

# FCC RF Test Report

APPLICANT	: LG Electronics Mobile Comm USA
EQUIPMENT	: Smart phone
BRAND NAME	: LG
MODEL NAME	: LG-X220g
FCC ID	: ZNFX220G
STANDARD	: FCC Part 15 Subpart C §15.247
CLASSIFICATION	: (DTS) Digital Transmission System

The product was received on Dec. 03, 2015 and testing was completed on Dec. 23, 2015. We, SPORTON INTERNATIONAL (KUNSHAN) INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL (KUNSHAN) INC., the test report shall not be reproduced except in full.

James Juang

Prepared by: James Huang / Manager

Approved by: Jones Tsai / Manager



SPORTON INTERNATIONAL (KUNSHAN) INC. No. 3-2, PingXiang Road, Kunshan, Jiangsu Province, P. R. China



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AP	PEND	IX A. RADIATED TEST RESULTS	



# **REVISION HISTORY**

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR5D0302B	Rev. 01	Initial issue of report	Jan. 19, 2016



# SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	6dB Bandwidth	≥ 0.5MHz	Pass	-
3.2	15.247(b)(1)	Peak Output Power	≤ 30dBm	Pass	-
3.3	15.247(e)	Power Spectral Density ≤ 8dBm/3kHz		Pass	-
3.4	15.247(d)	Conducted Band Edges and Spurious Emission	≤ 20dBc	Pass	-
3.5	15.247(d)	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 8.2 dB at 31.940 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 7.34 dB at 4.360 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	N/A	Pass	-



# **1** General Description

# 1.1 Applicant

#### LG Electronics Mobile Comm USA

1000 Sylvan Avenue Englewood Cliffs, NJ 07632

# 1.2 Manufacturer

#### Arima Communications Corp.

6F, No.866, Jhongjheng Rd., Jhonghe Dist., New Taipei City 23586, Taiwan

# **1.3 Product Feature of Equipment Under Test**

Product Feature					
Equipment	Smart phone				
Brand Name	LG				
Model Name	LG-X220g				
FCC ID	ZNFX220G				
EUT supports Radios application	GSM/GPRS/EGPRS(Downlink Only)/WCDMA/HSPA/ HSPA+(16QAM uplink is not supported)/ WLAN 2.4GHz 802.11b/g/n HT20/HT40/ Bluetooth v3.0 + EDR/Bluetooth v4.0 LE				
IMEI Code	Conducted: 353468062997251 Radiation: 353468062997100 Conduction: 353468062997145				
HW Version	5542MB-002				
SW Version	LGX220g-00-V08a-334-20-NOV-11-2015+0				
EUT Stage	Production Unit				

**Remark:** The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

# **1.4 Product Specification subjective to this standard**

Product Spec	Product Specification subjective to this standard				
Tx/Rx Frequency Range	2402 MHz ~ 2480 MHz				
Number of Channels	40				
<b>Carrier Frequency of Each Channel</b>	40 Channel(37 hopping + 3 advertising channel)				
Maximum Output Power to Antenna	-0.52 dBm (0.0009 W)				
Antenna Type/Gain	IFA Antenna with gain -0.10 dBi				
Type of Modulation	Bluetooth LE : GFSK				



# 1.5 Modification of EUT

No modifications are made to the EUT during all test items.

# **1.6 Testing Location**

Test Site	SPORTON INTERNATIONAL (KUNSHAN) INC.					
	No. 3-2, PingXiang Road, Kunshan, Jiangsu Province, P. R. China					
<b>Test Site Location</b>	TEL: +86-0512-5790-0158					
	FAX: +86-0512-5790-0958					
Toot Site No	Sporton Site No. FCC Registration No.					
Test Site No.	TH01-KS	03CH03-KS	CO01-KS	306251		

Note: The test site complies with ANSI C63.4 2009 requirement.

# 1.7 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.247
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r03
- ANSI C63.10-2013

#### Remark:

- 1. All test items were verified and recorded according to the standards and without any deviation during the test.
- 2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.



# 2 Test Configuration of Equipment Under Test

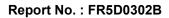
# 2.1 Descriptions of Test Mode

		Bluetooth 4.0 – LE RF Output Power
Channel	Fraguanay	Data Rate / Modulation
Channel	Frequency	GFSK
		1Mbps
Ch00	2402MHz	-1.07 dBm
Ch19	2440MHz	<mark>-0.52</mark> dBm
Ch39	2480MHz	-0.91 dBm

The RF output power was recorded in the following table:

a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction (150 kHz to 30 MHz), radiation (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). Pre-scanned tests, X, Y, Z in three orthogonal panels to determine the final configuration (X plane as worst plane) from all possible combinations.

b. AC power line Conducted Emission was tested under maximum output power.





# 2.2 Test Mode

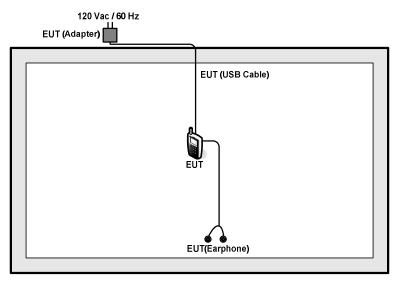
The following summary table is showing all test modes to demonstrate in compliance with the standard.

	Summary table of Test Cases					
Test Item	Data Rate / Modulation					
Test item	Bluetooth 4.0 – LE / GFSK					
Conducted	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps					
TCs	Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps					
105	Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps					
Radiated	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps					
TCs	Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps					
105	Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps					
AC Conducted Emission	Mode 1: GSM850 Idle + Bluetooth Link + WLAN Link + Earphone + USB Cable (Charging from Adapter)					
Remark: For	Remark: For Radiated Test Cases, The tests were performance with Adapter, Earphone, and USB					
Cab	le.					

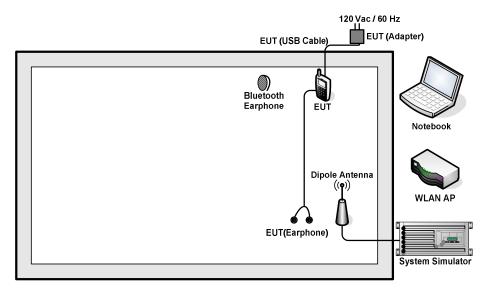


# 2.3 Connection Diagram of Test System

### <Bluetooth v4.0 LE Tx Mode>



#### <AC Conducted Emission Mode>





ltem	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	System Simulator	Anritsu	MT8820C	FCC DoC	N/A	Shielded, 1.5 m
2.	Bluetooth Earphone	Nokia	BH-102	PYAHS-107W	N/A	N/A
3.	WLAN AP	D-Link	DIR-855	KA2DIR855A2	N/A	Shielded, 1.8 m
4.	Notebook	Lenovo	G480	N/A	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m
5.	SD Card	Kingston	4GB	N/A	N/A	N/A

# 2.4 Support Unit used in test configuration and system

# 2.5 EUT Operation Test Setup

For Bluetooth v4.0 LE function, the engineering test program was provided and enabled to make EUT continuous transmit/receive.

