.4dB at 895.19MHz.
15.247(d)	Antenna Port Emission	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used.

**NOTE:** If The Frequency Hopping System operating in 2400-2483.5MHz band and the output power less than 125mW. The hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of hopping channel whichever is greater.

### 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	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.86 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.43 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	3.72 dB
	6GHz ~ 18GHz	4.00 dB
	18GHz ~ 40GHz	4.11 dB

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

Product	Bluetooth speaker
Brand	Ue
Test Model	S-00151
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	3.6Vdc from battery or 5Vdc from USB interface
Modulation Type	GFSK, $\pi/4$ -DQPSK, 8DPSK
Modulation Technology	FHSS
Transfer Rate	Up to 3Mbps
Operating Frequency	2402MHz ~ 2480MHz
Number of Channel	79
Output Power	9.419mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Adapter x 1
Data Cable Supplied	USB cable (shielded, 1.2m)

Note:

1. The EUT may have a lot of colors for marketing requirement.
2. The EUT must be supplied with a power adapter and a rechargeable battery, and following below different model names could be chosen:

Adapter				
No.	Brand	Model No.	Spec.	Energy Consumption
1	Ue	AD895320	AC Input: 100-240V, 0.3A, 50/60Hz DC Output: 5.1V, 2.0A USB cable: 1.2m, shielded	level 5
2	Ue	AD2051J20	AC Input: 100-240V, 0.3A, 50/60Hz DC Output: 5.1V, 2.0A USB cable: 1.2m, shielded	level 6

Battery		
Brand	Model No.	Spec.
Panasonic (Logitech)	NCR18650-1-T1236 (533-000104)	3.6Vdc, 3200mAh, 11.52Wh

Note: For radiated emissions test, the EUT was pre-tested with above Adapter 1~2 & battery, the worst case was found in Adapter 2. Therefore only the test data of the Adapter 2 was recorded in this report.

3. The antennas provided to the EUT, please refer to the following table:

Antenna Type	Antenna Connector	Gain (dBi)
Dipole	NA	0.73

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

79 channels are provided for BT-EDR mode:

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≥1G	RE<1G	PLC	APCM	
1	√	√	√	√	With Adapter 2
2	-	-	√	-	With Adapter 1

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

**NOTE:** 1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on Y-plane.

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

- 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.

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	3DH5

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

- 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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
0 to 78	0	FHSS	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, data rates 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 TECHNOLOGY	MODULATION TYPE	PACKET TYPE
0 to 78	0	FHSS	GFSK	DH5

**Antenna Port Conducted Measurement:**

- This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- 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.

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	3DH5

**Test Condition:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
<b>RE≥1G</b>	24deg. C, 68%RH	120Vac, 60Hz	Robert Cheng
<b>RE&lt;1G</b>	22deg. C, 67%RH	120Vac, 60Hz	Robert Cheng
<b>PLC</b>	25deg. C, 68%RH	120Vac, 60Hz	Jyunchun Lin
<b>APCM</b>	25deg. C, 60%RH	120Vac, 60Hz	Gary Cheng

### 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.

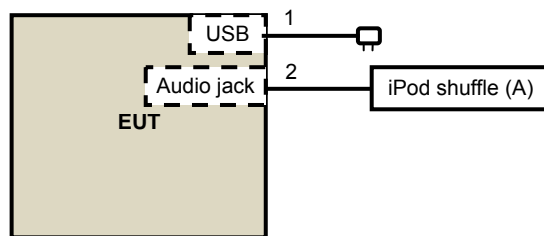
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	iPod shuffle	Apple	MC749TA/A	CC4DMFJUDFDM	NA	Provided by Lab

Note:

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

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB	1	1.2	Yes	0	Supplied by Client
2.	Audio	1	1	No	0	Provided by Lab

#### 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 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.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY50010156	Aug. 11, 2014	Aug. 10, 2015
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-04	Nov. 12, 2014	Nov. 11, 2015
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Feb. 09, 2015	Feb. 08, 2016
RF Cable	8D-FB	CHHCAB-001-1 CHHCAB-001-2	Oct. 05, 2014	Oct. 04, 2015
	RF-141	CHHCAB-004	Oct. 05, 2014	Oct. 04, 2015
Horn_Antenna AISI	AIH.8018	0000220091110	Feb. 06, 2015	Feb. 05, 2016
Pre-Amplifier Agilent	8449B	3008A01923	Oct. 28, 2014	Oct. 27, 2015
RF Cable	NA	131206 131213 131215 SNMY23685/4	Jan. 16, 2015	Jan. 15, 2016
Spectrum Analyzer R&S	FSV40	100964	Jun. 26, 2015	Jun 25, 2016
Pre-Amplifier SPACEK LABS	SLKKa-48-6	9K16	Dec. 12, 2014	Dec. 11, 2015
Horn_Antenna SCHWARZBECK	BBHA 9170	9170-424	Feb. 05, 2015	Feb. 04, 2016
RF Cable	NA	329751/4 RF104-204	Dec. 11, 2014	Dec. 10, 2015
Software	ADT_Radiated _V8.7.07	NA	NA	NA
Antenna Tower & Turn Table CT	NA	NA	NA	NA
Spectrum Analyzer R&S	FSP 40	100060	May 08, 2015	May 07, 2016
Power meter Anritsu	ML2495A	1014008	Apr. 28, 2015	Apr. 27, 2016
Power sensor Anritsu	MA2411B	0917122	Apr. 28, 2015	Apr. 27, 2016

**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 966 Chamber No. H.
3. The FCC Site Registration No. is 797305.
4. The CANADA Site Registration No. is IC 7450H-3.
5. Tested Date: July 30 to Aug. 04, 2015

#### 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:**

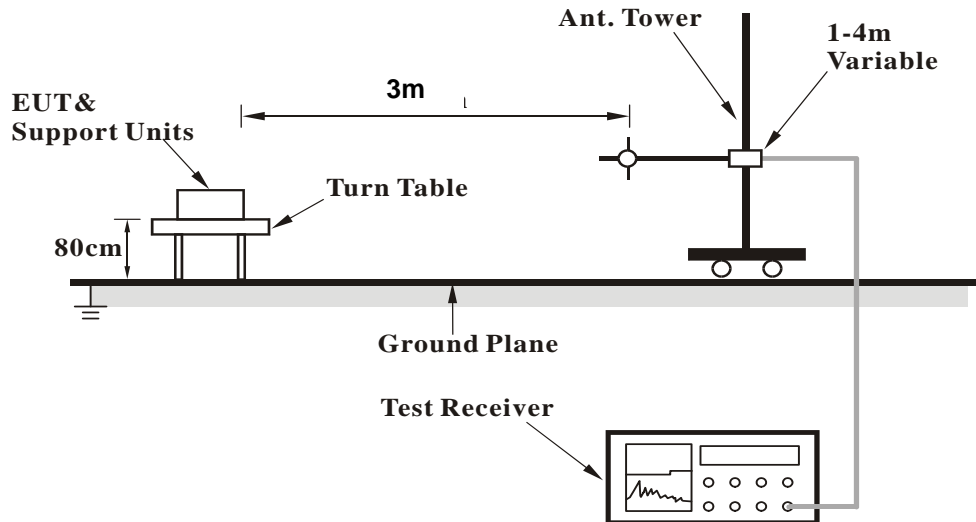
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

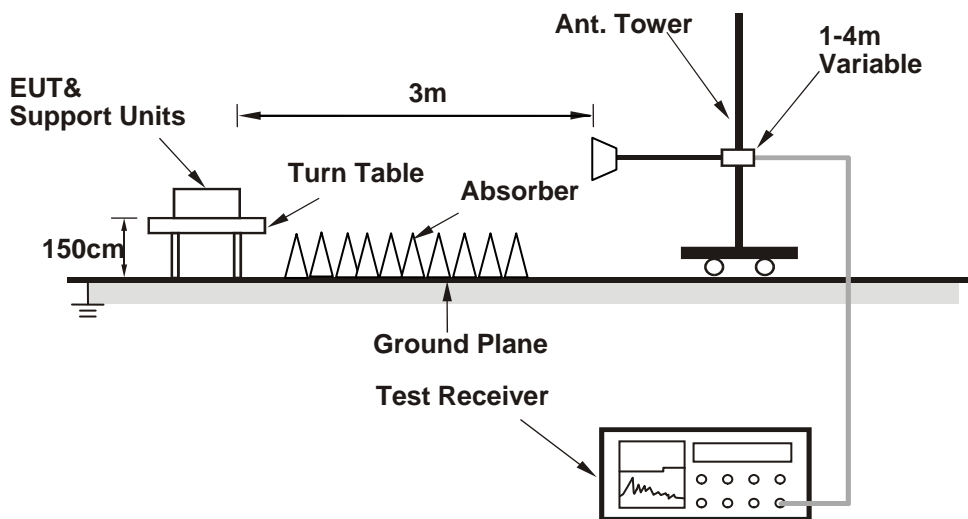
No deviation.

