

# TEST REPORT

**FCC ID: 2ABLQ-BTSPEAKER**

**Product: Portable Bluetooth Speaker**

**Model No.: NB21**

**Additional Model No.: NB15, NB17, NB19, NB20, NB22, NB23, NB25, NB26,  
NB27, NB28**

 **Trade Mark:**

**Report No.: TCT150504E020**

**Issued Date: June 1, 2015**

**Issued for:**

**NOGO INTERNATIONAL CO., LTD**

**The 4th F.of Bldg.1, Huangtian industrial zone, Xixiang town, Bao'an district,  
Shenzhen, China**

**Issued By:**

**Shenzhen Tongce Testing Lab.**

**1F, Leinuo Watch Building, Fuyong Town, Baoan Dist, Shenzhen, China**

**TEL: +86-755-27673339**

**FAX: +86-755-27673332**

**Note:** This report shall not be reproduced except in full, without the written approval of Shenzhen Tongce Testing Lab.

This document may be altered or revised by Shenzhen Tongce Testing Lab. personnel only, and shall be noted in the revision section of the document. The test results in the report only apply to the tested sample.

**TABLE OF CONTENTS**

<b>1. Test Certification.....</b>	<b>3</b>
<b>2. Test Result Summary .....</b>	<b>4</b>
<b>3. EUT Description .....</b>	<b>5</b>
<b>4. Genera Information.....</b>	<b>6</b>
4.1. Test environment and mode.....	6
4.2. Description of Support Units.....	6
<b>5. Facilities and Accreditations .....</b>	<b>7</b>
5.1. Facilities .....	7
5.2. Location .....	7
5.3. Measurement Uncertainty.....	7
<b>6. Test Results and Measurement Data .....</b>	<b>8</b>
6.1. Antenna requirement .....	8
6.2. Conducted Emission.....	9
6.3. Conducted Output Power .....	13
6.4. Emission Bandwidth .....	16
6.5. Power Spectral Density.....	19
6.6. Test Specification.....	19
6.7. Conducted Band Edge and Spurious Emission Measurement .....	22
6.8. Radiated Spurious Emission Measurement .....	25

## 1. Test Certification

<b>Product:</b>	Portable Bluetooth Speaker
<b>Model No.:</b>	NB21
<b>Additional Model No.:</b>	NB15, NB17, NB19, NB20, NB22, NB23, NB25, NB26, NB27, NB28
<b>Applicant:</b>	NOGO INTERNATIONAL CO., LTD
<b>Address:</b>	The 4th F.of Bldg.1, Huangtian industrial zone, Xixiang town, Bao'an district, Shenzhen, China
<b>Manufacturer:</b>	Shenzhen Xin Feng Long Industrial CO., LTD
<b>Address:</b>	The 4th F.of Bldg.1, Huangtian industrial zone, Xixiang town, Bao'an district, Shenzhen, China
<b>Date of Test:</b>	May 06 – May 15, 2015
<b>Applicable Standards:</b>	FCC CFR Title 47 Part 15 Subpart C Section 15.247 KDB 558074 D01 DTS Meas Guidance v03r02

The above equipment has been tested by Shenzhen Tongce Testing Lab. and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Tested By: Neil Wong

Neil Wong

Date: June 1, 2015

Reviewed By: Joe Zhou

Joe Zhou

Date: June 1, 2015

Approved By: Tomsin

Tomsin

Date: June 1, 2015

## 2. Test Result Summary

Requirement	CFR 47 Section	Result
Antenna requirement	§15.203/§15.247 (c)	PASS
AC Power Line Conducted Emission	§15.207	PASS
Conducted Peak Output Power	§15.247 (b)(3)	PASS
6dB Emission Bandwidth	§15.247 (a)(2)	PASS
Power Spectral Density	§15.247 (e)	PASS
Band Edge	1§5.247(d)	PASS
Spurious Emission	§15.205/§15.209	PASS

**Note:**

1. PASS: Test item meets the requirement.
2. Fail: Test item does not meet the requirement.
3. N/A: Test case does not apply to the test object.
4. The test result judgment is decided by the limit of test standard.