For AC power line conducted emissions, the EUT was set to connect with the WLAN AP under large package sizes transmission.

# 2.6 Measurement Results Explanation Example

#### For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss. Offset = RF cable loss. Following shows an offset computation example with cable loss 5.5 dB. Offset(dB) = RF cable loss(dB) = 5.5 (dB)



# 3 Test Result

# 3.1 6dB Bandwidth Measurement

### 3.1.1 Limit of 6dB Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

### 3.1.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

# 3.1.3 Test Procedures

- 1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r03.
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
- 5. Measure and record the results in the test report.

# 3.1.4 Test Setup



EUT

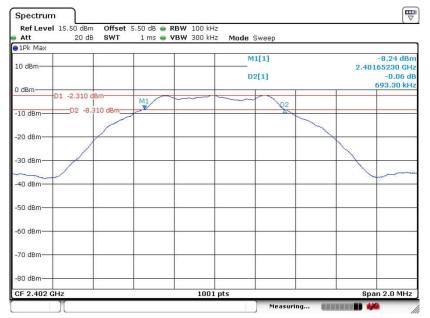
Spectrum Analyzer



#### 3.1.5 Test Result of 6dB Bandwidth

Test Mode	):	Bluetoot	h v4.0 LE	Temperature :	<b>24~25</b> ℃	
Test Engir	neer :	Issac So	ng	Relative Humidity :	49~51%	
Channel	Channel Frequency 6dB Band (MHz)		lwidth (MHz)	6dB Bandwidth Min. Limit (MHz)	Pass/Fail	
00	24	402	0	.693	0.5	Pass
19	24	440	0	.695	0.5	Pass
39	24	480	0	.693	0.5	Pass

#### 6 dB Bandwidth Plot on Channel 00



Date: 8.DEC.2015 03:26:45

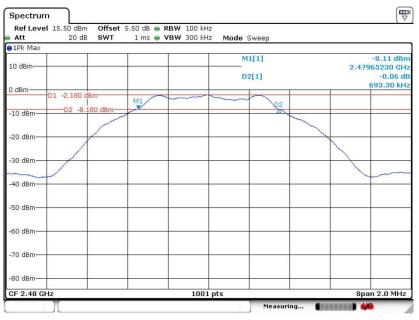




#### 6 dB Bandwidth Plot on Channel 19

Date: 8.DEC.2015 03:30:29

#### 6 dB Bandwidth Plot on Channel 39



Date: 8.DEC.2015 03:33:28

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# 3.2 Peak Output Power Measurement

### 3.2.1 Limit of Peak Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting antenna of directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. 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.

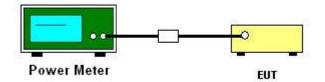
### 3.2.2 Measuring Instruments

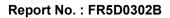
The section 4.0 of List of Measuring Equipment of this test report is used for test.

### 3.2.3 Test Procedures

- The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v03r03 section 9.1.2 PKPM1 Peak power meter method.
- 2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Measure the conducted output power and record the results in the test report.

# 3.2.4 Test Setup







# 3.2.5 Test Result of Peak Output Power

Test Mode :	Bluetooth v4.0 LE	Temperature :		:	<b>24~25</b> ℃		
Test Engineer :	Issac Song		Relative Hum	idity :	49~51%		
	<b>-</b>	RF Power (dBm)					
Channel	Frequency	(	GFSK	М	ax. Limits	Pass/Fail	
	(MHz)	1	Mbps		(dBm)	Pass/raii	
00	2402		-1.07		30.00	Pass	
19	2440		-0.52		30.00	Pass	
39	2480		-0.91		30.00	Pass	



# 3.3 Power Spectral Density Measurement

### 3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

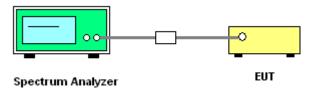
### 3.3.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

### 3.3.3 Test Procedures

- The testing follows Measurement Procedure 10.2 Method PKPSD of FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r03
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz.
   Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
- 5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
- 6. Measure and record the results in the test report.
- 7. The Measured power density (dBm)/ 100kHz is a reference level and used as 20dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

### 3.3.4 Test Setup





### 3.3.5 Test Result of Power Spectral Density

Test Mod	est Mode : Bluetooth v4.0 LE Ter		Temperature :	<b>24~25</b> ℃		
Test Eng	est Engineer : Issac Song Relative Hur		Relative Humidity :	49~51%		
Channel	Frequency Power Density		Max. Limits	Dece/Feil		
Channel	(MHz	)	PSD/100kHz (dBm)	PSD/3kHz (dBm)	(dBm/3kHz)	Pass/Fail
00	2402		-2.23	-17.01	8	Pass
19	2440		-1.67	-16.52	8	Pass
39	2480		-2.13	-16.89	8	Pass

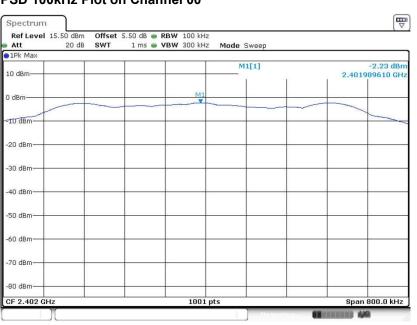
Note:

1. Measured power density (dBm) has offset with cable loss.

 The Measured power density (dBm)/ 100kHz is reference level and used as 20dBc down for Conducted Band Edges and Conducted Spurious Emission limit line.



# 3.3.6 Test Result of Power Spectral Density Plots (100kHz)

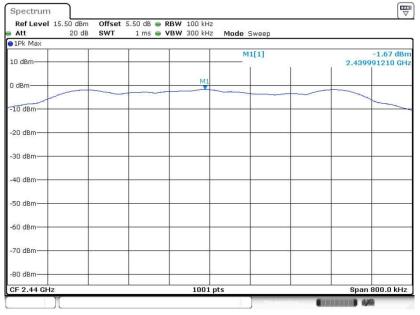


#### PSD 100kHz Plot on Channel 00

Date: 8.DEC.2015 03:28:00

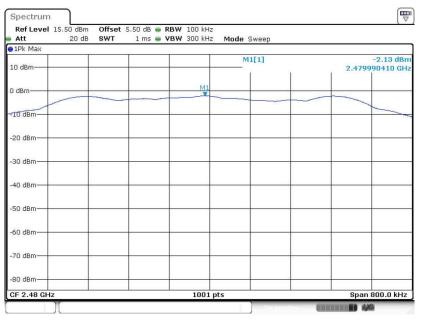


#### PSD 100kHz Plot on Channel 19



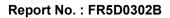
Date: 8.DEC.2015 03:31:38

#### PSD 100kHz Plot on Channel 39



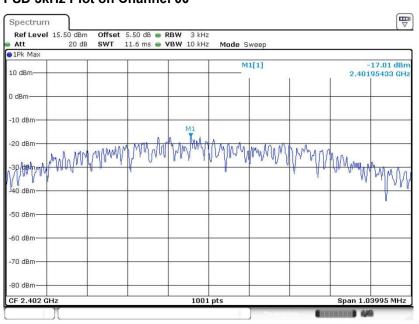
Date: 8.DEC.2015 03:35:34

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# 3.3.7 Test Result of Power Spectral Density Plots (3kHz)