#### 4.1.5 Test Setup

##### <Frequency Range below 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

1. Turn on the power of EUT.
2. The support unit (Notebook Computer) run test program "Bluetest 3.exe [V2.5]" to enable EUT under transmission/receiving 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		

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	49.9 PK	74.0	-24.1	1.78 H	27	53.09	-3.19
2	2390.00	19.8 AV	54.0	-34.2	1.78 H	27	22.99	-3.19
3	*2402.00	100.5 PK			1.78 H	27	103.66	-3.16
4	*2402.00	70.4 AV			1.78 H	27	73.56	-3.16
5	4804.00	58.2 PK	74.0	-15.8	1.80 H	95	52.26	5.94
6	4804.00	28.1 AV	54.0	-25.9	1.80 H	95	22.16	5.94
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	1.09 V	96	52.09	-3.19
2	2390.00	18.8 AV	54.0	-35.2	1.09 V	96	21.99	-3.19
3	*2402.00	105.4 PK			1.09 V	96	108.56	-3.16
4	*2402.00	75.3 AV			1.09 V	96	78.46	-3.16
5	4804.00	56.4 PK	74.0	-17.6	1.79 V	188	50.46	5.94
6	4804.00	26.3 AV	54.0	-27.7	1.79 V	188	20.36	5.94

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

<b>CHANNEL</b>	TX Channel 39	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		

**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	106.4 PK			1.76 H	12	109.42	-3.02
2	*2441.00	76.3 AV			1.76 H	12	79.32	-3.02
3	4882.00	58.4 PK	74.0	-15.6	1.78 H	100	52.35	6.05
4	4882.00	28.3 AV	54.0	-25.7	1.78 H	100	22.25	6.05
5	7323.00	56.5 PK	74.0	-17.5	1.12 H	45	45.48	11.02
6	7323.00	26.4 AV	54.0	-27.6	1.12 H	45	15.38	11.02

**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	102.4 PK			1.13 V	87	105.42	-3.02
2	*2441.00	72.3 AV			1.13 V	87	75.32	-3.02
3	4882.00	56.2 PK	74.0	-17.8	1.84 V	158	50.15	6.05
4	4882.00	26.1 AV	54.0	-27.9	1.84 V	158	20.05	6.05
5	7323.00	56.1 PK	74.0	-17.9	1.99 V	163	45.08	11.02
6	7323.00	26.0 AV	54.0	-28.0	1.99 V	163	14.98	11.02

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

<b>CHANNEL</b>	TX Channel 78	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		

**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	106.7 PK			1.83 H	38	109.58	-2.88
2	*2480.00	76.6 AV			1.83 H	38	79.48	-2.88
3	2483.50	53.3 PK	74.0	-20.7	1.83 H	38	56.17	-2.87
4	2483.50	23.2 AV	54.0	-30.8	1.83 H	38	26.07	-2.87
5	4960.00	58.7 PK	74.0	-15.3	1.75 H	87	52.66	6.04
6	4960.00	28.6 AV	54.0	-25.4	1.75 H	87	22.56	6.04
7	7440.00	56.6 PK	74.0	-17.4	1.09 H	51	44.87	11.73
8	7440.00	26.5 AV	54.0	-27.5	1.09 H	51	14.77	11.73

**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	102.5 PK			1.12 V	90	105.38	-2.88
2	*2480.00	72.4 AV			1.12 V	90	75.28	-2.88
3	2483.50	49.5 PK	74.0	-24.5	1.12 V	90	52.37	-2.87
4	2483.50	19.4 AV	54.0	-34.6	1.12 V	90	22.27	-2.87
5	4960.00	55.9 PK	74.0	-18.1	1.90 V	167	49.86	6.04
6	4960.00	25.8 AV	54.0	-28.2	1.90 V	167	19.76	6.04
7	7440.00	56.0 PK	74.0	-18.0	2.02 V	175	44.27	11.73
8	7440.00	25.9 AV	54.0	-28.1	2.02 V	175	14.17	11.73

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

**BT\_8DPSK**

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

<b>ANTENNA POLARITY &amp; TEST DISTANCE: HORIZONTAL AT 3 M</b>								
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	49.1 PK	74.0	-24.9	1.76 H	28	52.29	-3.19
2	2390.00	19.0 AV	54.0	-35.0	1.76 H	28	22.19	-3.19
3	*2402.00	104.5 PK			1.76 H	28	107.66	-3.16
4	*2402.00	74.4 AV			1.76 H	28	77.56	-3.16
5	4804.00	56.2 PK	74.0	-17.8	1.75 H	106	50.26	5.94
6	4804.00	26.1 AV	54.0	-27.9	1.75 H	106	20.16	5.94

<b>ANTENNA POLARITY &amp; TEST DISTANCE: VERTICAL AT 3 M</b>								
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	47.6 PK	74.0	-26.4	1.04 V	90	50.79	-3.19
2	2390.00	17.5 AV	54.0	-36.5	1.04 V	90	20.69	-3.19
3	*2402.00	102.1 PK			1.04 V	90	105.26	-3.16
4	*2402.00	72.0 AV			1.04 V	90	75.16	-3.16
5	4804.00	56.5 PK	74.0	-17.5	1.85 V	168	50.56	5.94
6	4804.00	26.4 AV	54.0	-27.6	1.85 V	168	20.46	5.94

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

<b>CHANNEL</b>	TX Channel 39	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		

**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	104.4 PK			1.82 H	36	107.42	-3.02
2	*2441.00	74.3 AV			1.82 H	36	77.32	-3.02
3	4882.00	56.1 PK	74.0	-17.9	1.81 H	105	50.05	6.05
4	4882.00	26.0 AV	54.0	-28.0	1.81 H	105	19.95	6.05
5	7323.00	56.4 PK	74.0	-17.6	1.12 H	54	45.38	11.02
6	7323.00	26.3 AV	54.0	-27.7	1.12 H	54	15.28	11.02

**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	102.8 PK			1.05 V	94	105.82	-3.02
2	*2441.00	72.7 AV			1.05 V	94	75.72	-3.02
3	4882.00	55.6 PK	74.0	-18.4	1.85 V	152	49.55	6.05
4	4882.00	25.5 AV	54.0	-28.5	1.85 V	152	19.45	6.05
5	7323.00	56.1 PK	74.0	-17.9	2.02 V	160	45.08	11.02
6	7323.00	26.0 AV	54.0	-28.0	2.02 V	160	14.98	11.02

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

<b>CHANNEL</b>	TX Channel 78	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		

**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	104.4 PK			1.84 H	19	107.28	-2.88
2	*2480.00	74.3 AV			1.84 H	19	77.18	-2.88
3	2483.50	52.6 PK	74.0	-21.4	1.84 H	19	55.47	-2.87
4	2483.50	22.5 AV	54.0	-31.5	1.84 H	19	25.37	-2.87
5	4960.00	55.8 PK	74.0	-18.2	1.76 H	97	49.76	6.04
6	4960.00	25.7 AV	54.0	-28.3	1.76 H	97	19.66	6.04
7	7440.00	56.2 PK	74.0	-17.8	1.16 H	48	44.47	11.73
8	7440.00	26.1 AV	54.0	-27.9	1.16 H	48	14.37	11.73

