



# SPORTON International Inc.

No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.  
Ph: 886-3-327-3456 / FAX: 886-3-327-0973 / www.sporton.com.tw

## FCC RADIO TEST REPORT

Applicant's company	LOGITECH FAR EAST LTD.
Applicant Address	No. 2, Creation Road IV Science-Based Industrial Park Hsin-Chu, Taiwan
FCC ID	JNZYR0047B
Manufacturer's company	LOGITECH FAR EAST LTD.
Manufacturer Address	No. 2, Creation Road IV Science-Based Industrial Park Hsin-Chu, Taiwan

Product Name	2.4GHz Cordless Keyboard
Brand Name	Logitech
Model Name	Y-R0047b
Test Rule	47 CFR FCC Part 15 Subpart C § 15.247
Test Freq. Range	2402 ~ 2480MHz
Received Date	Feb. 26, 2015
Final Test Date	Mar. 03, 2015
Submission Type	Original Equipment

### Statement

**Test result included is only for the Bluetooth LE of the product.**

The test result in this report refers exclusively to the presented test model / sample.

Without written approval of SPORTON International Inc., the test report shall not be reproduced except in full.

The measurements and test results shown in this test report were made in accordance with the procedures and found in compliance with the limit given in **ANSI C63.10-2013, 47 CFR FCC Part 15 Subpart C** and **KDB 558074 D01 v03r02**.

The test equipment used to perform the test is calibrated and traceable to NML/ROC.





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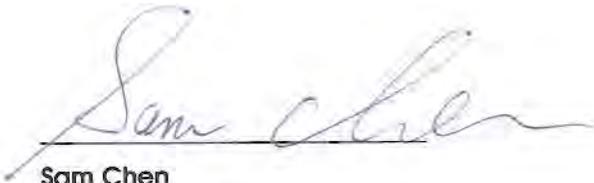
## History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR3D1752-01AB	Rev. 01	Initial issue of report	Mar. 16, 2015

## 1. VERIFICATION OF COMPLIANCE

Product Name : 2.4GHz Cordless Keyboard  
Brand Name : Logitech  
Model No. : Y-R0047b  
Applicant : LOGITECH FAR EAST LTD.  
Test Rule Part(s) : 47 CFR FCC Part 15 Subpart C § 15.247

Sporton International as requested by the applicant to evaluate the EMC performance of the product sample received on Feb. 26, 2015 would like to declare that the tested sample has been evaluated and found to be in compliance with the tested rule parts. The data recorded as well as the test configuration specified is true and accurate for showing the sample's EMC nature.



Sam Chen

SPORTON INTERNATIONAL INC.

## 2. SUMMARY OF THE TEST RESULT

Applied Standard: 47 CFR FCC Part 15 Subpart C				
Part	Rule Section	Description of Test	Result	Under Limit
4.1	15.207	AC Power Line Conducted Emissions	Complies	13.83 dB
4.2	15.247(b)(3)	Maximum Conducted Output Power	Complies	27.61 dB
4.3	15.247(e)	Power Spectral Density	Complies	16.89 dB
4.4	15.247(a)(2)	6dB Spectrum Bandwidth	Complies	-
4.5	15.247(d)	Radiated Emissions	Complies	10.72 dB
4.6	15.247(d)	Band Edge Emissions	Complies	16.90 dB
4.7	15.203	Antenna Requirements	Complies	-

### 3. GENERAL INFORMATION

#### 3.1. Product Details

Items	Description
Power Type	From Host System & Battery
Modulation	DSSS
Data Rate (Mbps)	GFSK: 1
Frequency Range	2402 ~ 2480MHz
Channel Number	40 (37 hopping + 3 advertising channel)
Channel Band Width (99%)	1.32 MHz
Maximum Conducted Output Power	2.39 dBm
Carrier Frequencies	Please refer to section 3.4
Antenna	Please refer to section 3.3

#### 3.2. Accessories

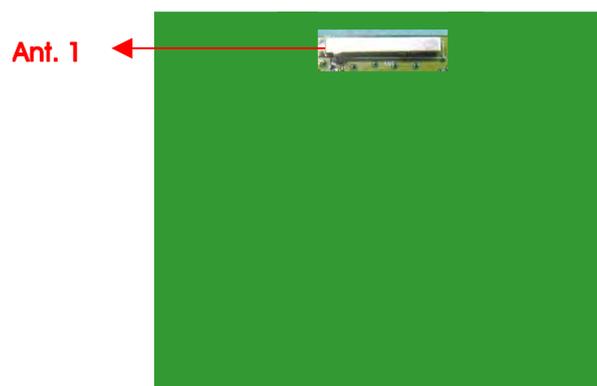
Power	Brand	Model	Rating
Li-polymer Rechargeable Battery	Logitech	603450	1100mAh, 3.7V, 4.07Wh
Other			
USB cable, shielded, 1.3m			

#### 3.3. Table for Filed Antenna

Ant.	Brand Holder	Part No.	Antenna Type	Connector	Gain (dBi)
1	SHENSHI ENTERPRISE/FENGHUA SHEN-XIN ELECTRONIC CO.,LTD.	415-002486	PIFA Antenna	N/A	4.85

Note: The EUT has one antenna.

Ant. 1 could transmit/receive simultaneously.



### 3.4. Table for Carrier Frequencies

Frequency Band	Channel No.	Frequency	Channel No.	Frequency
2400~2483.5MHz	0	2402 MHz	20	2442 MHz
	1	2404 MHz	:	:
	2	2406 MHz	37	2476 MHz
	:	:	38	2478 MHz
	18	2438 MHz	39	2480 MHz
	19	2440 MHz	-	-

### 3.5. Table for Test Modes

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	Mode	Data Rate	Channel	Antenna
AC Power Line Conducted Emissions	Normal Link	-	-	-
Maximum Conducted Output Power Power Spectral Density	GFSK	1 Mbps	0/19/39	1
6dB Spectrum Bandwidth	GFSK	1 Mbps	0/19/39	1
Radiated Emissions 9kHz~1GHz	Normal Link	-	-	-
Radiated Emissions 1GHz~10 <sup>th</sup> Harmonic	GFSK	1 Mbps	0/19/39	1
Band Edge Emissions	GFSK	1 Mbps	0/19/39	1

The following test modes were performed for all tests:

#### For Conducted Emission test:

Mode 1. Normal Link – BT4.0 (Charged)

#### For Radiated emissions test below 1GHz:

Mode 1. Normal Link – BT4.0 (Charged)

Mode 2. Normal Link – BT4.0 (Not Charged)

Mode 1 is the worst case, so it was selected to record in this test report

#### For Radiated emissions test above 1GHz:

Mode 1: CTX

### 3.6. Table for Testing Locations

Test Site Location					
Address:	No.8, Lane 724, Bo-ai St., Jhubei City, Hsinchu County 302, Taiwan, R.O.C.				
TEL:	886-3-656-9065	FAX:	886-3-656-9085		
Test Site No.	Site Category	Location	FCC Reg. No.	IC File No.	VCCI Reg. No
03CH01-CB	SAC	Hsin Chu	262045	IC 4086D	-
CO01-CB	Conduction	Hsin Chu	262045	IC 4086D	-
TH01-CB	OVEN Room	Hsin Chu	-	-	-

Open Area Test Site (OATS); Semi Anechoic Chamber (SAC).

### 3.7. Table for Supporting Units

For Test Site No.: CO01-CB

Support Unit	Brand	Model	FCC ID
NB	DELL	E6220	DoC
Mouse	Logitech	M-U0026	DoC
Earphone	SHYARO CHI	MIC-04	N/A
iPad	Apple	A1430	DoC

For Test Site No.: 03CH01-CB (Radiated emissions test below 1GHz)

Support Unit	Brand	Model	FCC ID
NB	DELL	E4300	DoC
Mouse	HP	FM100	DoC
Earphone	E-BOOKI	E-EPC040	N/A
iPad	Apple	A1432	DoC

For Test Site No.: 03CH01-CB (Radiated emissions test above 1GHz)

Support Unit	Brand	Model	FCC ID
NB	DELL	M1340	DoC
Keyboard	iCooky	SK068	DoC
Dongle Receiver	Logitech	C-U0007	DoC

For Test Site No.: TH01-CB

Support Unit	Brand	Model	FCC ID
NB	DELL	E6430	DoC
Keyboard	iCooky	SK068	DoC
Dongle Receiver	Logitech	C-U0007	DoC

### 3.8. Table for Parameters of Test Software Setting

During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

#### Power Parameters:

Test Software Version	Holdwave		
Frequency	2402 MHz	2440 MHz	2480 MHz
Power Parameters	Default	Default	Default