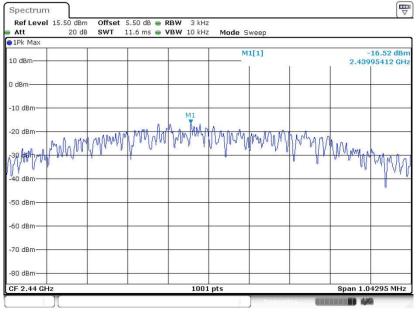


#### PSD 3kHz Plot on Channel 00

Date: 8.DEC.2015 03:27:37

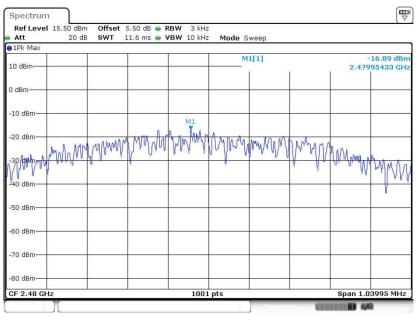


#### PSD 3kHz Plot on Channel 19



Date: 8.DEC.2015 03:31:12

#### PSD 3kHz Plot on Channel 39



Date: 8.DEC.2015 03:34:51

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# 3.4 Conducted Band Edges and Spurious Emission Measurement

# 3.4.1 Limit of Conducted Band Edges and Spurious Emission

All harmonics/spurious must be at least 20 dB down from the highest emission level within the authorized band.

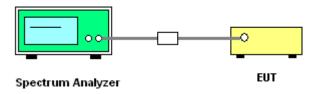
### 3.4.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

### 3.4.3 Test Procedure

- 1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r03.
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
- 5. Measure and record the results in the test report.
- 6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

### 3.4.4 Test Setup





# 3.4.5 Test Result of Conducted Band Edges Plots

Test Mode :	Bluetooth 4.0 LE	Temperature :	<b>24~25</b> ℃
Test Channel :	00 and 39	Relative Humidity :	49~51%
		Test Engineer :	Issac Song

#### Low Band Edge Plot on Channel 00

1Pk Max									
10 dBm					M	1[1]	ТТ		-60.54 dBr 994710 GH
D dBm	-	-	-					-	ut é
-10 dBm									η
-20 dBm	D1 -22.230	dBm							
-30 dBm								+	
-40 dBm								- N	h l
-50 dBm								-	
-60 dBm								M1 MV	- M
/ <b>ሊ.ሥዛለ</b> አውጭ -70 dBm	derively war	e-h-ground	hahamana	www.meroul	whenhow	lisehender	webshahartu	r~	5
								_F1	

Date: 8.DEC.2015 03:28:27



T T				
10 dBm			M1[1]	-62.14 dBr 2.4995600 GH
D dBm				
-10 dBm				
20 dBm-D1 -22.130 dBm-				
30 dBm				
40 dBm				
50 dBmW				M1
50 dBm	hamparkherry	howard how	mound when we and	montemanderstand
80 dBm	F1			

### High Band Edge Plot on Channel 39

Date: 8.DEC.2015 03:36:08

Issac Song



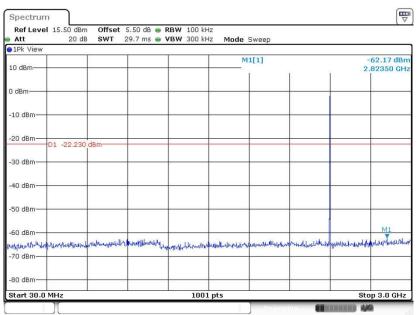
0.4.0				
	Test Mode :	Bluetooth 4.0 LE	Temperature :	<b>24~25</b> ℃
	Test Channel :	00	Relative Humidity :	49~51%

### 3.4.6 Test Result of Conducted Spurious Emission Plots

### Conducted Spurious Emission Plot on Bluetooth LE 1Mbps

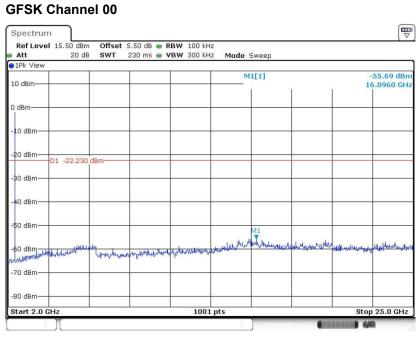
**Test Engineer :** 

#### GFSK Channel 00



Date: 8.DEC.2015 03:28:38





Date: 8.DEC.2015 03:28:47



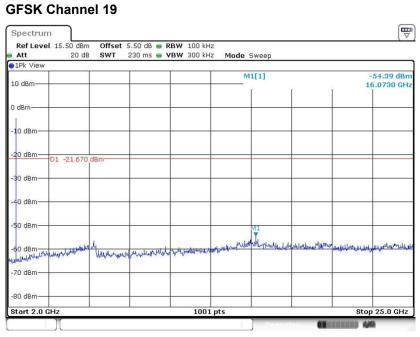
Test Mode :	Bluetooth 4.0 LE	Temperature :	<b>24~25</b> ℃
Test Channel :	19	Relative Humidity :	49~51%
		Test Engineer :	Issac Song

### GFSK Channel 19

Att 1Pk View	20 dB SWT	29.7 ms 👄 VBW	300 KHZ Mode	Sweep		
10 dBm				M1[1]	ĩ	-61.79 dBn 719.80 MH:
0 dBm				-	1	3
-10 dBm						
-20 dBm	21.670 dBm					
-30 dBm						
-40 dBm						
-50 dBm						
-60 dBm-	M1	old Provide A stille in these	Juria dal maria and	يتوجعنا والبار الألما فالرب والروة	non ta lilli - andrini a	
-70 dBm-	Hanamerahar (	Well and the Well and the	an change and a second s	Interfalling interfalling and	an Awrana man dalaya ya kata da	anthone and see Lakes as to re-
-80 dBm						
Start 30.0 MHz			1001 pts			Stop 3.0 GH