**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	102.1 PK			1.14 V	99	104.98	-2.88
2	*2480.00	72.0 AV			1.14 V	99	74.88	-2.88
3	2483.50	49.4 PK	74.0	-24.6	1.14 V	99	52.27	-2.87
4	2483.50	19.3 AV	54.0	-34.7	1.14 V	99	22.17	-2.87
5	4960.00	55.4 PK	74.0	-18.6	1.87 V	159	49.36	6.04
6	4960.00	25.3 AV	54.0	-28.7	1.87 V	159	19.26	6.04
7	7440.00	55.6 PK	74.0	-18.4	1.96 V	148	43.87	11.73
8	7440.00	25.5 AV	54.0	-28.5	1.96 V	148	13.77	11.73

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

**Below 1GHz Data**

**BT\_GFSK**

<b>CHANNEL</b>	TX Channel 0	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
<b>FREQUENCY RANGE</b>	Below 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	36.30	26.2 QP	40.0	-13.8	1.50 H	73	40.42	-14.24
2	102.07	27.8 QP	43.5	-15.7	1.50 H	262	45.04	-17.21
3	159.98	34.8 QP	43.5	-8.7	2.00 H	285	47.79	-12.98
4	254.94	40.2 QP	46.0	-5.9	1.00 H	244	53.94	-13.79
5	264.01	38.3 QP	46.0	-7.7	1.00 H	298	51.78	-13.45
6	895.19	42.6 QP	46.0	-3.4	1.00 H	155	42.51	0.05

**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	62.11	33.1 QP	40.0	-6.9	1.50 V	68	47.55	-14.42
2	101.97	31.5 QP	43.5	-12.0	1.00 V	16	48.76	-17.22
3	134.03	32.6 QP	43.5	-10.9	1.00 V	65	46.38	-13.80
4	250.68	36.2 QP	46.0	-9.8	1.00 V	81	50.03	-13.86
5	373.19	33.5 QP	46.0	-12.5	1.00 V	155	43.75	-10.25
6	713.70	39.7 QP	46.0	-6.3	1.00 V	121	42.98	-3.25

**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

## 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 0.50MHz.

### 4.2.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver R&S	ESCS 30	100375	May 06, 2015	May 05, 2016
Line-Impedance Stabilization Network (for EUT) SCHWARZBECK	NSLK-8127	8127-522	Sep. 15, 2014	Sep. 14, 2015
Line-Impedance Stabilization Network (for Peripheral) R&S	ENV216	100072	June 11, 2015	June 10, 2016
RF Cable	5D-FB	COCCAB-001	Mar. 09, 2015	Mar. 08, 2016
50 ohms Terminator	N/A	EMC-03	Sep. 22, 2014	Sep. 21, 2015
50 ohms Terminator	N/A	EMC-02	Sep. 30, 2014	Sep. 29, 2015
Software BVADT	BVADT_Cond_ V7.3.7.3	NA	NA	NA

**Note:**

1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Shielded Room No. C.
- 3 The VCCI Con C Registration No. is C-3611.
- 4 Tested Date: July 30, 2015



#### 4.2.3 Test Procedures

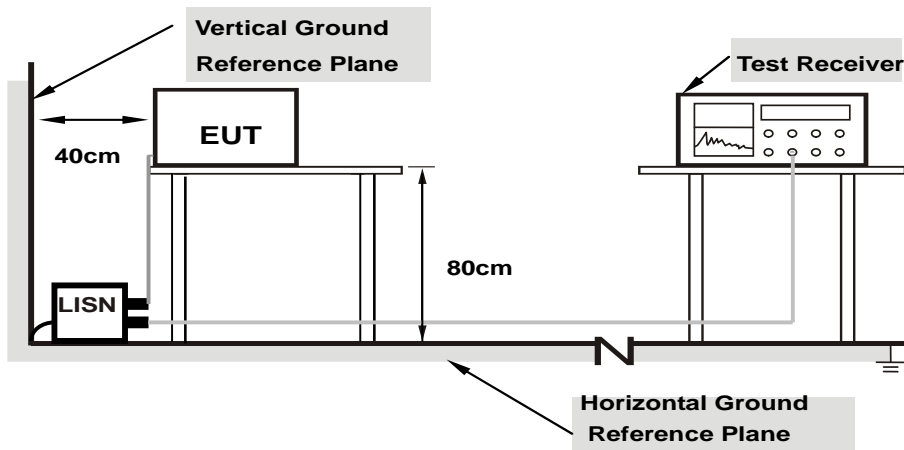
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling 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:** The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

#### 4.2.4 Deviation from Test Standard

No deviation.

#### 4.2.5 Test Setup



**Note: 1.Support units were connected to second LISN.**

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.

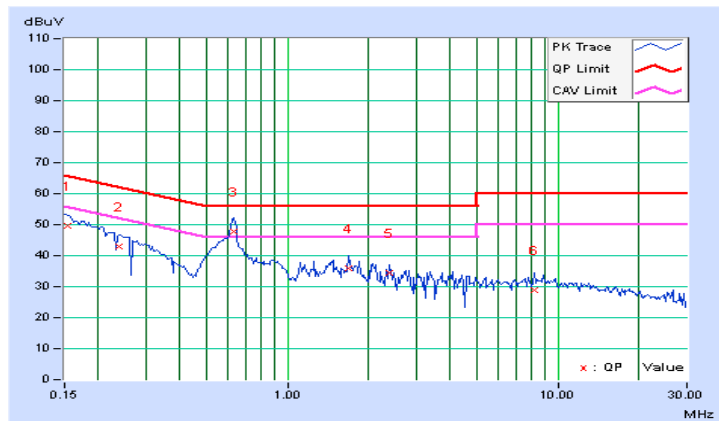
4.2.7 Test Results (Mode 1)

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	0.14	49.46	34.06	49.60	34.20	65.79	55.79	-16.19	-21.59
2	0.23984	0.15	42.70	28.20	42.85	28.35	62.10	52.10	-19.25	-23.75
<b>3</b>	<b>0.63047</b>	<b>0.18</b>	<b>47.70</b>	<b>38.66</b>	<b>47.88</b>	<b>38.84</b>	<b>56.00</b>	<b>46.00</b>	<b>-8.12</b>	<b>-7.16</b>
4	1.69141	0.24	35.64	26.92	35.88	27.16	56.00	46.00	-20.12	-18.84
5	2.38281	0.28	33.98	24.96	34.26	25.24	56.00	46.00	-21.74	-20.76
6	8.22266	0.63	28.42	20.14	29.05	20.77	60.00	50.00	-30.95	-29.23

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

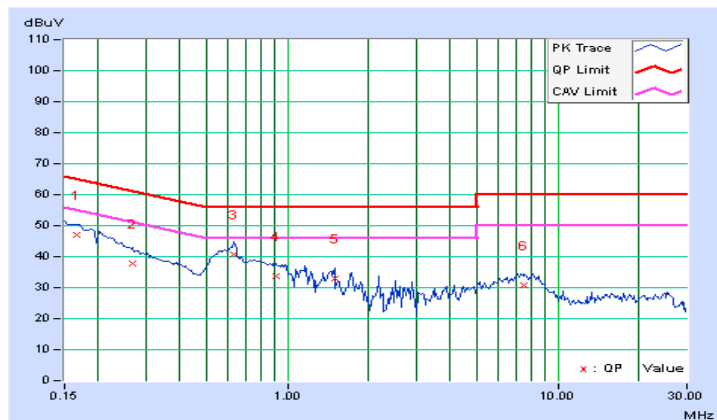


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16562	0.14	47.04	31.32	47.18	31.46	65.18	55.18	-17.99	-23.71
2	0.26719	0.16	37.56	22.62	37.72	22.78	61.20	51.20	-23.48	-28.42
3	0.63047	0.21	40.46	32.94	40.67	33.15	56.00	46.00	-15.33	-12.85
4	0.91172	0.23	33.36	23.50	33.59	23.73	56.00	46.00	-22.41	-22.27
5	1.49609	0.27	32.74	24.20	33.01	24.47	56.00	46.00	-22.99	-21.53
6	7.48438	0.63	30.16	20.12	30.79	20.75	60.00	50.00	-29.21	-29.25