### 3. EUT Description

<b>Product Name:</b>	Portable Bluetooth Speaker
<b>Model :</b>	NB21
<b>Additional Model:</b>	NB15, NB17, NB19, NB20, NB22, NB23, NB25, NB26, NB27, NB28
<b>Trade Mark:</b>	
<b>Operation Frequency:</b>	2402MHz~2480MHz
<b>Channel Separation:</b>	2MHz
<b>Number of Channel:</b>	40
<b>Modulation Technology:</b>	GFSK
<b>Antenna Type:</b>	Internal Antenna
<b>Antenna Gain:</b>	0dBi
<b>Power Supply:</b>	Rechargeable Li-ion Battery DC3.7V

#### Operation Frequency each of channel

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2402MHz	10	2422MHz	20	2442MHz	30	2462MHz
1	2404MHz	11	2424MHz	21	2444MHz	31	2464MHz
...	...	...	...	...	...	...	...
8	2418MHz	18	2438MHz	28	2458MHz	38	2478MHz
9	2420MHz	19	2440MHz	29	2460MHz	39	2480MHz

Remark: Channel 0, 19 & 39 have been tested.

## 4. General Information

### 4.1. Test environment and mode

Operating Environment:	
Temperature:	25.0 °C
Humidity:	56 % RH
Atmospheric Pressure:	1010 mbar
Test Mode:	
Engineering mode:	Keep the EUT in continuous transmitting by select channel and modulations
The sample was placed 0.8m above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.	

### 4.2. 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.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
PC	DIPFCG0008HP	/	/	Lenovo

**Note:**

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

## 5. Facilities and Accreditations

### 5.1. Facilities

The test facility is recognized, certified, or accredited by the following organizations:

- FCC - Registration No.: 572331

Shenzhen Tongce Testing Lab

The 3m Semi-anechoic chamber has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

- IC - Registration No.: 10668A-1

The 3m Semi-anechoic chamber of Shenzhen TCT Testing Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

- CNAS - Registration No.: CNAS L6165

Shenzhen TCT Testing Technology Co., Ltd. is accredited to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L6165.

### 5.2. Location

Shenzhen Tongce Testing Lab

Address: 1F, Leinuo Watch Building, Fuyong Town, Baoan Dist, Shenzhen, China

Tel: 86-755-36638142

### 5.3. Measurement Uncertainty

The reported uncertainty of measurement  $y \pm U$ , where expended uncertainty  $U$  is based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95 %.

No.	Item	MU
1	Conducted Emission	$\pm 2.56\text{dB}$
2	RF power, conducted	$\pm 0.12\text{dB}$
3	Spurious emissions, conducted	$\pm 0.11\text{dB}$
4	All emissions, radiated(<1G)	$\pm 3.92\text{dB}$
5	All emissions, radiated(>1G)	$\pm 4.28\text{dB}$
6	Temperature	$\pm 0.1^\circ\text{C}$
7	Humidity	$\pm 1.0\%$

## 6. Test Results and Measurement Data

### 6.1. Antenna requirement

<b>Standard requirement:</b>	FCC Part15 C Section 15.203 /247(c)
------------------------------	-------------------------------------