Date: 8.DEC.2015 03:32:00





Date: 8.DEC.2015 03:32:08



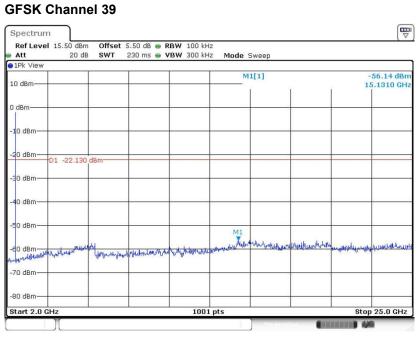
Test Mode :	Bluetooth 4.0 LE	Temperature :	<b>24~25</b> ℃
Test Channel :	39	Relative Humidity :	49~51%
		Test Engineer :	Issac Song

### GFSK Channel 39

Att 20 dB SWT	29.7 ms 👄 VBW 300 kH	Iz Mode Sweep		
1Pk View	1 1	M1[1]		-62.06 dBn
10 dBm		MILI		2.98960 GH
			1 1	
0 dBm				
-10 dBm				
-20 dBm D1 -22,130 dBm				
-30 dBm-				
-40 dBm				1
-50 dBm-				
-60 dBm				N
-00 abm	Luka atum ahli	Tean could be aliast ou	that a southall a transfer	I COLORIAL RECORDERATION
-70 dBm	and a second and the second and a second and the	and a straight and and a straight an	and monoral field and with factors and	Photostantantan
-/ U UDIII-				
-80 dBm-			-	
-oo dam				

Date: 8.DEC.2015 03:36:18





Date: 8.DEC.2015 03:36:27



# 3.5 Radiated Band Edges and Spurious Emission Measurement

# 3.5.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

Frequency	Field Strength	Measurement Distance
(MHz)	(microvolts/meter)	(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

# 3.5.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.



### 3.5.3 Test Procedures

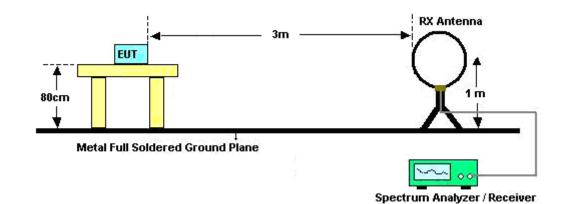
- 1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r03.
- 2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
- 3. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
- 4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
- 5. Corrected Reading: Antenna Factor + Cable Loss + Read Level Preamp Factor = Level
- 6. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
- 7. Use the following spectrum analyzer settings:
  - (1) Span shall wide enough to fully capture the emission being measured;
  - (2) Set RBW=100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
  - (3) Set RBW = 1 MHz, VBW= 3MHz for  $f \ge 1$  GHz for peak measurement. For average measurement:
    - VBW = 10 Hz, when duty cycle is no less than 98 percent.
    - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
Bluetooth v4.0 LE	60.25	0.38	2.62	3kHz

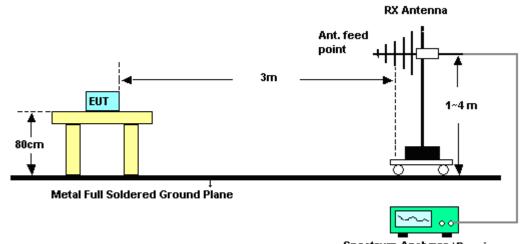


# 3.5.4 Test Setup

For radiated emissions below 30MHz



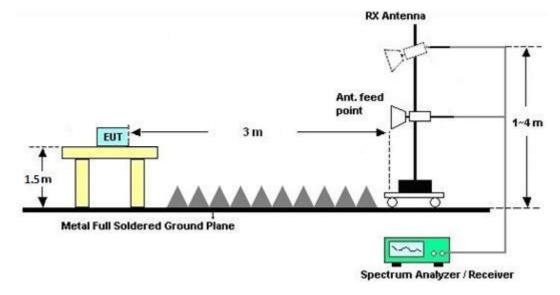
#### For radiated emissions from 30MHz to 1GHz



Spectrum Analyzer / Receiver



#### For radiated emissions above 1GHz



# 3.5.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

# 3.5.6 Test Result of Radiated Spurious at Band Edges

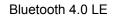
Please refer to Appendix A.

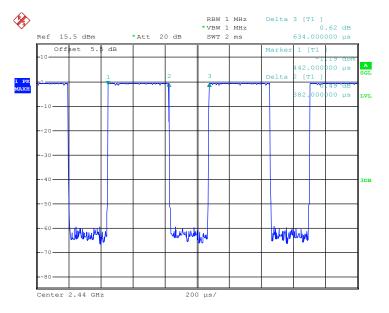
# 3.5.7 Test Result of Radiated Spurious Emission (30MHz ~ 10<sup>th</sup> Harmonic)

Please refer to Appendix A.



# 3.5.8 Duty Cycle Plot





Date: 5.DEC.2015 00:40:46



# **3.6 AC Conducted Emission Measurement**

# 3.6.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (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 the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBµV)		
Frequency of emission (MHZ)	Quasi-peak	Average	
0.15-0.5	66 to 56*	56 to 46*	
0.5-5	56	46	
5-30	60	50	

\*Decreases with the logarithm of the frequency.

### 3.6.2 Measuring Instruments

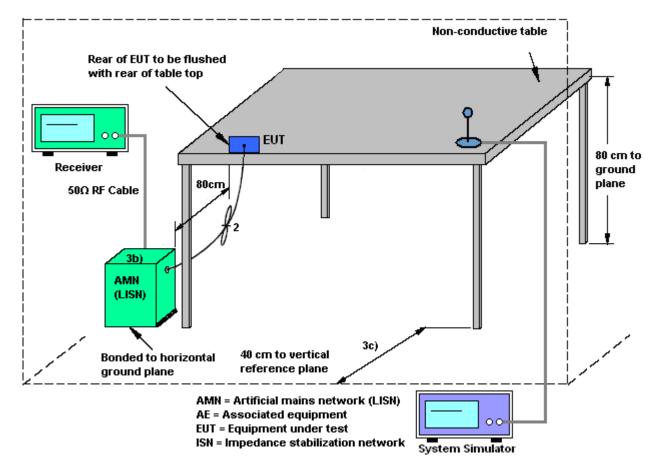
The section 4.0 of List of Measuring Equipment of this test report is used for test.

### 3.6.3 Test Procedures

- 1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- 2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- 3. All the support units are connecting to the other LISN.
- 4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
- 5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
- 6. Both sides of AC line were checked for maximum conducted interference.
- 7. The frequency range from 150 kHz to 30 MHz was searched.
- Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.