**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



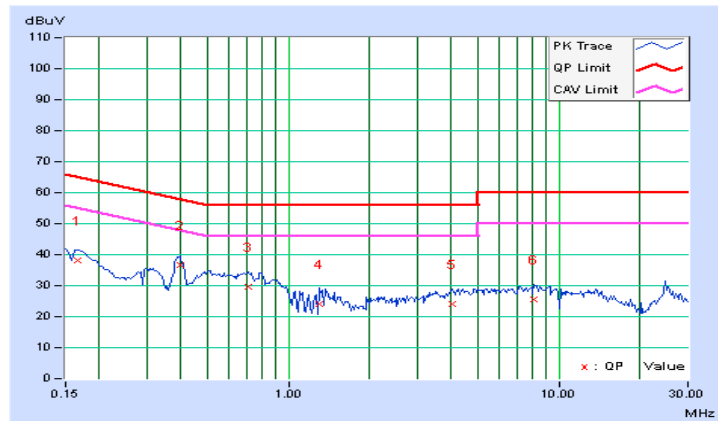
#### 4.2.8 Test Results (Mode 2)

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16562	0.14	38.02	23.04	38.16	23.18	65.18	55.18	-27.01	-31.99
2	0.39609	0.17	36.58	29.24	36.75	29.41	57.93	47.93	-21.19	-18.53
3	0.70859	0.19	29.34	19.36	29.53	19.55	56.00	46.00	-26.47	-26.45
4	1.30469	0.22	23.92	15.18	24.14	15.40	56.00	46.00	-31.86	-30.60
5	4.02734	0.38	23.86	16.58	24.24	16.96	56.00	46.00	-31.76	-29.04
6	8.03516	0.62	25.10	17.78	25.72	18.40	60.00	50.00	-34.28	-31.60

**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

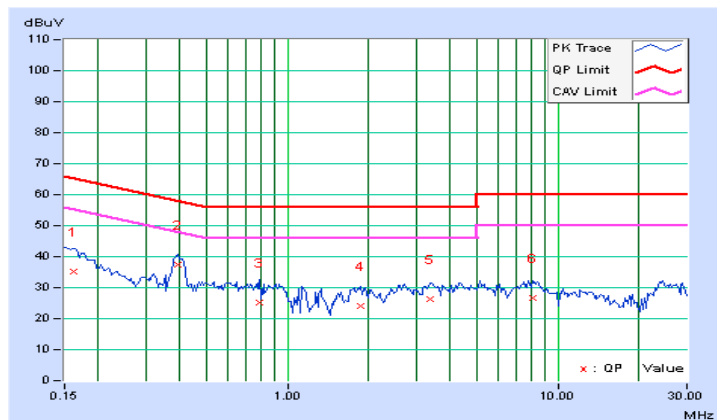


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16172	0.14	34.96	19.36	35.10	19.50	65.38	55.38	-30.27	-35.87
2	0.39219	0.19	37.30	28.84	37.49	29.03	58.02	48.02	-20.53	-18.99
3	0.79063	0.22	24.98	15.08	25.20	15.30	56.00	46.00	-30.80	-30.70
4	1.87500	0.29	23.82	17.40	24.11	17.69	56.00	46.00	-31.89	-28.31
5	3.35547	0.38	25.74	18.96	26.12	19.34	56.00	46.00	-29.88	-26.66
6	8.06250	0.67	26.16	17.32	26.83	17.99	60.00	50.00	-33.17	-32.01

**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

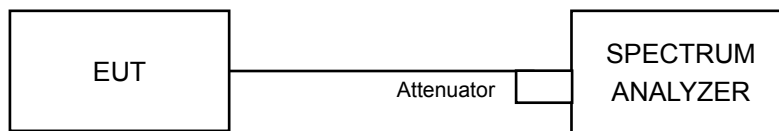


### 4.3 Number of Hopping Frequency Used Measurement

#### 4.3.1 Limits of Hopping Frequency Used Measurement

At least 15 channels frequencies, and should be equally spaced.

#### 4.3.2 Test Setup



#### 4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

#### 4.3.4 Test Procedures

- a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- c. Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
- d. Set the SA on View mode and then plot the result on SA screen.
- e. Repeat above procedures until all frequencies measured were complete.

#### 4.3.5 Deviation from Test Standard

No deviation.

### 4.3.6 Test Results

There are 79 hopping frequencies in the hopping mode. Please refer to next page for the test result. On the plots, it shows that the hopping frequencies are equally spaced.

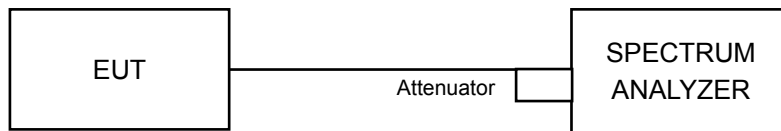


#### 4.4 Dwell Time on Each Channel Measurement

##### 4.4.1 Limits of Dwell Time on Each Channel Measurement

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

##### 4.4.2 Test Setup



##### 4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

##### 4.4.4 Test Procedures

- Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
- Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
- Repeat above procedures until all different time-slot modes have been completed.

##### 4.4.5 Deviation from Test Standard

No deviation.



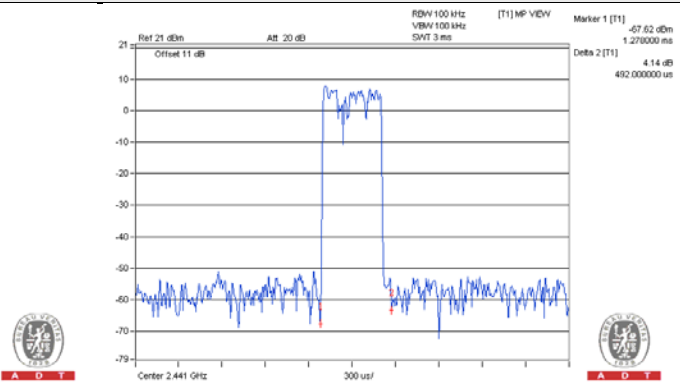
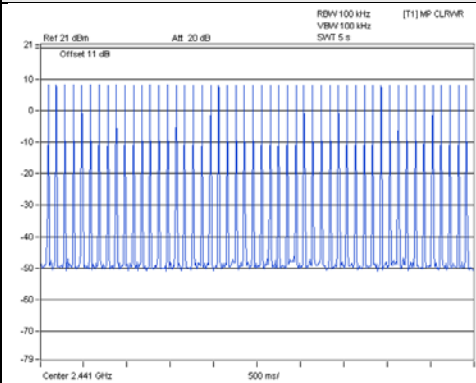
## 4.4.6 Test Results