### 3.9. EUT Operation during Test

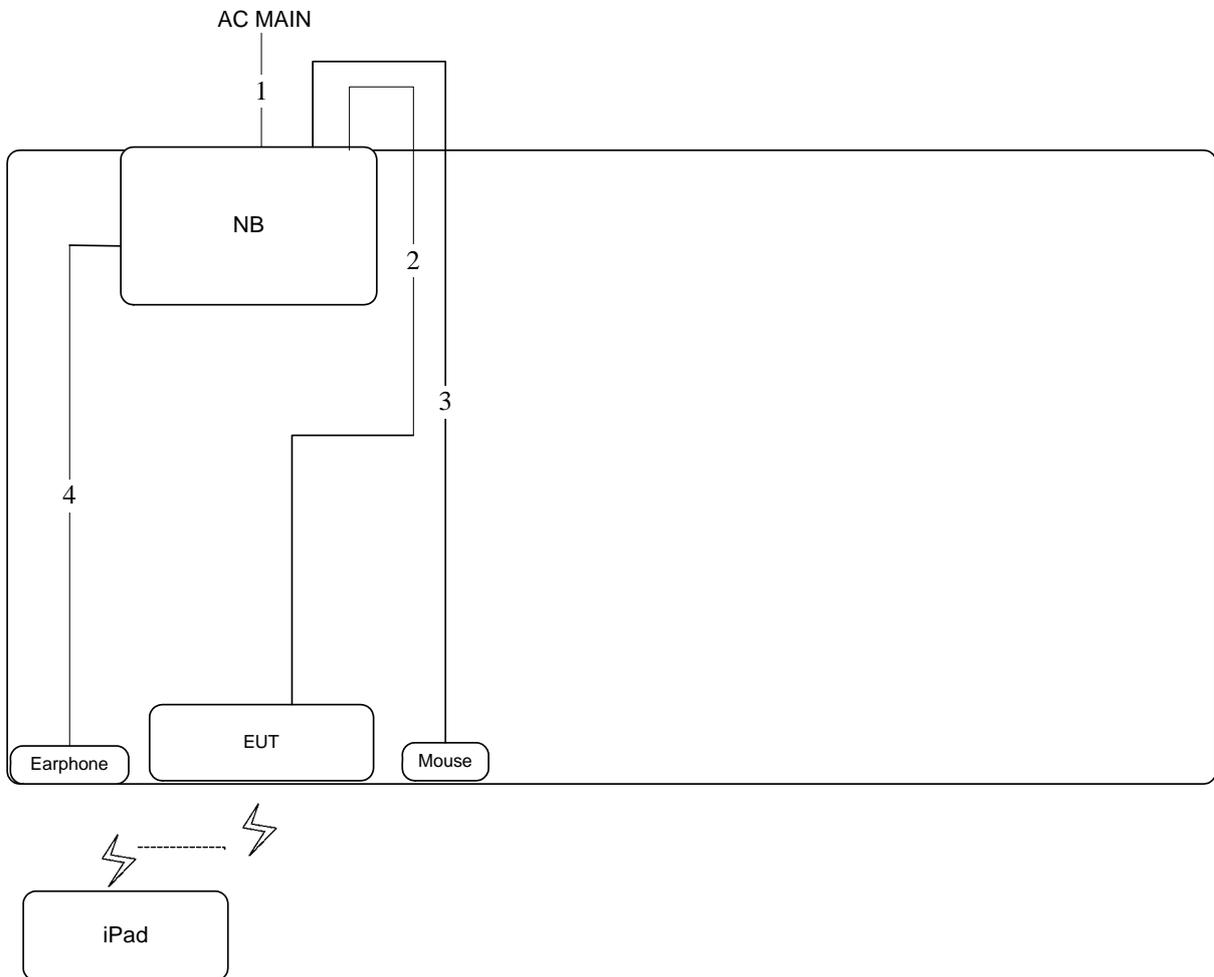
The EUT was programmed to be in continuously transmitting mode.

### 3.10. Duty Cycle

Mode	On Time (ms)	On+Off Time (ms)	Duty Cycle (%)	Duty Factor (dB)	1/T Minimum VBW (kHz)
GFSK	0.200	14.550	1.37	18.62	5.00

### 3.11. Test Configurations

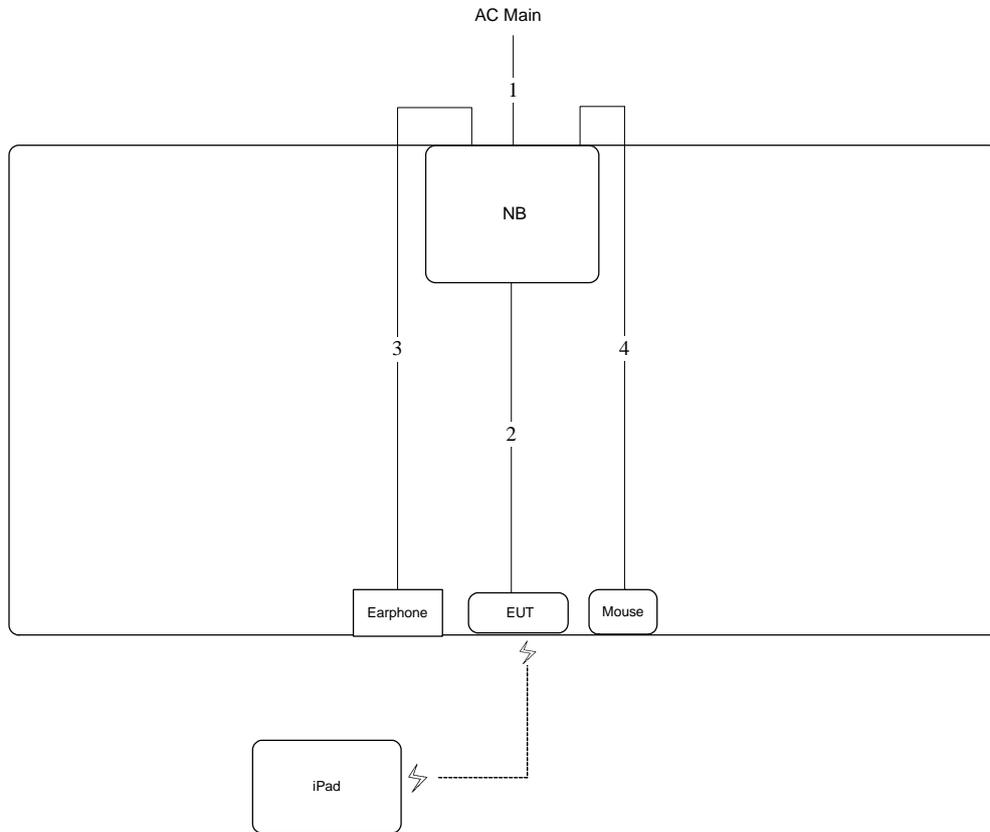
#### 3.11.1. AC Power Line Conduction Emissions Test Configuration



Item	Connection	Shielded	Length
1	Power cable	No	2.6m
2	USB cable	Yes	1.3m
3	USB cable	Yes	1.8m
4	Audio cable	No	1.1m

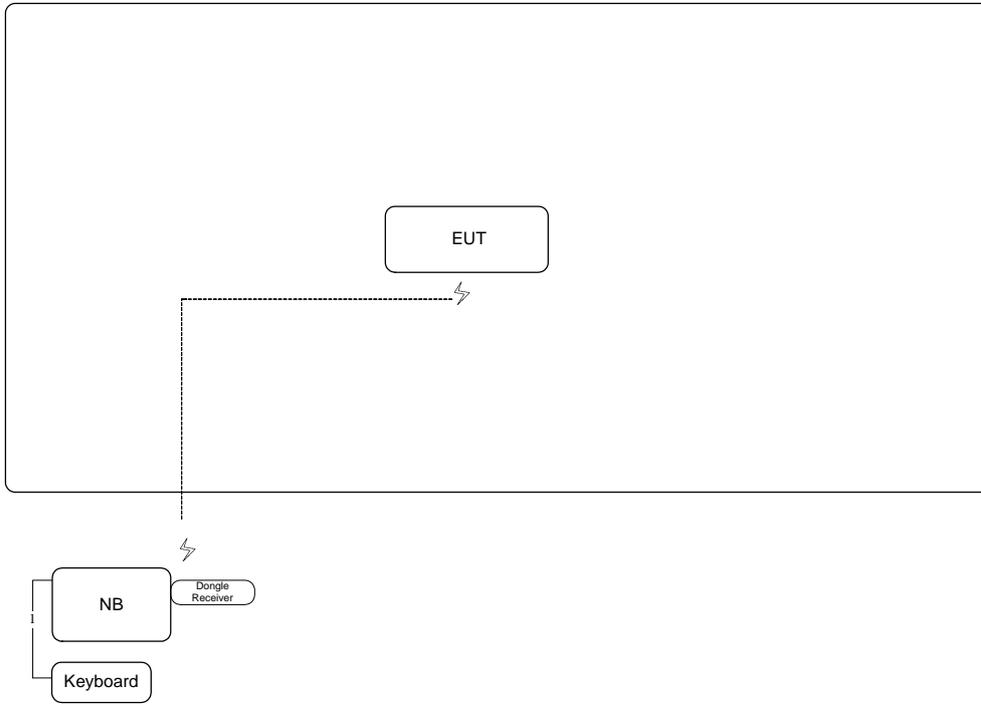
### 3.11.2. Radiation Emissions Test Configuration

Test Configuration: 30MHz~1GHz



Item	Connection	Shielded	Length
1	Power cable	No	2.6m
2	USB cable	Yes	1.3m
3	Audio cable	No	1.1m
4	USB cable	Yes	1.8m

Test Configuration: above 1GHz



Item	Connection	Shielded	Length
1	USB cable	Yes	1.8m

## 4. TEST RESULT

### 4.1. AC Power Line Conducted Emissions Measurement

#### 4.1.1. Limit

For this product which is designed to be connected to the AC power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed below limits table.