## 3.6.4 Test Setup

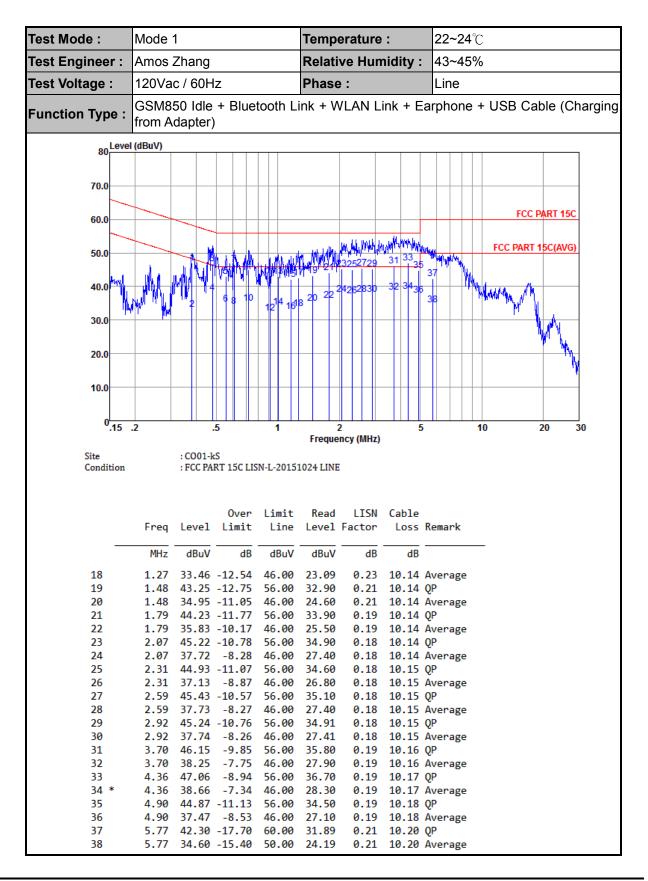




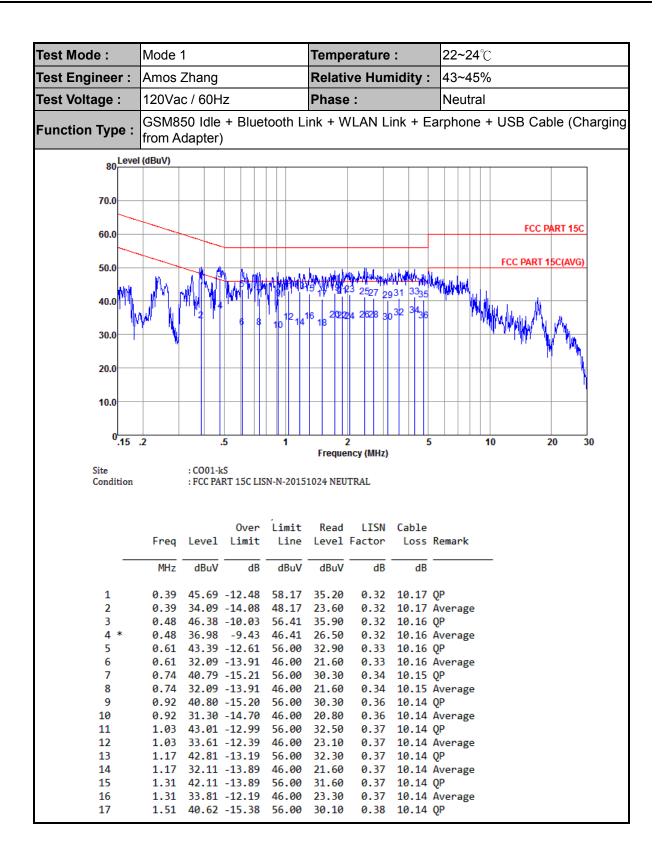
## 3.6.5 Test Result of AC Conducted Emission

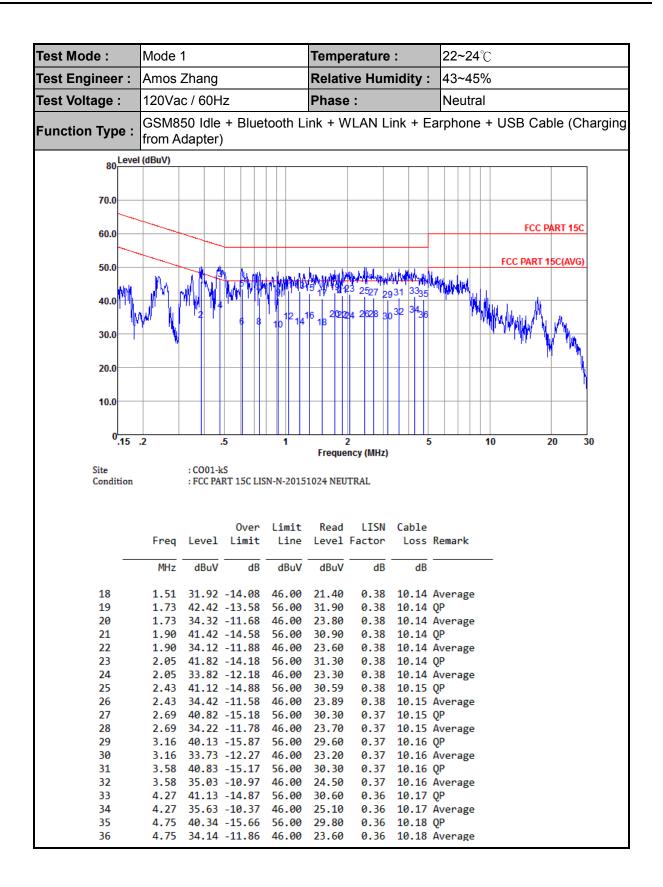
Test Mode :	Mode 1	Temperature :	<b>22~24</b> ℃										
Test Engineer :	Amos Zhang	Relative Humidity :	43~45%										
Test Voltage :	120Vac / 60Hz	Phase :	Line										
Function Type :	GSM850 Idle + Bluetootl from Adapter)	h Link + WLAN Link + Ea	arphone + USB Cable (Charging										
80Leve	80 Level (dBuV)												
70.0													
60.0			FCC PART 15C										
50.0		h. u. M. M. C. U. 3252729 31 33.25	FCC PART 15C(AVG)										
40.0 to		King 1 - 19 21 1 - 20 - 20 - 32 - 34 <sub>36</sub> 4 1≤18 - 20 - 22 24262830 - 32 - 34 <sub>36</sub>	37 M										
30.0	M <sup>Y</sup> MM T 12		M.										
20.0													
10.0													
0 <mark>.15</mark>	.2 .5 1		10 20 30										
Site Condition	: CO01-kS : FCC PART 15C LISN-L-2	Frequency (MHz) 0151024 LINE											
	Over Lim Freq Level Limit Li	nit Read LISN Cable .ne Level Factor Loss F	Remark										
	MHz dBuV dB dB	BuV dBuV dB dB											
1 2	0.38 33.30 -15.00 48.	30         36.70         0.23         10.17         (           30         22.90         0.23         10.17         (	Äverage										
3 4 5		36         27.80         0.23         10.16         0           00         32.60         0.23         10.16         0	Average QP										
6 7 8		00         24.30         0.23         10.16         4           00         36.19         0.24         10.16         4           00         23.79         0.24         10.16         4	2P _										
9 10 11	0.72 34.89 -11.11 46.	00         34.60         0.24         10.15         0           00         24.50         0.24         10.15         0           00         32.80         0.25         10.14         0	Average										
12 13 14 15	0.92 31.99 -14.01 46. 1.00 42.99 -13.01 56. 1.00 33.89 -12.11 46.	00         21.60         0.25         10.14         0.25           00         32.60         0.25         10.14         0.25           00         23.50         0.25         10.14         0.25           00         31.70         0.23         10.14         0.25	Average QP Average										
16 17	1.17         32.57         -13.43         46.           1.27         42.46         -13.54         56.	00 22.20 0.23 10.14	Average										