**15.203 requirement:**

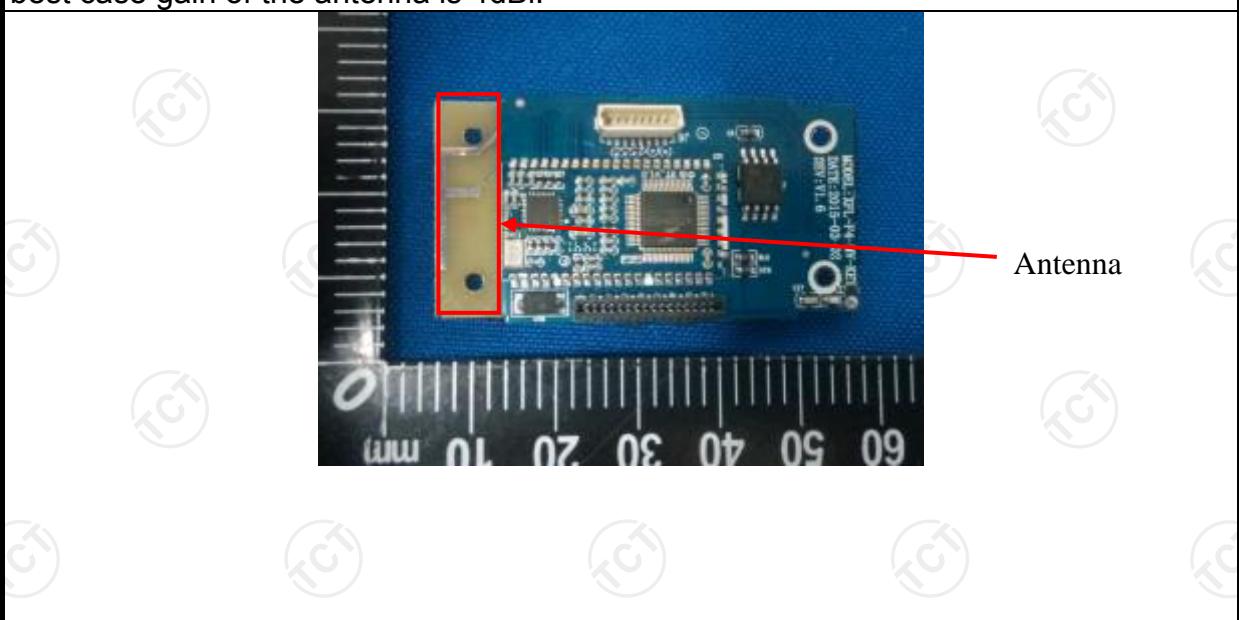
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

**15.247(c) (1)(i) requirement:**

(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

**E.U.T Antenna:**

The Bluetooth antenna is an internal antenna which permanently attached, and the best case gain of the antenna is 4dBi.



## 6.2. Conducted Emission

### 6.2.1. Test Specification

<b>Test Requirement:</b>	FCC Part15 C Section 15.207														
<b>Test Method:</b>	ANSI C63.4:2009														
<b>Frequency Range:</b>	150 kHz to 30 MHz														
<b>Receiver setup:</b>	RBW=9 kHz, VBW=30 kHz, Sweep time=auto														
<b>Limits:</b>	<table border="1"> <thead> <tr> <th rowspan="2">Frequency range (MHz)</th> <th colspan="2">Limit (dBuV)</th> </tr> <tr> <th>Quasi-peak</th> <th>Average</th> </tr> </thead> <tbody> <tr> <td>0.15-0.5</td> <td>66 to 56*</td> <td>56 to 46*</td> </tr> <tr> <td>0.5-5</td> <td>56</td> <td>46</td> </tr> <tr> <td>5-30</td> <td>60</td> <td>50</td> </tr> </tbody> </table>	Frequency range (MHz)	Limit (dBuV)		Quasi-peak	Average	0.15-0.5	66 to 56*	56 to 46*	0.5-5	56	46	5-30	60	50
Frequency range (MHz)	Limit (dBuV)														
	Quasi-peak	Average													
0.15-0.5	66 to 56*	56 to 46*													
0.5-5	56	46													
5-30	60	50													
<b>Test Setup:</b>	<p>Reference Plane</p> <p>Test table/Insulation plane</p> <p>Remark: E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</p>														
<b>Test Mode:</b>	Charging + Transmitting Mode														
<b>Test Procedure:</b>	<ol style="list-style-type: none"> <li>1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.</li> <li>2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).</li> <li>3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2009 on conducted measurement.</li> </ol>														
<b>Test Result:</b>	PASS														