## GFSK

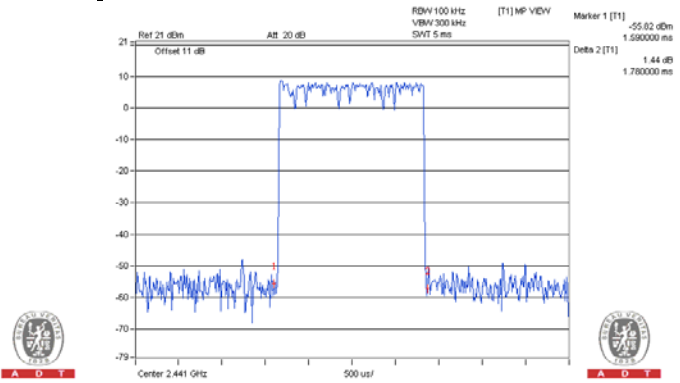
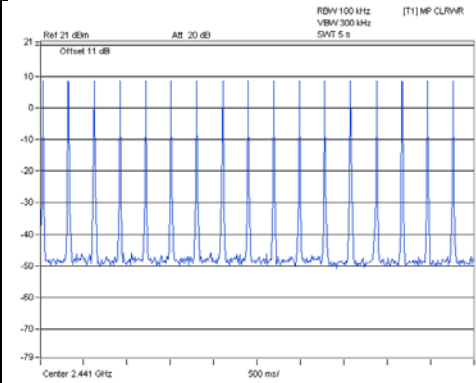
Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
DH1	50 (times / 5 sec) * 6.32 = 316 times	0.492	155.47	400
DH3	17 (times / 5 sec) * 6.32 = 170.44 times	1.78	191.24	400
DH5	10 (times / 5 sec) * 6.32 = 63.2 times	3.04	192.13	400

**NOTE:** Test plots of the transmitting time slot are shown on next page.

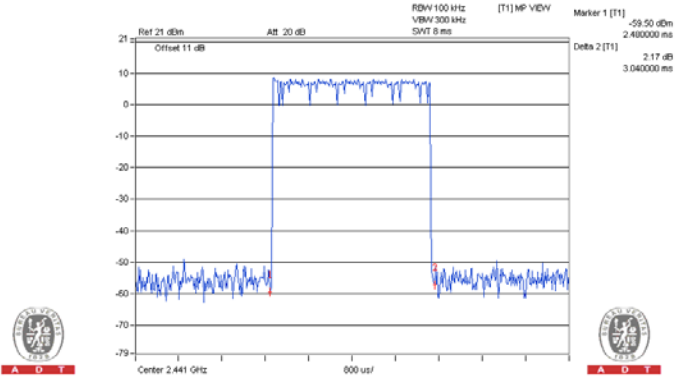
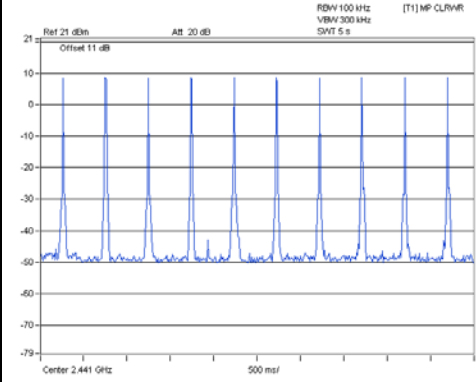
### DH1



### DH3



### DH5

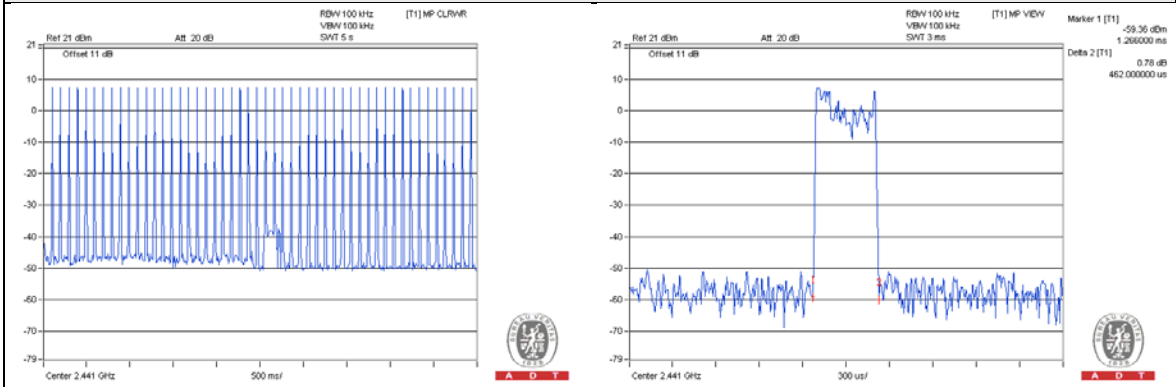


**8DPSK**

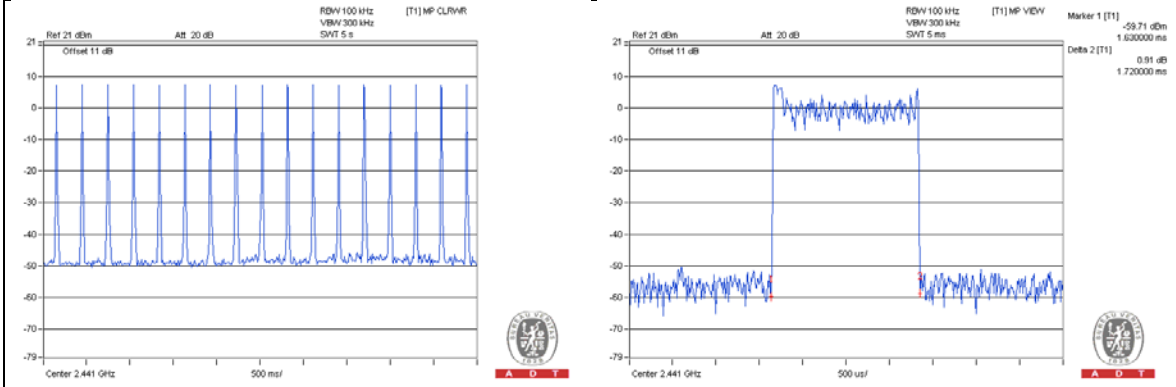
Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
3DH1	50 (times / 5 sec) * 6.32 = 316 times	0.462	145.99	400
3DH3	17 (times / 5 sec) * 6.32 = 107.44 times	1.72	184.8	400
3DH5	10 (times / 5 sec) * 6.32 = 63.2 times	3.056	193.14	400

**NOTE:** Test plots of the transmitting time slot are shown on next page.

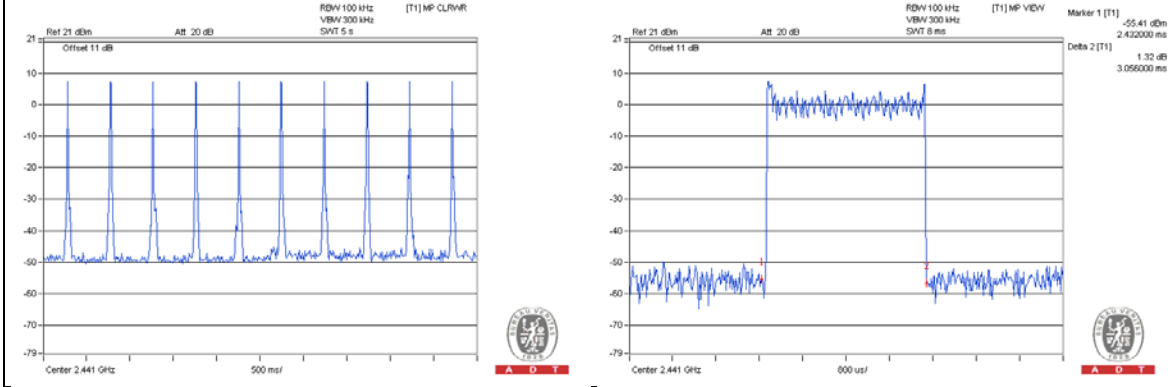
### 3DH1



### 3DH3



### 3DH5

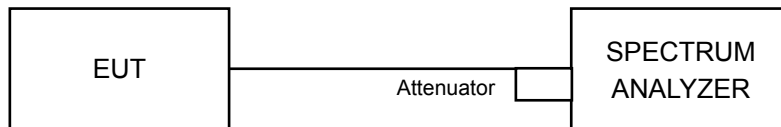


## 4.5 Channel Bandwidth Measurement

### 4.5.1 Limits of Channel Bandwidth Measurement

For frequency hopping system operating in the 2400-2483.5MHz, If the 20dB bandwidth of hopping channel is greater than 25kHz, two-thirds 20dB bandwidth of hopping channel shall be a minimum limit for the hopping channel separation.