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# 3.7 Antenna Requirements

## 3.7.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. 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 FCC rule.

# 3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

## 3.7.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.



# 4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark	
Spectrum Analyzer	R&S	FSV30	101338	9kHz~30GHz	May 04, 2015	Dec. 08, 2015	May 03, 2016	Conducted (TH01-KS)	
Pulse Power Senor	Anritsu	MA2411B	0917070	30MHz~40GHz	Jan. 23, 2015	Dec. 08, 2015	Jan. 22, 2016	Conducted (TH01-KS)	
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 23, 2015	Dec. 08, 2015	Jan. 22, 2016	Conducted (TH01-KS)	
EMI Test Receiver	R&S	ESR7	101403	9kHz~7GHz;Ma x 30dBm	Sep. 10, 2015	Dec. 23, 2015	Sep. 09, 2016	Radiation (03CH03-KS)	
EXA Spectrum Analyzer	Keysight	N9010A	MY551502 44	10Hz-44GHz	Jun. 05, 2015	Dec. 23, 2015	Jun. 04, 2016	Radiation (03CH03-KS)	
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Nov. 10, 2015	Dec. 23, 2015	Nov. 09, 2016	Radiation (03CH03-KS)	
Bilog Antenna	TeseQ	CBL6112D	35406	25MHz-2GHz	Jun. 25, 2015	Dec. 23, 2015	Jun. 24, 2016	Radiation (03CH03-KS)	
Horn Antenna	Schwarzbeck	BBHA9120D	9120D-135 6	1GHz~18GHz	Jun. 25, 2015	Dec. 23, 2015 Jun. 24, 201		Radiation (03CH03-KS)	
SHF-EHF Horn	Schwarzbeck	BBHA 9170	BBHA1702 49	15GHz ~40GHz	Mar. 03, 2015	Dec. 23, 2015	Mar. 02, 2016	Radiation (03CH03-KS)	
Amplifier	Burgeon	BPA-530	102212	0.01MHz-3000M Hz	Aug. 10, 2015	Dec. 23, 2015	Aug. 09, 2016	Radiation (03CH03-KS)	
Amplifier	Agilent	8449B	3008A023 70	1GHz~26.5GHz	Oct. 24, 2015	Dec. 23, 2015	Oct. 23, 2016	Radiation (03CH03-KS)	
AC Power Source	Chroma	61601	F1040900 04	N/A	NCR	Dec. 23, 2015	NCR	Radiation (03CH03-KS)	
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Dec. 23, 2015	NCR	Radiation (03CH03-KS)	
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Dec. 23, 2015	NCR	Radiation (03CH03-KS)	
EMI Test Receiver	R&S	ESR7	101403	9kHz~7GHz;Ma x 30dBm	Sep. 10, 2015	Dec. 08, 2015	Sep. 09, 2016	Conduction (CO01-KS)	
AC LISN	MessTec	AN3016	060103	9kHz~30MHz	Oct. 24, 2015	Dec. 08, 2015	Oct. 23, 2016	Conduction (CO01-KS)	
AC LISN (for auxiliary equipment)	MessTec	AN3016	060105	9kHz~30MHz	Oct. 24, 2015	Dec. 08, 2015	Oct. 23, 2016	Conduction (CO01-KS)	
AC Power Source	Chroma	61602	ABP00000 0811	AC 0V~300V, 45Hz~1000Hz	Oct. 24, 2015	Dec. 08, 2015	Oct. 23, 2016	Conduction (CO01-KS)	



# 5 Uncertainty of Evaluation

### Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence	2.3 dB
of 95% (U = 2Uc(y))	2.5 UB

#### Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence	4.5 dB
of 95% (U = 2Uc(y))	



# Appendix A. Radiated Spurious Emission

BLE	2.4GHz 2400~2483.5MHz (Band Edge @ 3m)											
ANT	CH00 2402MHz											
1	Horizontal	Vertical										
Peak	111         Level (dBuV/m)           105.3         1           33.6         1           33.6         1           10.2         1           10.3         1           10.4         1           10.5         1           10.2         1           10.2         1           10.2         1           10.2         1           10.2         1           10.2         1           10.2         1           10.4         1           10.4         1           10.4         1           10.4         1           10.4         1           10.4         1           10.4         1           10.4         1           10.4         1           10.4         1           10.4         1           10.4         1           10.4         1           10.4         1           10.4         1           10.4         1           10.4         1           10.4         1           10.4         1	Image: state of the s										
Average	n) 105.3 33.6 41.9 70.2 58.5 46.8 55.1 23.4 11.7 (210) 2320. 2330. 2340. 2350. 2360. 2370. 2380. 2390. 2400 Frequency (Mitz)	117       Level (dBaVIm)         105.3       -         105.3       -         105.3       -         105.4       -         105.5       -         105.6       -         105.7       -         105.8       -         105.4										





BLE	2.4GHz 2400~2483.5MHz (Fundamental Emission @ 3m)											
ANT	CH00 2402MHz											
1	Horizontal	Vertical										
Peak	105.3 105.3 105.4 10	117         Level (dBuV/m)           105.3										
Average	117 197 193 193 193 193 193 193 193 194 194 195 195 195 195 195 195 195 195	117     105.3     105.3       93.6     1     105.3       93.6     1     105.3       93.6     1     105.3       93.6     1     105.3       93.6     1     105.3       93.6     1     105.3       93.6     1     105.3       93.6     1     105.3       10.7     10.3     10.3       11.7     10.3     2420.2430.2440.2450.2460.2470.2483.3										