Frequency (MHz)	QP Limit (dBuV)	AV Limit (dBuV)
0.15~0.5	66~56	56~46
0.5~5	56	46
5~30	60	50

#### 4.1.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

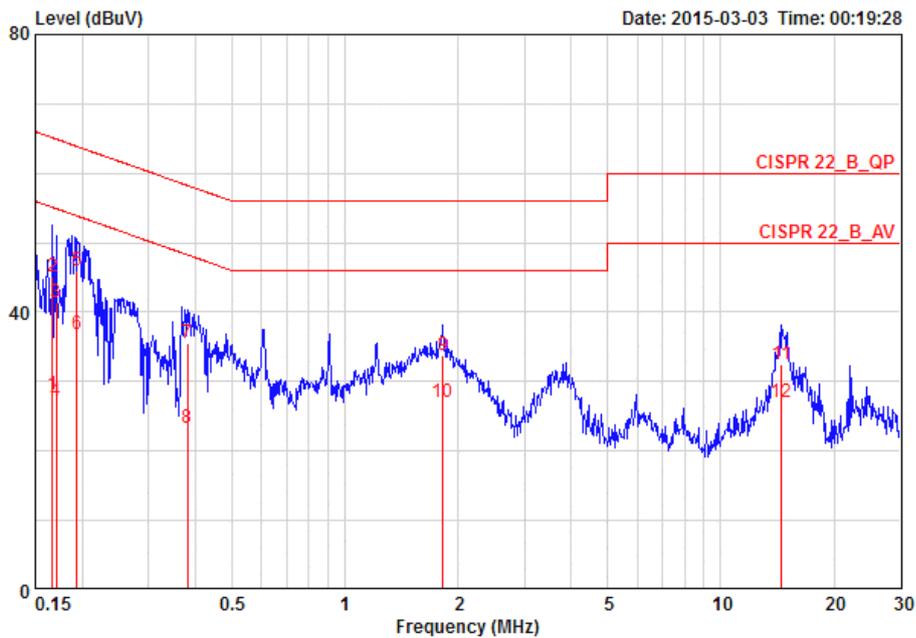
#### 4.1.3. Test Procedures

1. Configure the EUT according to ANSI C63.10. The EUT or host of EUT has to be placed 0.4 meter far from the conducting wall of the shielding room and at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT or host of EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connected to the other LISNs. The LISN should provide 50uH/50ohms coupling impedance.
4. The frequency range from 150 kHz to 30 MHz was searched.
5. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. The measurement has to be done between each power line and ground at the power terminal.



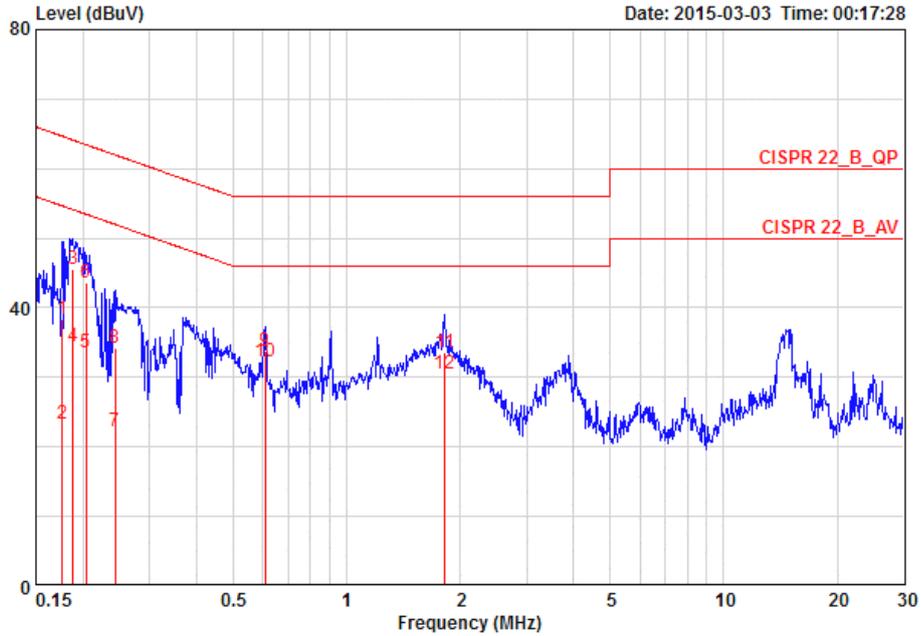
4.1.7. Results of AC Power Line Conducted Emissions Measurement

Temperature	24°C	Humidity	52%
Test Engineer	Kane Liu	Phase	Line
Configuration	Normal Link		



	Freq	Level	Over	Limit	Read	LISN	Cable	Remark	Pol/Phase
	MHz	dBuV	Limit	Line	Level	Factor	Loss		
			dB	dBuV	dBuV	dB	dB		
1	0.16677	28.04	-27.08	55.12	17.85	10.03	0.16	AVERAGE	LINE
2	0.16677	45.17	-19.95	65.12	34.98	10.03	0.16	QP	LINE
3	0.17034	41.34	-23.60	64.94	31.15	10.03	0.16	QP	LINE
4	0.17034	27.19	-27.75	54.94	17.00	10.03	0.16	AVERAGE	LINE
5 e	0.19344	46.08	-17.80	63.89	35.89	10.03	0.16	QP	LINE
6 e	0.19344	36.94	-16.94	53.89	26.75	10.03	0.16	AVERAGE	LINE
7	0.38113	35.46	-22.80	58.25	25.25	10.03	0.18	QP	LINE
8	0.38113	23.28	-24.98	48.25	13.07	10.03	0.18	AVERAGE	LINE
9	1.819	33.73	-22.27	56.00	23.46	10.03	0.24	QP	LINE
10 e	1.819	27.08	-18.92	46.00	16.81	10.03	0.24	AVERAGE	LINE
11	14.517	32.46	-27.54	60.00	21.89	10.13	0.44	QP	LINE
12	14.517	26.93	-23.07	50.00	16.36	10.13	0.44	AVERAGE	LINE

Temperature	24°C	Humidity	52%
Test Engineer	Kane Liu	Phase	Neutral
Configuration	Normal Link		



	Freq	Level	Over	Limit	Read	LISN	Cable	Remark	Pol/Phase
	MHz	dBuV	Limit	Line	Level	Factor	Loss		
			dB	dBuV	dBuV	dB	dB		
1	0.17584	38.42	-26.26	64.68	28.30	9.96	0.16	QP	NEUTRAL
2	0.17584	23.37	-31.31	54.68	13.25	9.96	0.16	AVERAGE	NEUTRAL
3 e	0.18838	45.67	-18.44	64.11	35.53	9.97	0.16	QP	NEUTRAL
4	0.18838	34.35	-19.76	54.11	24.21	9.97	0.16	AVERAGE	NEUTRAL
5	0.20396	33.58	-19.87	53.45	23.44	9.98	0.17	AVERAGE	NEUTRAL
6	0.20396	43.67	-19.78	63.45	33.53	9.98	0.17	QP	NEUTRAL
7	0.24293	22.30	-29.69	52.00	12.18	9.95	0.17	AVERAGE	NEUTRAL
8	0.24293	34.18	-27.81	62.00	24.06	9.95	0.17	QP	NEUTRAL
9	0.60752	33.80	-22.20	56.00	23.73	9.88	0.19	QP	NEUTRAL
10 e	0.60752	32.17	-13.83	46.00	22.10	9.88	0.19	AVERAGE	NEUTRAL
11	1.819	33.59	-22.41	56.00	23.46	9.89	0.24	QP	NEUTRAL
12 e	1.819	30.55	-15.45	46.00	20.42	9.89	0.24	AVERAGE	NEUTRAL

Note: Level = Read Level + LISN Factor + Cable Loss.