### 4.5.2 Test Setup



### 4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.5.4 Test Procedures

- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
- Repeat above procedures until all frequencies measured were complete.

### 4.5.5 Deviation from Test Standard

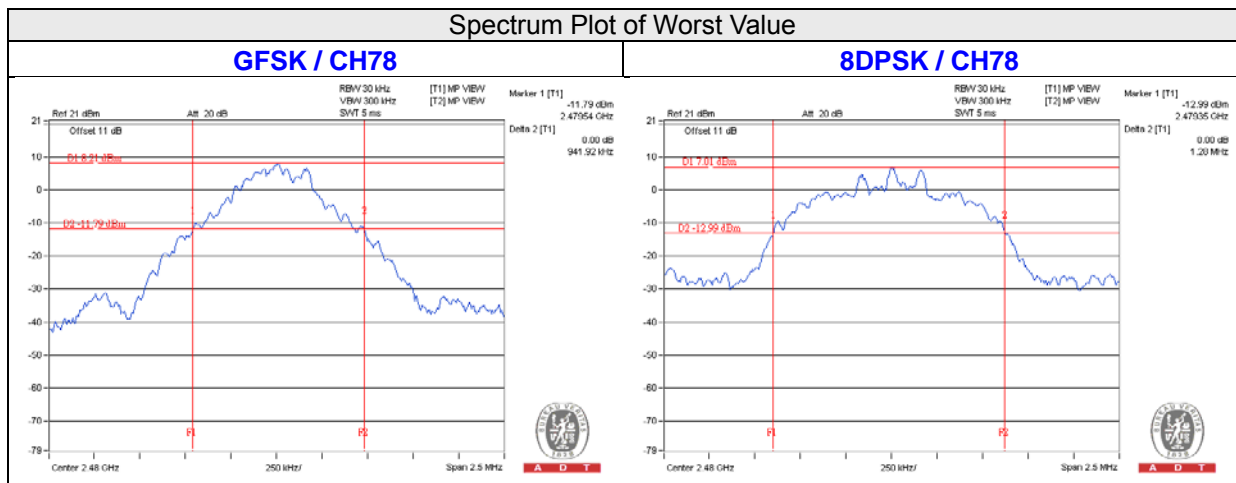
No deviation.

### 4.5.6 EUT Operating Conditions

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

### 4.5.7 Test Results

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	
		GFSK	8DPSK
0	2402	0.93	1.27
39	2441	0.93	1.27
78	2480	0.94	1.28

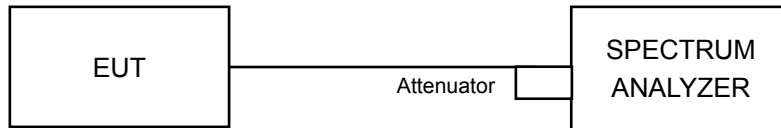


## 4.6 Hopping Channel Separation Measurement

### 4.6.1 Limits of Hopping Channel Separation Measurement

At least 25kHz or two-third of 20dB hopping channel bandwidth (whichever is greater).

### 4.6.2 Test Setup



### 4.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.6.4 Test Procedures

#### Measurement Procedure REF

- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
- By using the MaxHold function record the separation of two adjacent channels.
- Measure the frequency difference of these two adjacent channels by SA MARK function. And then plot the result on SA screen.
- Repeat above procedures until all frequencies measured were complete.

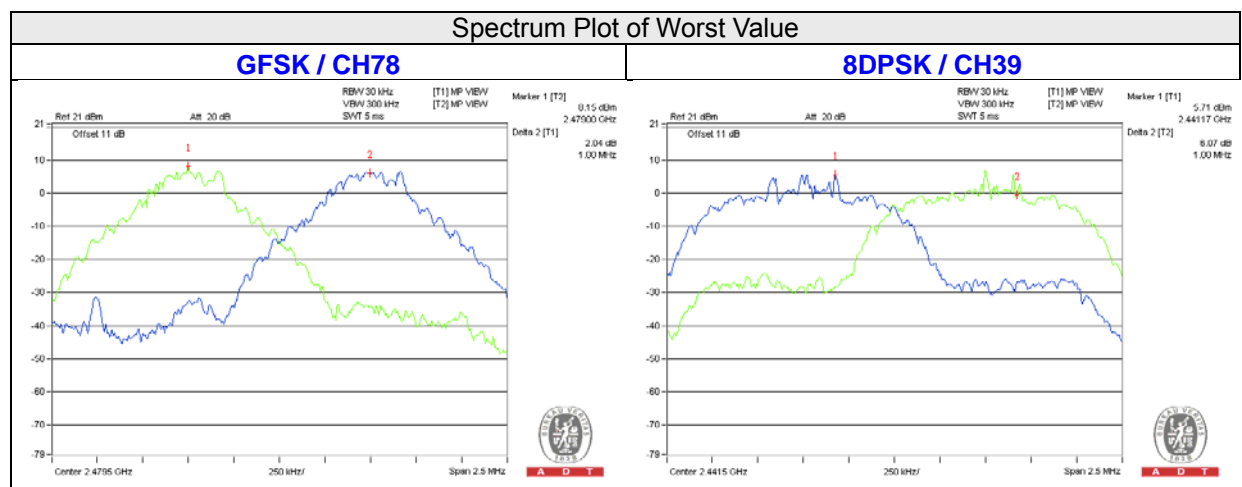
### 4.6.5 Deviation from Test Standard

No deviation.

#### 4.6.6 Test Results

Channel	Frequency (MHz)	Adjacent Channel Separation (MHz)		20dB Bandwidth (MHz)		Minimum Limit (MHz)		Pass / Fail
		GFSK	8DPSK	GFSK	8DPSK	GFSK	8DPSK	
0	2402	1.01	1.01	0.93	1.27	0.62	0.85	Pass
39	2441	1.00	1.00	0.93	1.27	0.62	0.85	Pass
78	2480	1.00	1.01	0.94	1.28	0.63	0.86	Pass

**NOTE:** The minimum limit is two-third 20dB bandwidth.



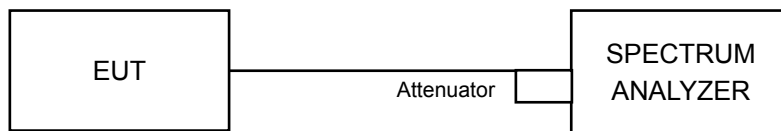


## 4.7 Maximum Output Power Measurement

### 4.7.1 Limits of Maximum Output Power Measurement

The Maximum Output Power Measurement is 125mW.

### 4.7.2 Test Setup



### 4.7.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.7.4 Test Procedures

- a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- c. The center frequency of the spectrum analyzer is set to the fundamental frequency and using 3MHz RBW and 10 MHz VBW.
- d. Measure the captured power within the band and recording the plot.
- e. Repeat above procedures until all frequencies required were complete.

### 4.7.5 Deviation from Test Standard

No deviation.