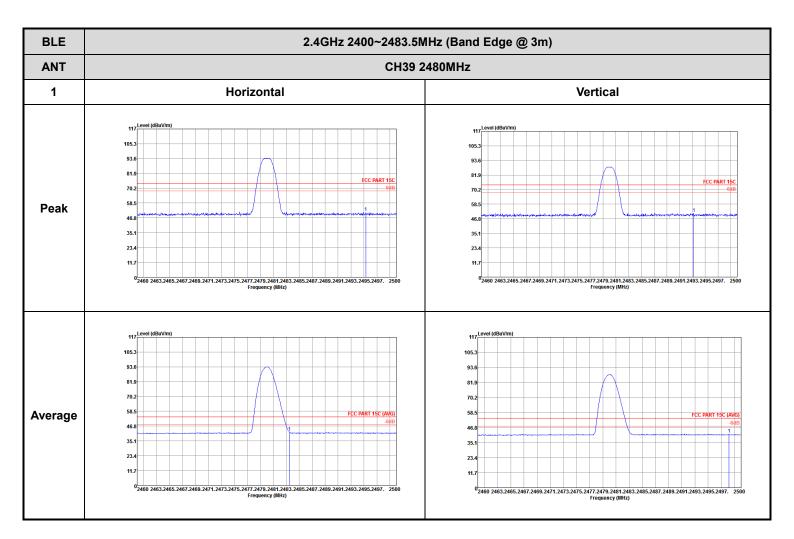




BLE	2.4GHz 2400~2483.5MHz (Fundamental Emission @ 3m)												
ANT	CH19 2440MHz												
1	Horizontal	Vertical											
Peak	117 105.3 105.3 105.3 105.3 105.3 105.3 105.4 105.	117         Level (dBuVm)           105.3         33.6           33.6         1           93.6         1           70.2         6           70.2         6           58.5         6           51.1         6           35.1         6           35.1         6           35.1         6           35.1         6           35.1         6           35.1         6           35.1         6           35.1         6           35.1         6           35.1         6           35.1         6           35.1         7           92.400         2410.         2420.         2430.           2440.         2450.         2460.         2470.         2483.5											
Average	105         105           33.6         40.0           61.9         40.0           70.2	117 105.3 30.6 40.9 70.2 58.5 46.8 35.1 10.5 46.8 36.1 70.2 58.5 46.8 36.1 70.2 46.8 36.1 70.2 46.8 36.1 70.2 46.8 36.1 70.2 46.8 36.1 70.2 46.8 70.2 46.0 70.2											

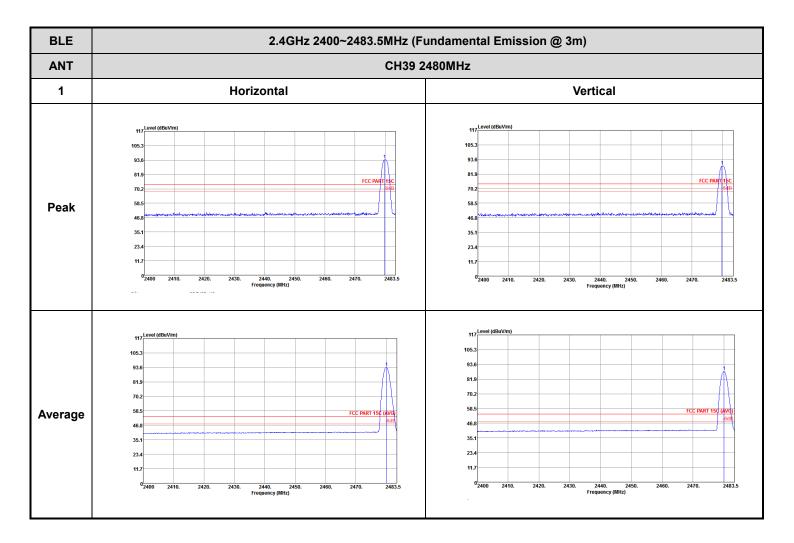












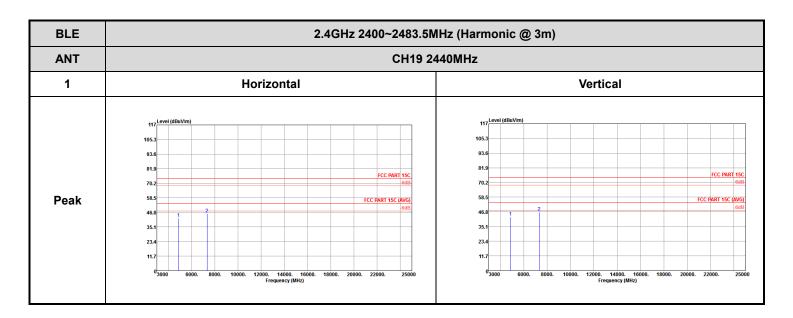


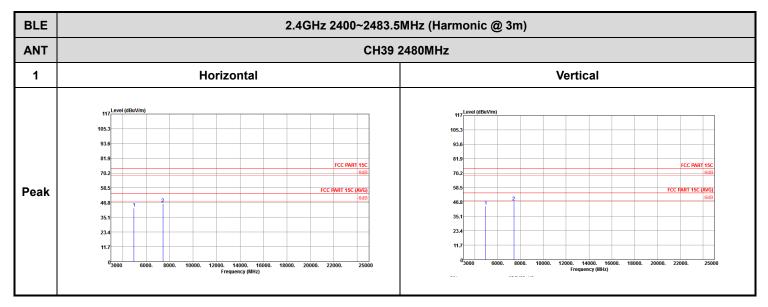


BLE	2.4GHz 2400~2483.5MHz (Harmonic @ 3m)           CH00 2402MHz									
ANT										
1	Horizontal	Vertical								
Peak	117 105.3 33.6 81.9 70.2 58.5 46.8 1 35.4 1 30.0 6000. 8000. 10000. 12000. 18000. 20000. 22000. 25000 Frequency (Mitz)	117         Level (dBuV/m)           105.3								