## 4.2. Maximum Conducted Output Power Measurement

### 4.2.1. Limit

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. The limited has to be reduced by the amount in dB that the gain of the antenna exceed 6dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

### 4.2.2. Measuring Instruments and Setting

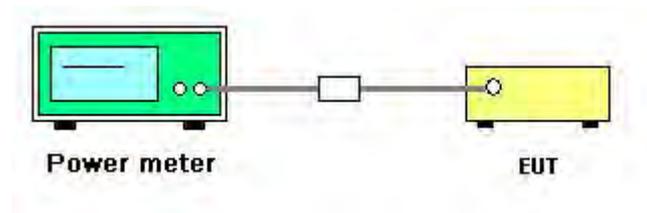
Please refer to section 5 of equipments list in this report. The following table is the setting of the power meter.

Power Meter Parameter	Setting
Bandwidth	50MHz bandwidth is greater than the EUT emission bandwidth
Detector	Average

### 4.2.3. Test Procedures

1. Test procedures refer KDB 558074 D01 v03r02 section 9.2.3.2.
2. This procedure provides an alternative for determining the RMS output power using a broadband RF average power meter with a thermocouple detector.

### 4.2.4. Test Setup Layout



### 4.2.5. Test Deviation

There is no deviation with the original standard.

### 4.2.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

#### 4.2.7. Test Result of Maximum Conducted Output Power

<b>Temperature</b>	20°C	<b>Humidity</b>	63%
<b>Test Engineer</b>	Lucas Huang	<b>Configurations</b>	GFSK
<b>Test Date</b>	Mar. 03, 2015		

Channel	Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
0	2402 MHz	2.04	30.00	Complies
19	2440 MHz	2.33	30.00	Complies
39	2480 MHz	2.39	30.00	Complies

### 4.3. Power Spectral Density Measurement

#### 4.3.1. Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

#### 4.3.2. Measuring Instruments and Setting

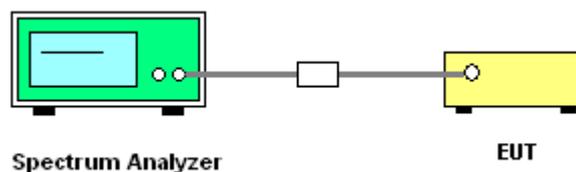
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	5-30 % greater than the DTS channel bandwidth.
RBW	$3 \text{ kHz} \leq \text{RBW} \leq 100\text{kHz}$
VBW	$\geq 3 \times \text{RBW}$
Detector	Peak
Trace	Max Hold
Sweep Time	Auto couple

#### 4.3.3. Test Procedures

1. Test was performed in accordance with KDB 558074 D01 v03r02 for Performing Compliance Measurements on Digital Transmission Systems (DTS) - section 10.2 Method PKPSD (peak PSD).
2. Use this procedure when the maximum conducted output power in the fundamental emission is used to demonstrate compliance. The EUT must be configured to transmit continuously at full power over the measurement duration.
3. Ensure that the number of measurement points in the sweep  $\geq 2 \times \text{span/RBW}$  (use of a greater number of measurement points than this minimum requirement is recommended).
4. Use the peak marker function to determine the maximum level in any 3 kHz band segment within the fundamental EBW.
5. The resulting PSD level must be  $\leq 8 \text{ dBm}$ .

#### 4.3.4. Test Setup Layout



#### 4.3.5. Test Deviation

There is no deviation with the original standard.

#### 4.3.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

#### 4.3.7. Test Result of Power Spectral Density

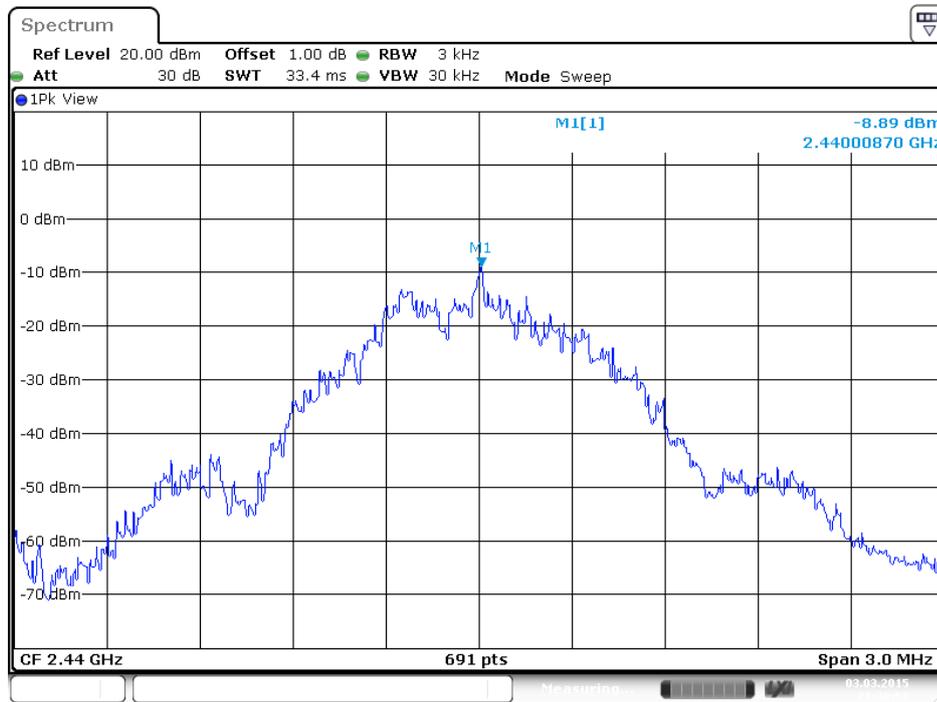
<b>Temperature</b>	20°C	<b>Humidity</b>	63%
<b>Test Engineer</b>	Lucas Huang	<b>Configurations</b>	GFSK

Channel	Frequency	Power Density (dBm/3kHz)	Power Density Limit (dBm/3kHz)	Result
0	2402 MHz	-9.90	8.00	Complies
19	2440 MHz	-8.89	8.00	Complies
39	2480 MHz	-10.56	8.00	Complies

Note: All the test values were listed in the report.

For plots, only the channel with worse result was shown.

Power Density Plot on Configuration Bluetooth / 2440 MHz



Date: 3 MAR 2015 21:30:58

## 4.4. 6dB Spectrum Bandwidth Measurement

### 4.4.1. Limit

For digital modulation systems, the minimum 6dB bandwidth shall be at least 500 kHz.

### 4.4.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

6dB Spectrum Bandwidth	
Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> 6dB Bandwidth
RBW	100kHz
VBW	$\geq 3 \times \text{RBW}$
Detector	Peak
Trace	Max Hold
Sweep Time	Auto
99% Occupied Bandwidth	
Spectrum Parameters	Setting
Span	1.5 times to 5.0 times the OBW
RBW	1 % to 5 % of the OBW
VBW	$\geq 3 \times \text{RBW}$
Detector	Peak
Trace	Max Hold

### 4.4.3. Test Procedures

For Radiated 6dB Bandwidth Measurement:

1. The transmitter was radiated to the spectrum analyzer in peak hold mode.
2. Test was performed in accordance with KDB 558074 D01 v03r02 for Performing Compliance Measurements on Digital Transmission Systems (DTS) - section 8.0 DTS bandwidth=> 8.1 Option 1.
3. Measured the spectrum width with power higher than 6dB below carrier.

### 4.4.4. Test Setup Layout

For Radiated 6dB Bandwidth Measurement:

This test setup layout is the same as that shown in section 4.5.4.

### 4.4.5. Test Deviation

There is no deviation with the original standard.