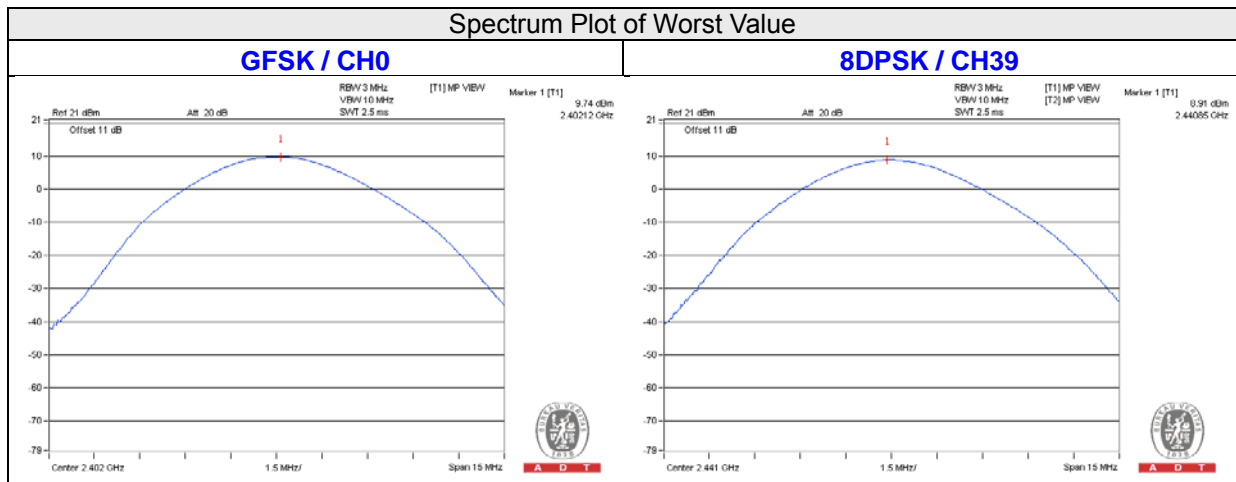
### 4.7.6 EUT Operating Conditions

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

### 4.7.7 Test Results

Channel	Frequency (MHz)	Output Power (mW)		Output Power (dBm)		Power Limit (mW)	Pass/Fail
		GFSK	8DPSK	GFSK	8DPSK		
0	2402	9.419	7.621	9.74	8.82	125	Pass
39	2441	9.226	7.780	9.65	8.91	125	Pass
78	2480	9.016	7.674	9.55	8.85	125	Pass

Spectrum Plot of Worst Value



## 4.8 Conducted Out of Band Emission Measurement

### 4.8.1 Limits of Conducted Out of Band Emission Measurement

Below 20dB of the highest emission level of operating band (in 100kHz RBW).

### 4.8.2 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.8.3 Test Procedures

The transmitter output was connected to the spectrum analyzer via a low lose cable. Set both RBW and VBW of spectrum analyzer to 100 kHz and 300 kHz with suitable frequency span including 100 MHz bandwidth from band edge. The band edges was measured and recorded.

### 4.8.4 Deviation from Test Standard

No deviation.

### 4.8.5 EUT Operating Conditions

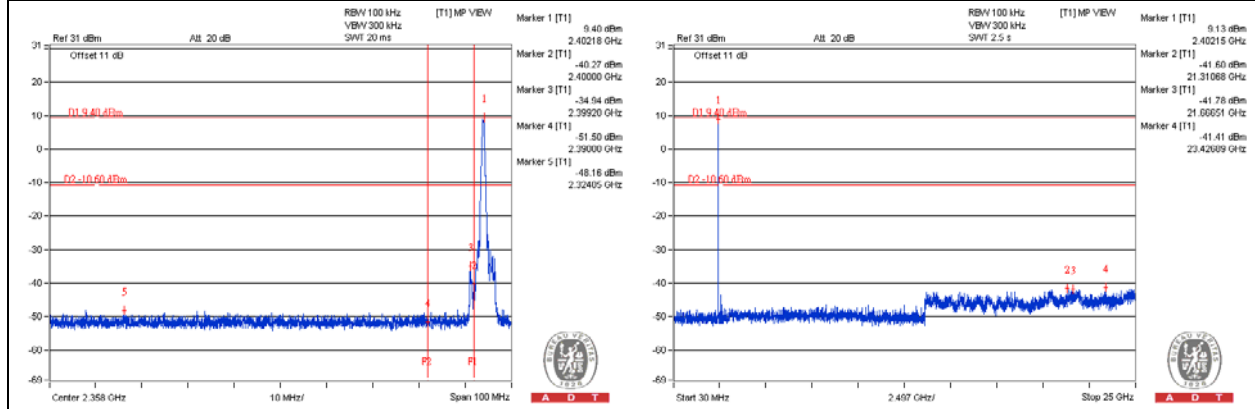
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

### 4.8.6 Test Results

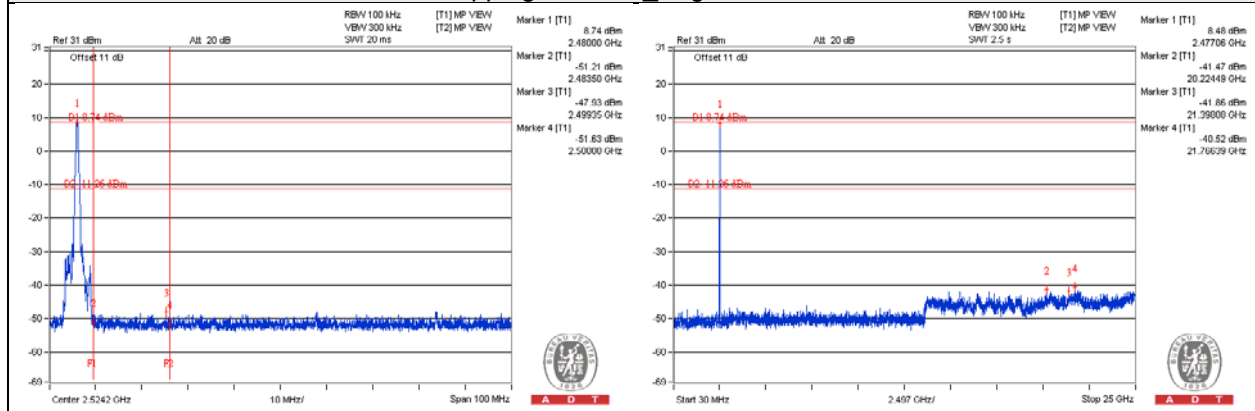
The spectrum plots are attached on the following images. D1 line indicates the highest level, D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.