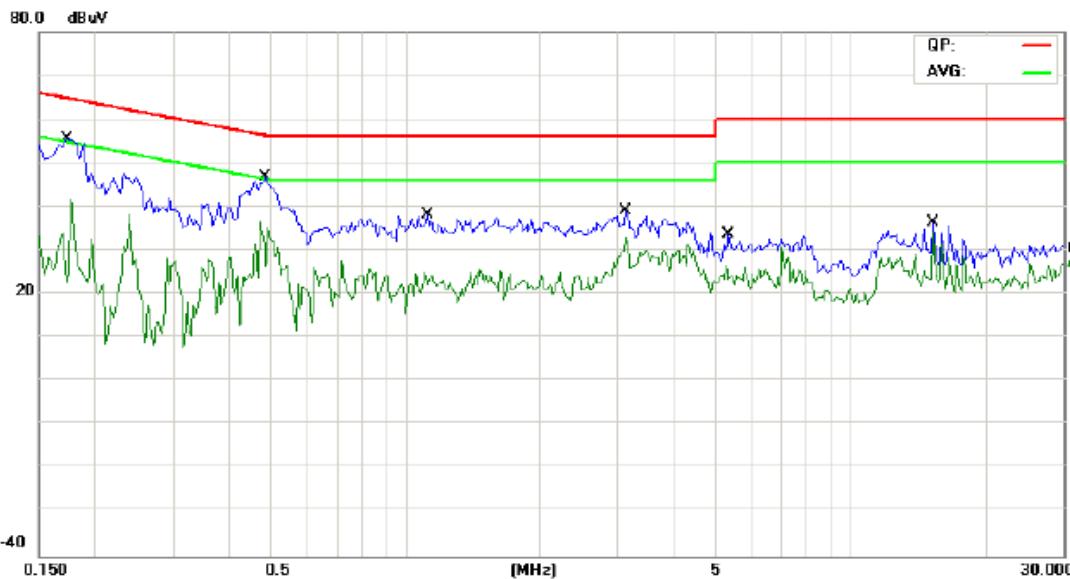
### 6.2.2. Test Instruments

Conducted Emission Shielding Room Test Site (843)				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	R&S	ESCS30	100139	Sep. 16, 2015
LISN	Schwarzbeck	NSLK 8126	8126453	Sep. 29, 2015
LISN	AFJ	LS16C	16010947251	Sep. 29, 2015
Coax cable	TCT	CE-05	N/A	Sep. 15, 2015
EMI Test Software	Shurples Technology	EZ-EMC	N/A	N/A

**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

### 6.2.3. Test data

Please refer to following diagram for individual  
Conducted Emission on Line Terminal of the power line (150 kHz to 30MHz)



Site Chamber #2				Phase: <i>L1</i>		Temperature: 25 (C)	
Limit: FCC Part 15B Conduction(QP)				Power: AC 120V/60Hz		Humidity: 56 %	
No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over
		MHz	dBuV	dB	dBuV	dBuV	dB
1		0.1734	38.78	11.50	50.28	64.79	-14.51
2		0.1734	23.20	11.50	34.70	54.79	-20.09
3 *		0.4859	30.74	11.32	42.06	56.24	-14.18
4		0.4859	18.79	11.32	30.11	46.24	-16.13
5		1.1227	22.20	11.24	33.44	56.00	-22.56
6		1.1227	11.80	11.24	23.04	46.00	-22.96
7		3.1211	18.03	11.29	29.32	56.00	-26.68
8		3.1211	7.89	11.29	19.18	46.00	-26.82
9		5.3242	13.84	10.67	24.51	60.00	-35.49
10		5.3242	6.76	10.67	17.43	50.00	-32.57
11		15.2813	20.71	11.60	32.31	60.00	-27.69
12		15.2813	11.24	11.60	22.84	50.00	-27.16

**Note:**

Freq. = Emission frequency in MHz

Reading level (dB $\mu$ V) = Receiver reading

Corr. Factor (dB) = Antenna factor + Cable loss

Measurement (dB $\mu$ V) = Reading level (dB $\mu$ V) + Corr. Factor (dB)