### 4.4.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

#### 4.4.7. Test Result of 6dB Spectrum Bandwidth

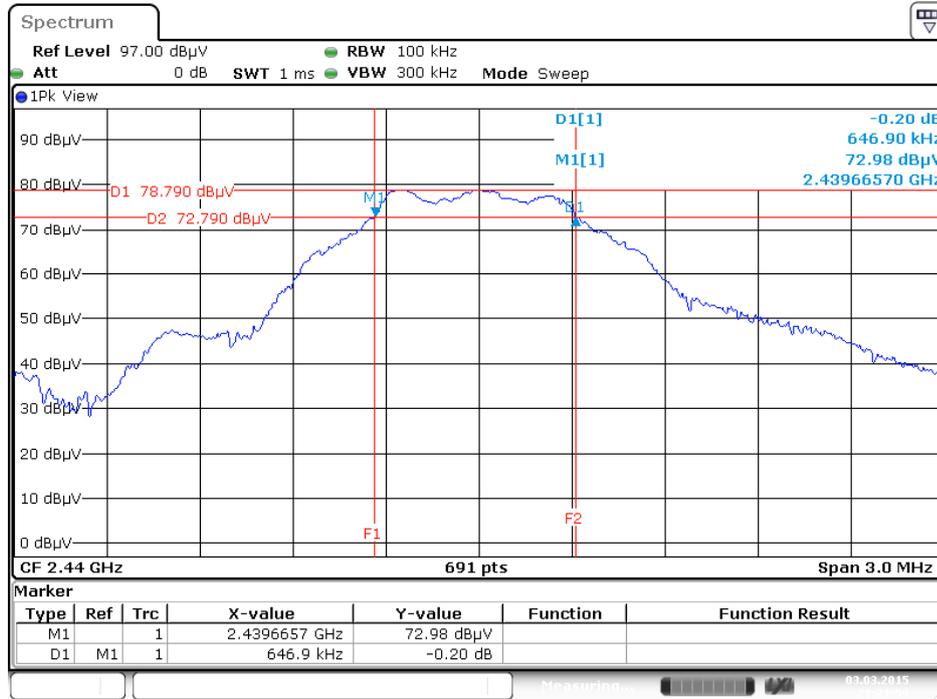
<b>Temperature</b>	20°C	<b>Humidity</b>	63%
<b>Test Engineer</b>	Lucas Huang	<b>Configurations</b>	GFSK

Channel	Frequency	6dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Min. Limit (kHz)	Test Result
0	2402 MHz	0.82	1.32	500	Complies
19	2440 MHz	0.65	0.96	500	Complies
39	2480 MHz	0.66	0.96	500	Complies

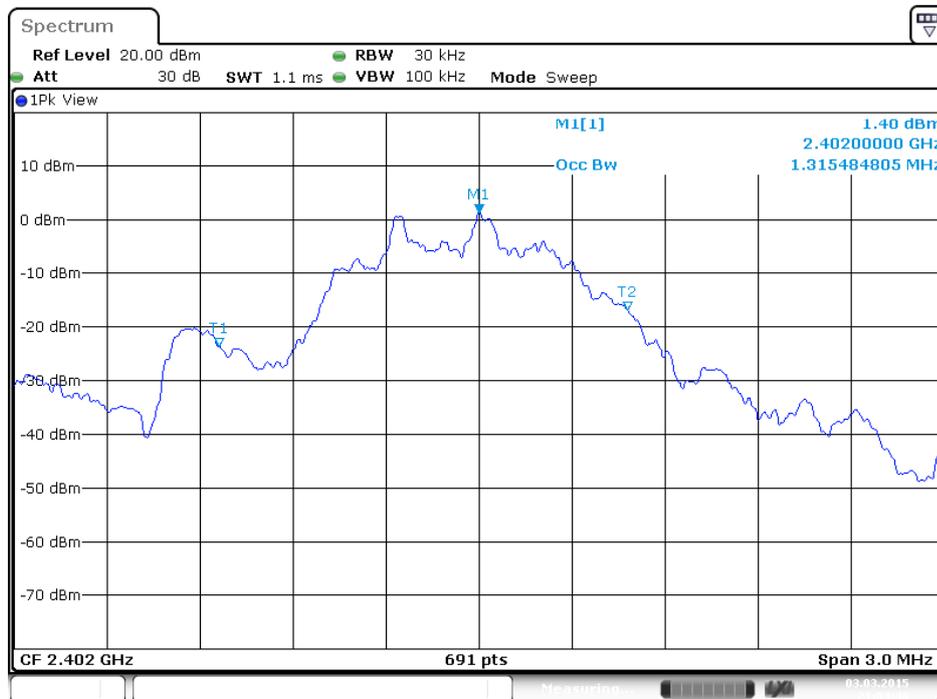
Note: All the test values were listed in the report.

For plots, only the channel with worse result was shown.

### 6 dB Bandwidth Plot on Configuration Bluetooth / 2440 MHz



### 99% Occupied Bandwidth Plot on Configuration Bluetooth / 2402 MHz



## 4.5. Radiated Emissions Measurement

### 4.5.1. Limit

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (micorvolts/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

### 4.5.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RBW / VBW (Emission in restricted band)	1 MHz / 3MHz for Peak, 1 MHz / 1/T for Average
RBW / VBW (Emission in non-restricted band)	100kHz / 300kHz for peak

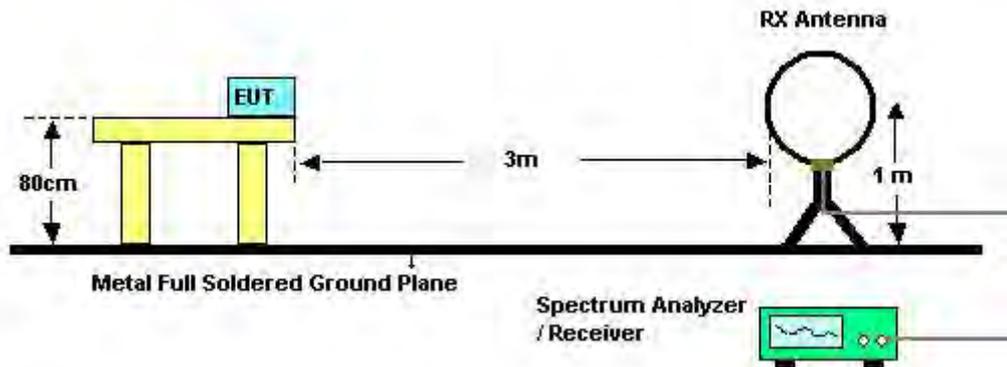
Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RBW 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RBW 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RBW 120kHz for QP

#### 4.5.3. Test Procedures

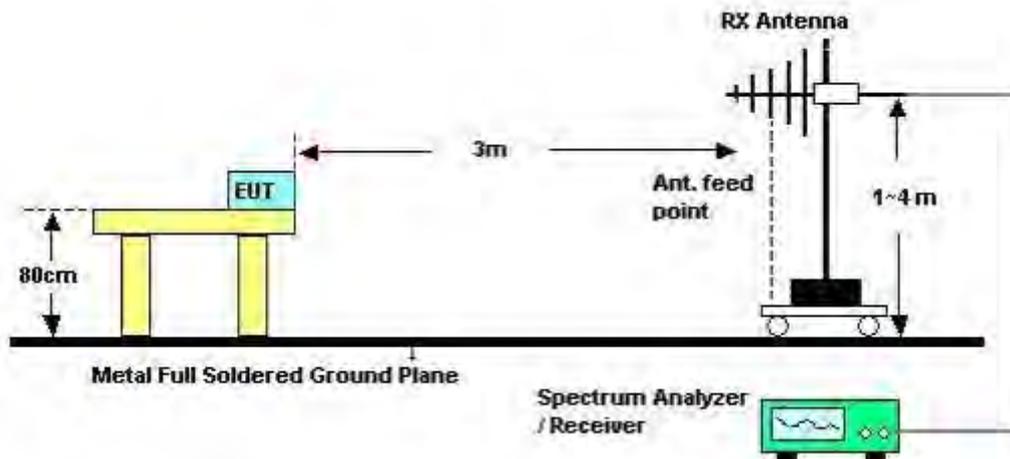
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and 3MHz RBW for peak reading. Then 1MHz RBW and 1/T VBW for average reading in spectrum analyzer.
7. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
8. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
9. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High – Low scan is not required in this case.

#### 4.5.4. Test Setup Layout

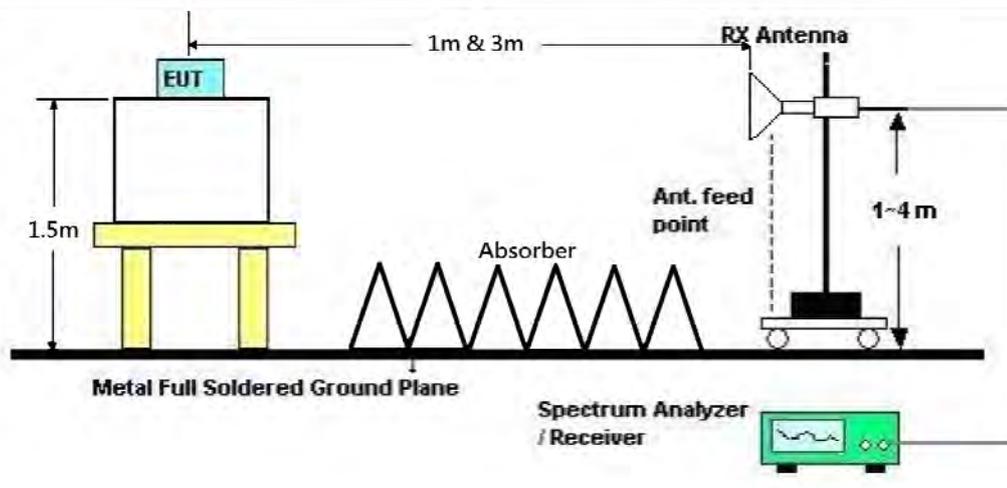
For Radiated Emissions: 9kHz ~30MHz



For Radiated Emissions: 30MHz~1GHz



For Radiated Emissions: Above 1GHz



#### 4.5.5. Test Deviation

There is no deviation with the original standard.