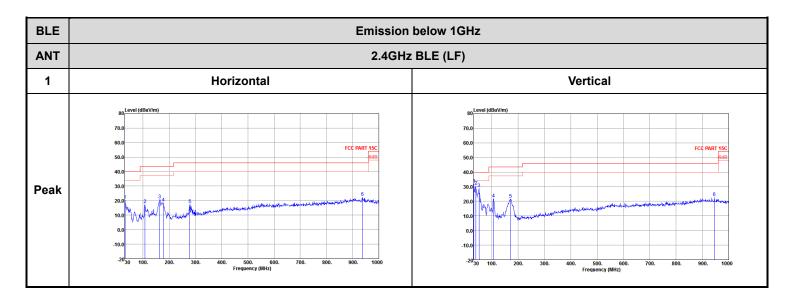














## BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBµV/m)	( dB )	(dBµV/m)	(dBµV)	( dB/m )	( dB )	(dB)	( cm )	(deg)	(P/A)	(H/V)
		2351.04	51	-23	74	55.63	26.86	5.52	37.01	109	240	Ρ	Н
		2349.78	40.89	-13.11	54	45.52	26.86	5.52	37.01	109	240	А	Н
	*	2402.254	89.8	-	-	94.23	27	5.59	37.02	109	240	Ρ	Н
BLE CH 00	*	2402.087	89.5	-	-	93.93	27	5.59	37.02	109	240	А	Н
2402MHz		2335.74	50.68	-23.32	74	55.31	26.86	5.52	37.01	311	204	Ρ	V
240211112		2348.25	40.87	-13.13	54	45.5	26.86	5.52	37.01	311	204	А	V
	*	2402.338	84.79	-	-	89.22	27	5.59	37.02	311	204	Ρ	V
	*	2402.087	84.53	-	-	88.96	27	5.59	37.02	311	204	А	V
	*	2440.247	94.15	-	-	98.08	27.39	5.65	36.97	111	109	Ρ	Н
BLE CH 19 2440MHz	*	2439.997	93.91	-	-	97.84	27.39	5.65	36.97	111	109	А	Н
	*	2440.247	85.62	-	-	89.55	27.39	5.65	36.97	100	121	Ρ	V
2440101112	*	2440.08	85.15	-	-	89.08	27.39	5.65	36.97	100	121	А	V



												1	-
	*	2479.826	93.8	-	-	97.41	27.64	5.69	36.94	100	99	Р	Н
	*	2480.076	93.63	-	-	97.24	27.64	5.69	36.94	100	99	А	Н
		2495.28	51.2	-22.8	74	54.65	27.77	5.71	36.93	100	99	Р	Н
BLE CH 39		2483.52	42.04	-11.96	54	45.65	27.64	5.69	36.94	100	99	А	Н
2480MHz	*	2479.826	88.25	-	-	91.86	27.64	5.69	36.94	300	206	Р	V
240011112	*	2480.076	87.92	-	-	91.53	27.64	5.69	36.94	300	206	А	V
		2493.2	51.26	-22.74	74	54.71	27.77	5.71	36.93	300	206	Р	V
		2498.16	41.64	-12.36	54	45.09	27.77	5.71	36.93	300	206	А	V
Remark	1. No other spurious found.												



BLE (Harmonic @ 3m)													
BLE	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	
		(MHz)	(dBµV/m)	( dB )	(dBµV/m)	(dBµV)	(dB/m)	( dB )	( dB )	( cm )	(deg)	(P/A)	(H/V)
BLE CH 00		4803	42.47	-31.53	74	39.84	31.48	7.84	36.69	100	360	Р	н
2402MHz		4803	42.59	-31.41	74	39.96	31.48	7.84	36.69	100	360	Р	V
		4881	42.12	-31.88	74	39.3	31.59	7.89	36.66	100	360	Р	н
BLE CH 19		7320	45.77	-28.23	74	38.78	34.08	9.62	36.71	100	0	Р	Н
2440MHz		4881	42.57	-31.43	74	39.75	31.59	7.89	36.66	100	360	Р	V
244011112		7320	46.44	-27.56	74	39.45	34.08	9.62	36.71	100	0	Р	V
		4959	42.52	-31.48	74	39.48	31.72	7.95	36.63	100	360	Р	Н
BLE CH 39		7440	46.01	-27.99	74	38.57	34.44	9.77	36.77	100	0	Ρ	Н
2480MHz		4959	43.38	-30.62	74	40.34	31.72	7.95	36.63	100	360	Р	V
2480101112		7440	46.78	-27.22	74	39.34	34.44	9.77	36.77	100	0	Р	V
Remark		o other spurio I results are P		st Peak	and Averag	je limit lin	e.						

### 2.4GHz 2400~2483.5MHz



### Emission below 1GHz

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBµV/m)	( dB )	(dBµV/m)	(dBµV)	(dB/m)	( dB )	(dB)	( cm )	(deg)	(P/A)	(H/V)
2.4GHz BLE LF		30.97	20.37	-19.63	40	33.45	18.71	0.79	32.58	110	254	Р	Н
		107.6	17.38	-26.12	43.5	37.28	11.36	1.04	32.3	-	-	Р	Н
		162.89	20.78	-22.72	43.5	40.54	11.22	1.44	32.42	-	-	Р	Н
		177.44	18.5	-25	43.5	38.9	10.66	1.44	32.5	-	-	Р	Н
		278.32	17.29	-28.71	46	34.89	12.61	1.9	32.11	-	-	Р	Н
		937.92	22.31	-23.69	46	28.3	21.86	3.57	31.42	-	-	Р	Н
		31.94	31.8	-8.2	40	45.34	18.22	0.79	32.55	100	214	Р	V
-		39.7	30.43	-9.57	40	47.9	14.3	0.79	32.56	-	-	Р	V
		51.34	28.89	-11.11	40	52.17	8.44	0.79	32.51	-	-	Р	V
		106.63	21.9	-21.6	43.5	41.81	11.35	1.04	32.3	-	-	Р	V
		170.65	21.53	-21.97	43.5	41.63	10.92	1.44	32.46	-	-	Р	V
		945.68	22.75	-23.25	46	28.76	21.69	3.68	31.38	-	-	Р	V
Remark	1. No other spurious found.												
	2. All results are PASS against limit line.												



## Note symbol

*	Fundamental Frequency which can be ignored. However, the level of any							
	unwanted emissions shall not exceed the level of the fundamental frequency.							
!	Test result is <b>over limit</b> line.							
P/A	Peak or Average							
H/V	Horizontal or Vertical							



## A calculation example for radiated spurious emission is shown as below:

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	(dBµV/m)	( dB )	(dBµV/m)	(dBµV)	( dB/m )	( dB )	( dB )	( cm )	(deg)	(P/A)	(H/V)
802.11b		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	Р	н
CH 01													
2412MHz		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	А	Н

1. Level(dBµV/m) =

Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBµV) - Preamp Factor(dB)

2. Over Limit(dB) = Level(dBµV/m) – Limit Line(dBµV/m)

### For Peak Limit @ 2390MHz:

1. Level(dBµV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBµV) - Preamp Factor(dB)

- $= 32.22(dB/m) + 4.58(dB) + 54.51(dB\mu V) 35.86 (dB)$
- = 55.45 (dBµV/m)
- 2. Over Limit(dB)
- = Level(dBµV/m) Limit Line(dBµV/m)
- $= 55.45(dB\mu V/m) 74(dB\mu V/m)$
- = -18.55(dB)

#### For Average Limit @ 2390MHz:

- 1. Level(dBµV/m)
- = Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBµV) Preamp Factor(dB)
- = 32.22(dB/m) + 4.58(dB) + 42.6(dBµV) 35.86 (dB)
- = 43.54 (dBµV/m)
- 2. Over Limit(dB)
- = Level(dBµV/m) Limit Line(dBµV/m)
- $= 43.54(dB\mu V/m) 54(dB\mu V/m)$
- = -10.46(dB)

#### Both peak and average measured complies with the limit line, so test result is "PASS".