GFSK

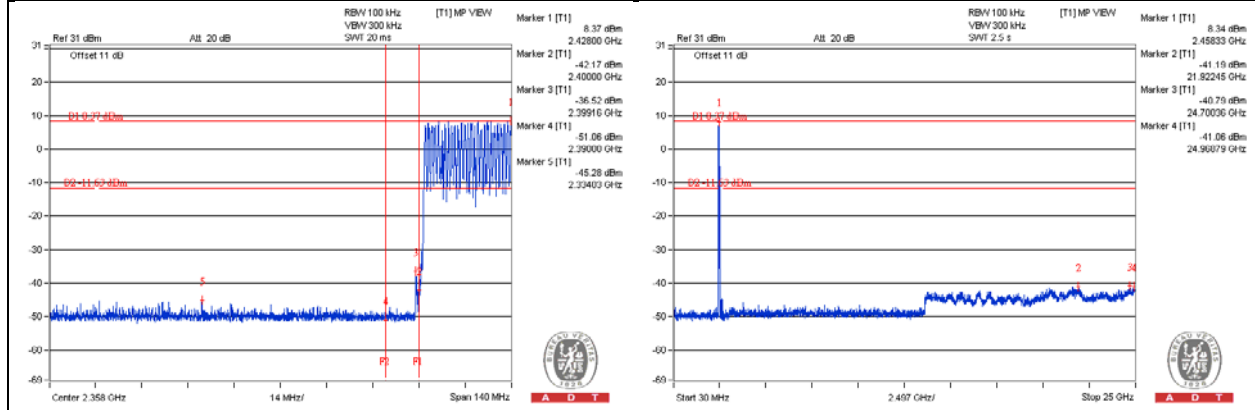
Hopping disabled Low Channel



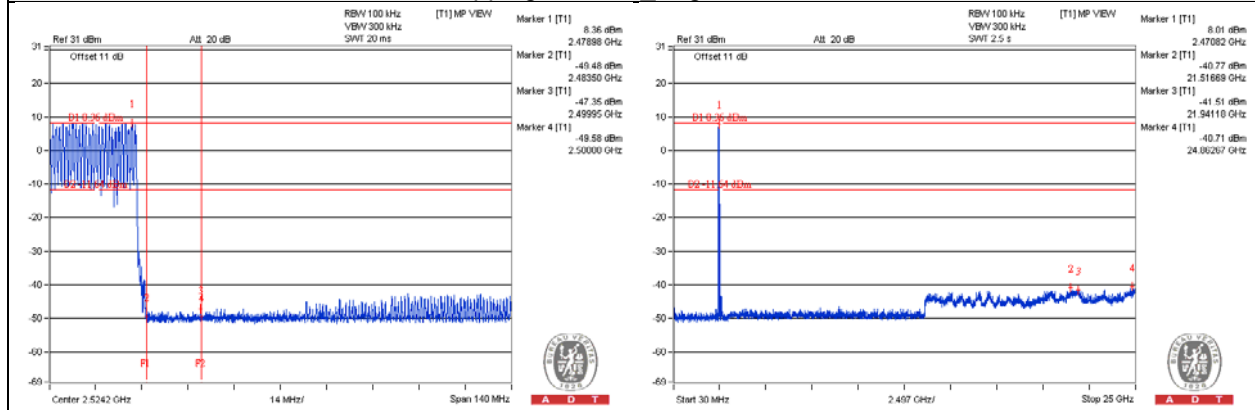
Hopping disabled High Channel



Hopping enabled Low Channel

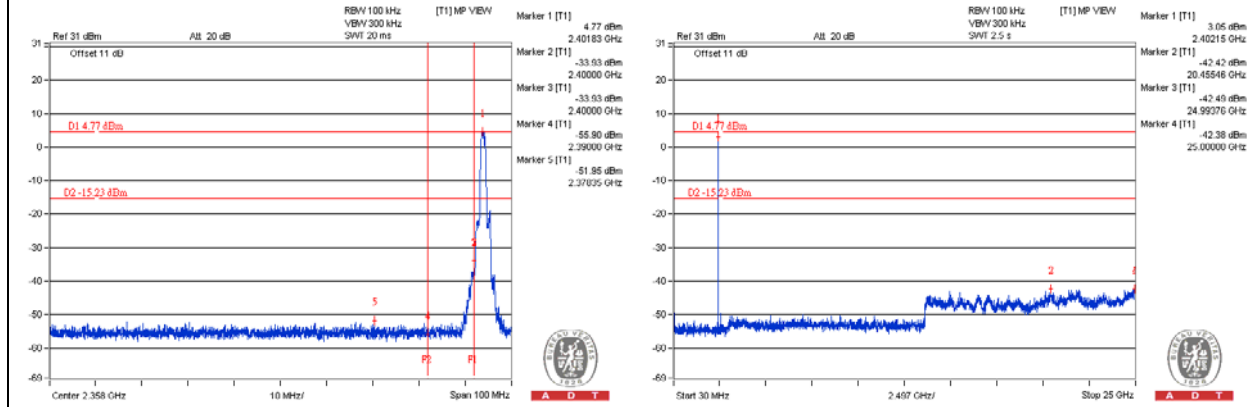


Hopping enabled High Channel

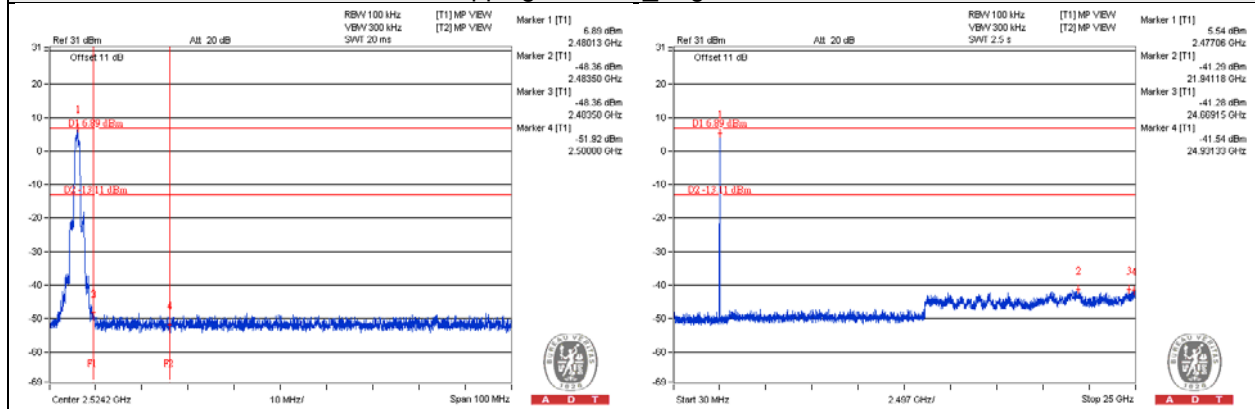


8DPSK

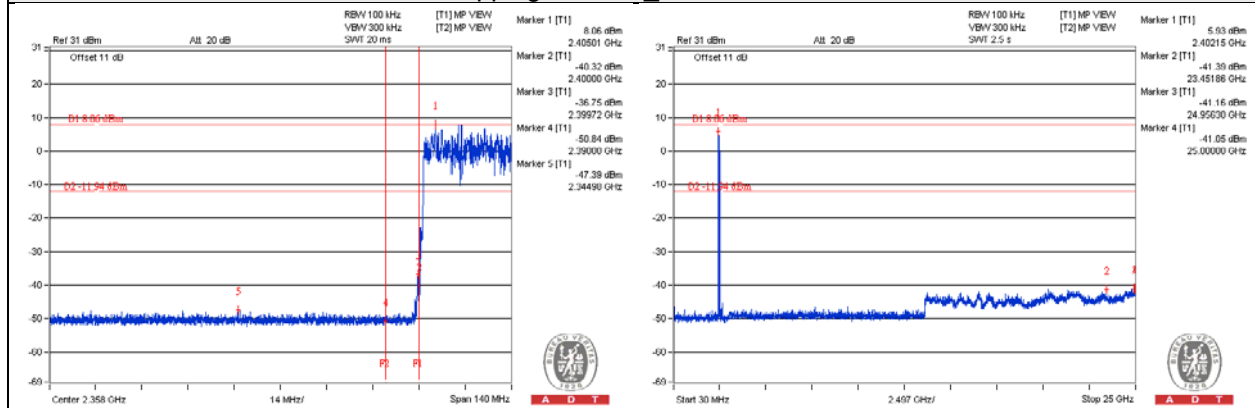
Hopping disabled Low Channel



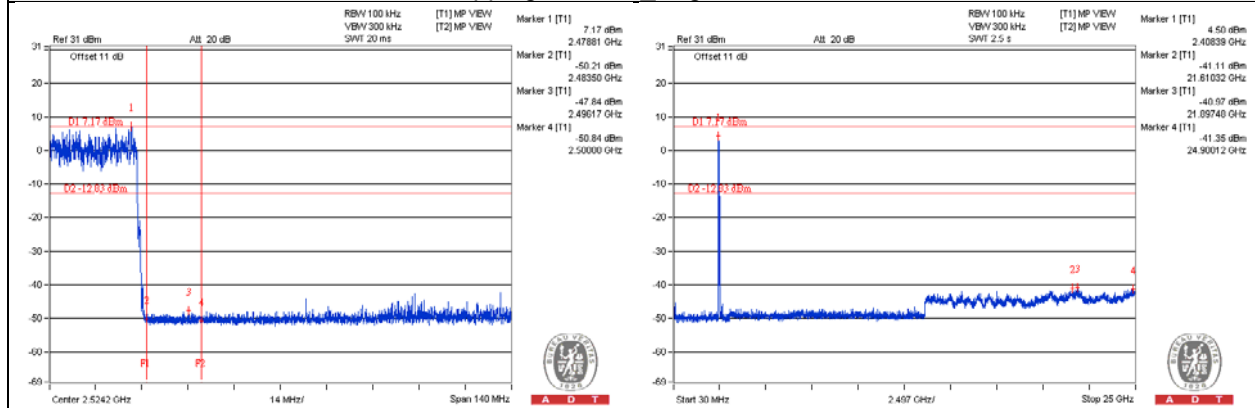
Hopping disabled High Channel



Hopping enabled Low Channel



Hopping enabled High Channel





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

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