#### 4.5.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

#### 4.5.7. Results of Radiated Emissions (9kHz~30MHz)

<b>Temperature</b>	26°C	<b>Humidity</b>	68%
<b>Test Engineer</b>	Gino Huang	<b>Configurations</b>	Normal Link
<b>Test Date</b>	Feb. 26, 2015 ~ Feb. 27, 2015	<b>Test Mode</b>	Mode 1

<b>Freq. (MHz)</b>	<b>Level (dBuV)</b>	<b>Over Limit (dB)</b>	<b>Limit Line (dBuV)</b>	<b>Remark</b>
-	-	-	-	See Note

Note:

The amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

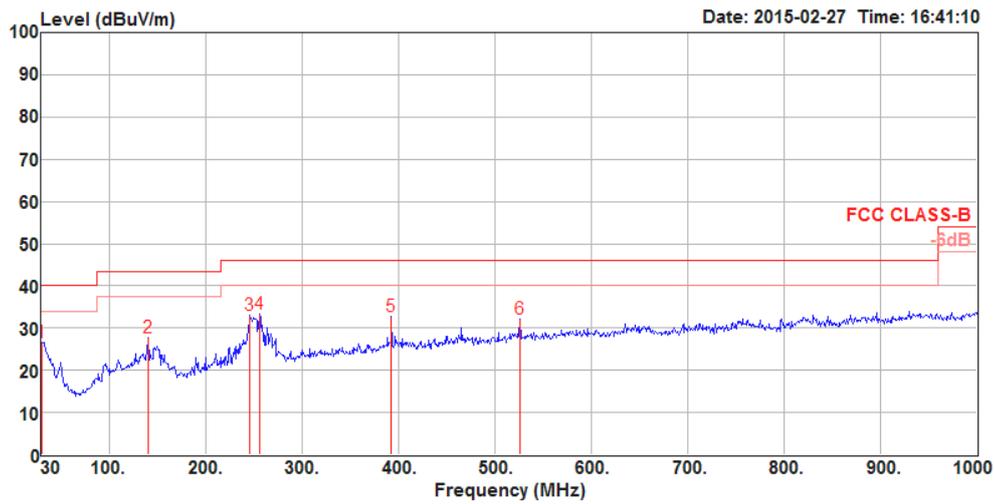
Distance extrapolation factor =  $40 \log(\text{specific distance} / \text{test distance})$  (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

4.5.8. Results of Radiated Emissions (30MHz~1GHz)

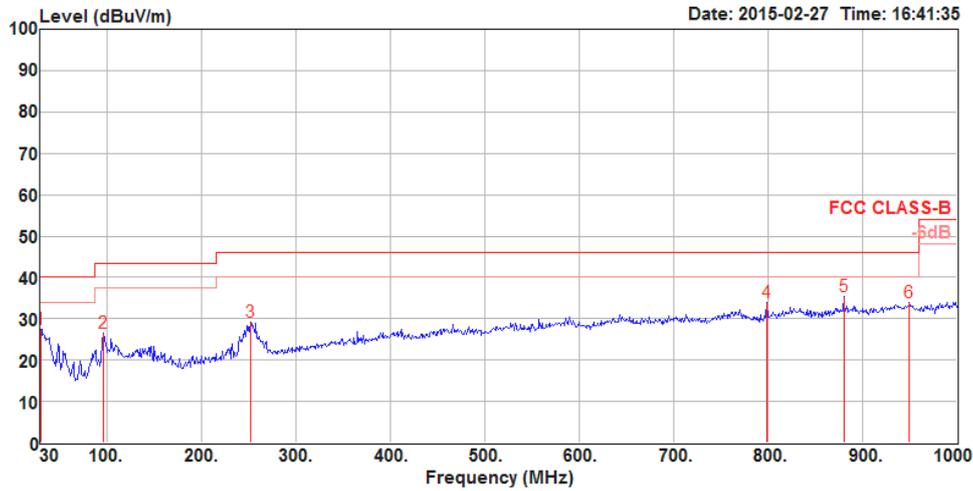
Temperature	26°C	Humidity	68%
Test Engineer	Gino Huang	Configurations	Normal Link
Test Mode	Mode 1		

Horizontal



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	30.00	26.70	40.00	-13.30	38.41	0.43	20.10	32.24	100	81	Peak	HORIZONTAL
2	140.58	27.82	43.50	-15.68	46.94	1.03	12.02	32.17	200	163	Peak	HORIZONTAL
3	246.31	32.98	46.00	-13.02	51.09	1.37	12.65	32.13	100	158	Peak	HORIZONTAL
4	256.01	33.26	46.00	-12.74	50.52	1.39	13.50	32.15	125	130	Peak	HORIZONTAL
5	392.78	32.80	46.00	-13.20	46.76	1.73	16.34	32.03	125	53	Peak	HORIZONTAL
6	525.67	32.05	46.00	-13.95	43.96	2.01	18.26	32.18	100	152	Peak	HORIZONTAL

**Vertical**



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBUV/m	dBUV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	30.00	27.54	40.00	-12.46	39.25	0.43	20.10	32.24	125	231	Peak	VERTICAL
2	95.96	26.60	43.50	-16.90	47.56	0.85	10.36	32.17	125	249	Peak	VERTICAL
3	252.13	29.10	46.00	-16.90	46.72	1.38	13.12	32.12	400	89	Peak	VERTICAL
4	798.24	33.87	46.00	-12.13	42.70	2.46	20.79	32.08	100	273	Peak	VERTICAL
5	879.72	35.28	46.00	-10.72	42.82	2.59	21.54	31.67	400	360	Peak	VERTICAL
6	949.56	33.96	46.00	-12.04	40.30	2.68	22.00	31.02	200	353	Peak	VERTICAL

**Note:**

The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.

Emission level (dBUV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

#### 4.5.9. Results for Radiated Emissions (1GHz~10<sup>th</sup> Harmonic)

<b>Temperature</b>	26°C	<b>Humidity</b>	68%
<b>Test Engineer</b>	Gino Huang	<b>Configurations</b>	Channel 0
<b>Test Date</b>	Feb. 27, 2015		

##### *Horizontal*

	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	4804.27	32.08	74.00	-41.92	30.06	4.09	32.52	34.59	276	168	Peak	HORIZONTAL
2	4804.27	-5.16	54.00	-59.16	-7.18	4.09	32.52	34.59	276	168	Average	HORIZONTAL

##### *Vertical*

	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	4803.47	31.70	74.00	-42.30	29.68	4.09	32.52	34.59	315	195	Peak	VERTICAL
2	4803.47	-5.54	54.00	-59.54	-7.56	4.09	32.52	34.59	315	195	Average	VERTICAL



<b>Temperature</b>	26°C	<b>Humidity</b>	68%
<b>Test Engineer</b>	Gino Huang	<b>Configurations</b>	Channel 19
<b>Test Date</b>	Feb. 27, 2015		

**Horizontal**

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	4880.36	32.07	74.00	-41.93	29.85	4.13	32.66	34.57	264	147	Peak	HORIZONTAL
2	4880.36	-5.17	54.00	-59.17	-7.39	4.13	32.66	34.57	264	147	Average	HORIZONTAL
3	7320.13	37.55	74.00	-36.45	30.19	5.10	37.09	34.83	322	169	Peak	HORIZONTAL
4	7320.13	0.31	54.00	-53.69	-7.05	5.10	37.09	34.83	322	169	Average	HORIZONTAL

**Vertical**

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	4879.22	31.35	74.00	-42.65	29.13	4.13	32.66	34.57	360	189	Peak	VERTICAL
2	4879.22	-5.89	54.00	-59.89	-8.11	4.13	32.66	34.57	360	189	Average	VERTICAL
3	7320.32	37.24	74.00	-36.76	29.88	5.10	37.09	34.83	323	143	Peak	VERTICAL
4	7320.32	0.00	54.00	-54.00	-7.36	5.10	37.09	34.83	323	143	Average	VERTICAL



<b>Temperature</b>	26°C	<b>Humidity</b>	68%
<b>Test Engineer</b>	Gino Huang	<b>Configurations</b>	Channel 39
<b>Test Date</b>	Feb. 27, 2015		

**Horizontal**

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	4959.14	31.59	74.00	-42.41	29.13	4.17	32.83	34.54	178	177	Peak	HORIZONTAL
2	4959.14	-5.65	54.00	-59.65	-8.11	4.17	32.83	34.54	178	177	Average	HORIZONTAL
3	7440.19	38.93	74.00	-35.07	31.41	5.13	37.24	34.85	138	146	Peak	HORIZONTAL
4	7440.19	1.68	54.00	-52.32	-5.84	5.13	37.24	34.85	138	146	Average	HORIZONTAL

**Vertical**

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	4959.69	32.30	74.00	-41.70	29.84	4.17	32.83	34.54	332	168	Peak	VERTICAL
2	4959.69	-4.94	54.00	-58.94	-7.40	4.17	32.83	34.54	332	168	Average	VERTICAL
3	7439.52	38.94	74.00	-35.06	31.42	5.13	37.24	34.85	125	220	Peak	VERTICAL
4	7439.52	1.69	54.00	-52.31	-5.83	5.13	37.24	34.85	125	220	Average	VERTICAL

**Note:**

The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

## 4.6. Emissions Measurement

### 4.6.1. Limit

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (micorvolts/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

### 4.6.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	100 MHz
RBW / VBW (Emission in restricted band)	1MHz / 3MHz for Peak, 1MHz / 1/T for Average
RBW / VBW (30dBc in any 100 kHz bandwidth emission)	100 kHz / 300 kHz for Peak

### 4.6.3. Test Procedures

#### For Radiated band edges Measurement:

1. The test procedure is the same as section 4.5.3, only the frequency range investigated is limited to 100MHz around band edges.

#### For Radiated Out of Band Emission Measurement:

1. Test was performed in accordance with KDB 558074 D01 v03r02 for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 10.1 Unwanted Emissions into Non-Restricted Frequency Bands Measurement Procedure.

#### **4.6.4. Test Setup Layout**

For Radiated band edges Measurement:

This test setup layout is the same as that shown in section 4.5.4.

For Radiated Out of Band Emission Measurement:

This test setup layout is the same as that shown in section 4.5.4.

#### **4.6.5. Test Deviation**

There is no deviation with the original standard.

#### **4.6.6. EUT Operation during Test**

The EUT was programmed to be in continuously transmitting mode.

#### 4.6.7. Test Result of Band Edge and Fundamental Emissions

<b>Temperature</b>	26°C	<b>Humidity</b>	68%
<b>Test Engineer</b>	Gino Huang	<b>Configurations</b>	Channel 0, 19, 39
<b>Test Date</b>	Feb. 27, 2015		

##### Channel 0

	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	deg	cm		
1	2383.60	55.32	74.00	-18.68	24.53	2.85	27.94	0.00	273	148 Peak	HORIZONTAL
2	2383.60	18.08	54.00	-35.92	-12.71	2.85	27.94	0.00	273	148 Average	HORIZONTAL
3	2402.00	100.52			69.74	2.86	27.92	0.00	273	148 Peak	HORIZONTAL
4	2402.00	63.28			32.50	2.86	27.92	0.00	273	148 Average	HORIZONTAL

Item 3, 4 are the fundamental frequency at 2402 MHz.

##### Channel 19

	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	deg	cm		
1	2340.00	55.43	74.00	-18.57	24.62	2.82	27.99	0.00	264	159 Peak	HORIZONTAL
2	2340.00	18.19	54.00	-35.81	-12.62	2.82	27.99	0.00	264	159 Average	HORIZONTAL
3	2440.00	99.95			69.20	2.89	27.86	0.00	264	159 Peak	HORIZONTAL
4	2440.00	62.71			31.96	2.89	27.86	0.00	264	159 Average	HORIZONTAL
5	2485.10	55.16	74.00	-18.84	24.43	2.91	27.82	0.00	264	159 Peak	HORIZONTAL
6	2485.10	17.92	54.00	-36.08	-12.81	2.91	27.82	0.00	264	159 Average	HORIZONTAL

Item 3, 4 are the fundamental frequency at 2440 MHz.

##### Channel 39

	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	deg	cm		
1	2480.20	98.62			67.89	2.91	27.82	0.00	275	150 Peak	HORIZONTAL
2	2480.20	61.38			30.65	2.91	27.82	0.00	275	150 Average	HORIZONTAL
3	2494.30	57.10	74.00	-16.90	26.38	2.92	27.80	0.00	275	150 Peak	HORIZONTAL
4	2494.30	19.86	54.00	-34.14	-10.86	2.92	27.80	0.00	275	150 Average	HORIZONTAL

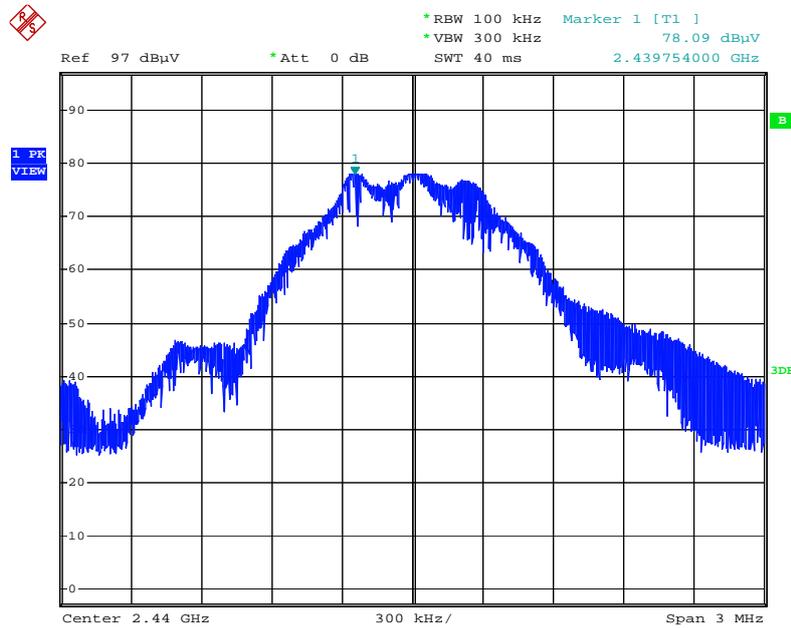
Item 1, 2 are the fundamental frequency at 2480 MHz.

Note:

Emission level (dBuV/m) = 20 log Emission level (uV/m).

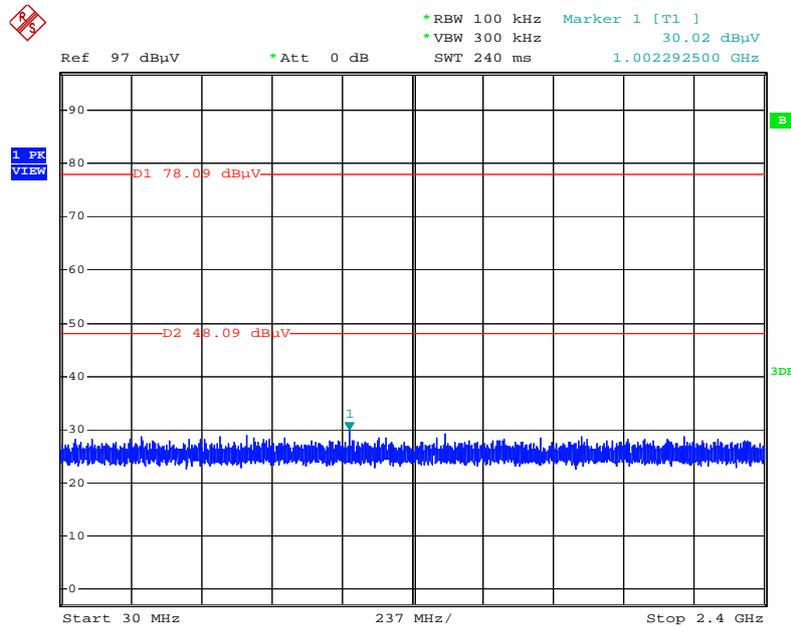
Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

**For Emission not in Restricted Band**  
**Plot on Configuration / Reference Level**



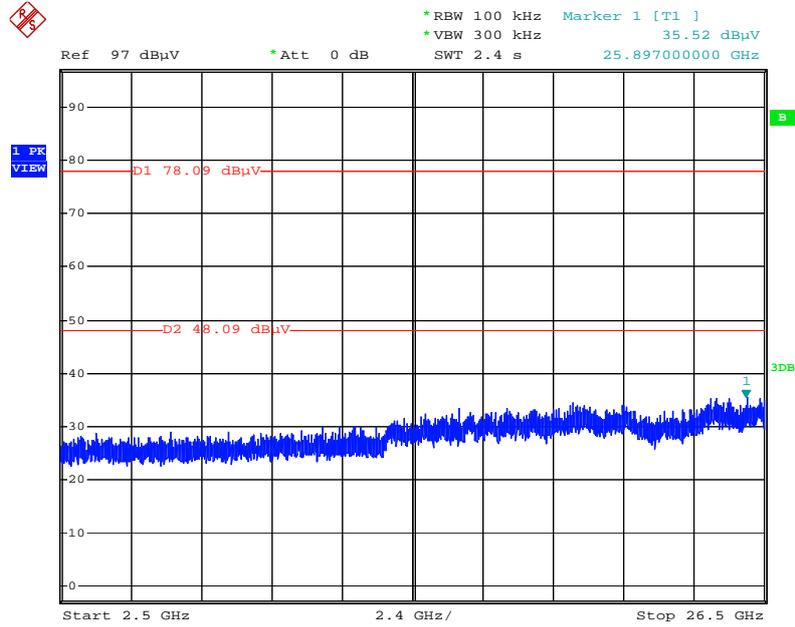
Date: 27.FEB.2015 23:36:24

**Plot on Configuration For Bluetooth 4.0 / Channel 0 / 30MHz~2400MHz (down 30dBc)**



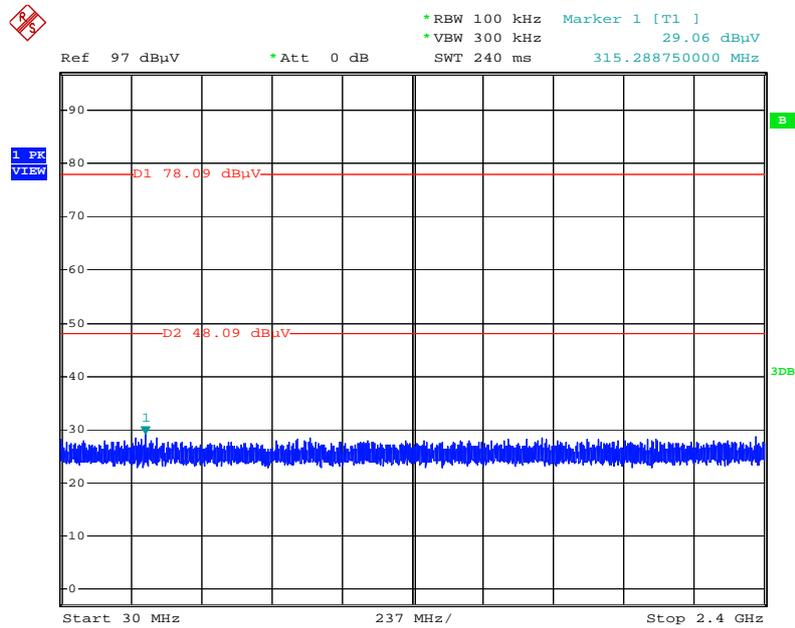
Date: 27.FEB.2015 23:40:14

Plot on Configuration For Bluetooth 4.0 / Channel 0 / 2500MHz~26500MHz (down 30dBc)



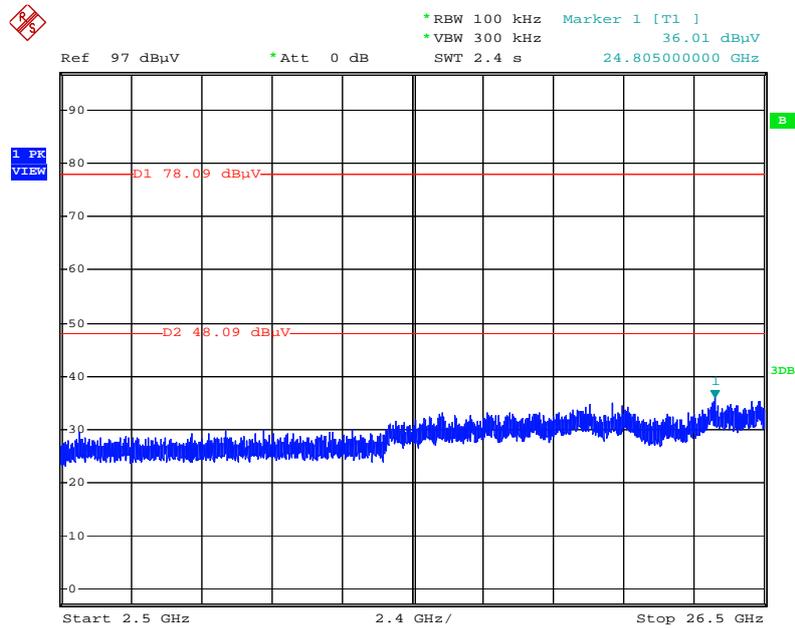
Date: 27.FEB.2015 23:41:06

Plot on Configuration For Bluetooth 4.0 / Channel 39 / 30MHz~2400MHz (down 30dBc)



Date: 27.FEB.2015 23:42:31

## Plot on Configuration For Bluetooth 4.0 / Channel 39 / 2500MHz~26500MHz (down 30dBc)



Date: 27.FEB.2015 23:43:09

## 4.7. Antenna Requirements

### 4.7.1. Limit

Except for special regulations, the Low-power Radio-frequency Devices must not be equipped with any jacket for installing an antenna with extension cable. An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

### 4.7.2. Antenna Connector Construction

Please refer to section 3.3 in this test report; antenna connector complied with the requirements.

## 5. LIST OF MEASURING EQUIPMENTS

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
EMI Test Receiver	R&S	ESCS 30	100355	9kHz ~ 2.75GHz	Apr. 23, 2014	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150kHz ~ 100MHz	Dec. 02, 2014	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Dec. 02, 2014	Conduction (CO01-CB)
COND Cable	Woken	Cable	01	150kHz ~ 30MHz	Dec. 03, 2014	Conduction (CO01-CB)
Software	Audix	E3	5.410e	-	N.C.R.	Conduction (CO01-CB)
BILOG ANTENNA	Schaffner	CBL6112D	22021	20MHz ~ 2GHz	May 26, 2014	Radiation (03CH01-CB)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz ~ 30 MHz	Jul. 28, 2014	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz ~ 18GHz	Oct. 28, 2014	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Aug. 22, 2014	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10991	0.1MHz ~ 1.3GHz	Feb. 24, 2015	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 12, 2015	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	Nov. 06, 2014	Radiation (03CH01-CB)
EMI Test Receiver	Agilent	N9038A	MY52260123	9kHz ~ 8GHz	Jan. 21, 2015	Radiation (03CH01-CB)
EMI Test Receiver	R&S	ESR26	101289	9kHz ~ 26GHz	Aug. 22, 2014	Radiation (03CH01-CB)
Turn Table	INN CO	CO 2000	N/A	0 ~ 360 degree	N.C.R.	Radiation (03CH01-CB)
Antenna Mast	INN CO	CO 2000	N/A	1 m ~ 4 m	N.C.R.	Radiation (03CH01-CB)
RF Cable-low	Woken	Low Cable-1	N/A	30 MHz ~ 1 GHz	Nov. 15, 2014	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G-1	N/A	1 GHz ~ 40 GHz	Nov. 15, 2014	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G-2	N/A	1 GHz ~ 40 GHz	Nov. 15, 2014	Radiation (03CH01-CB)
Signal analyzer	R&S	FSV40	100979	9kHz~40GHz	Dec. 12, 2014	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-7	1 GHz – 26.5 GHz	Nov. 15, 2014	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-8	1 GHz – 26.5 GHz	Nov. 15, 2014	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-9	1 GHz – 26.5 GHz	Nov. 15, 2014	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-10	1 GHz – 26.5 GHz	Nov. 15, 2014	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-6	1 GHz – 26.5 GHz	Nov. 15, 2014	Conducted (TH01-CB)
Power Sensor	Agilent	U2021XA	MY53410001	50MHz~18GHz	Nov. 03, 2014	Conducted (TH01-CB)

Note: Calibration Interval of instruments listed above is one year.  
N.C.R. means Non-Calibration required.

## 6. MEASUREMENT UNCERTAINTY

Test Items	Uncertainty	Remark
Conducted Emission (150kHz ~ 30MHz)	2.4 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	3.6 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	3.7 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	3.5 dB	Confidence levels of 95%
Conducted Emission	1.7 dB	Confidence levels of 95%