Limit (dB $\mu$ V) = Limit stated in standard

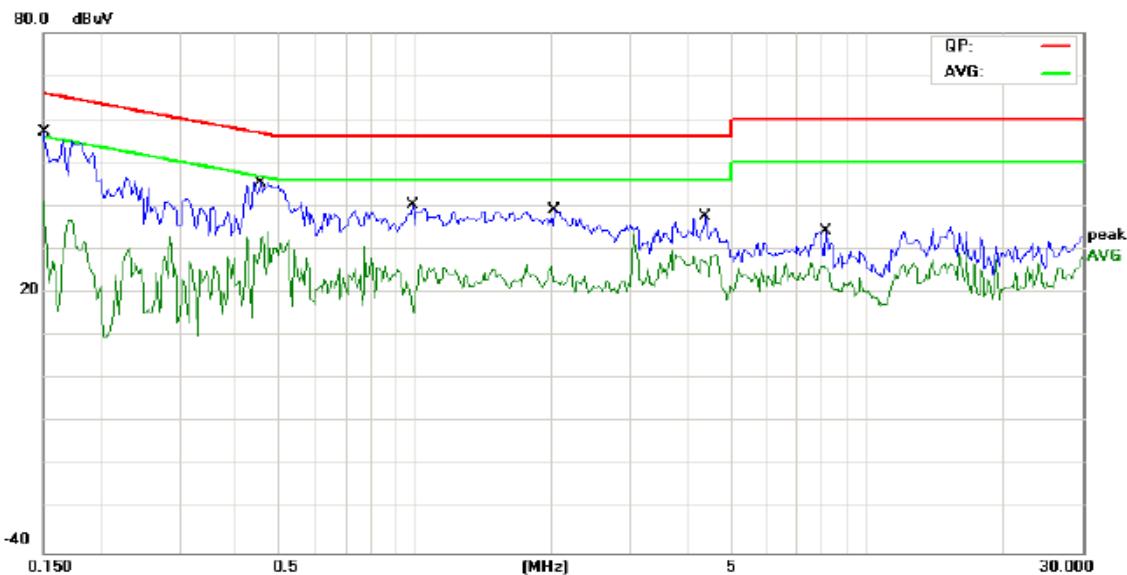
Margin (dB) = Measurement (dB $\mu$ V) – Limits (dB $\mu$ V)

Q.P. = Quasi-Peak

AVG = average

\* is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz.

## Conducted Emission on Neutral Terminal of the power line (150 kHz to 30MHz)



Site Chamber #2	Phase:	<b>N</b>	Temperature:	25 (C)
Limit: FCC Part 15B Conduction(QP)	Power:	AC 120V/60Hz	Humidity:	56 %

No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over		
			Level	Factor	ment				
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1500	34.82	11.52	46.34	65.99	-19.65	QP	
2		0.1500	12.40	11.52	23.92	55.99	-32.07	AVG	
3	*	0.4547	29.64	11.33	40.97	56.79	-15.82	QP	
4		0.4547	17.01	11.33	28.34	46.79	-18.45	AVG	
5		0.9859	22.20	11.18	33.38	56.00	-22.62	QP	
6		0.9859	6.57	11.18	17.75	46.00	-28.25	AVG	
7		2.0250	21.25	11.68	32.93	56.00	-23.07	QP	
8		2.0250	8.62	11.68	20.30	46.00	-25.70	AVG	
9		4.3906	20.33	10.84	31.17	56.00	-24.83	QP	
10		4.3906	10.18	10.84	21.02	46.00	-24.98	AVG	
11		8.0897	16.06	11.09	27.15	60.00	-32.85	QP	
12		8.0897	7.19	11.09	18.28	50.00	-31.72	AVG	

### Note:-

*Freq. = Emission frequency in MHz*

*Reading level (dBuV) = Receiver reading*

Corr. Factor (dB) = Antenna factor + Cable loss

Measurement (dBuV) = Reading level (dBuV) + Corr. Factor (dB)

Limit (dBuV) = Limit stated in standard

Margin (dB) = Measurement (dBuV) – L

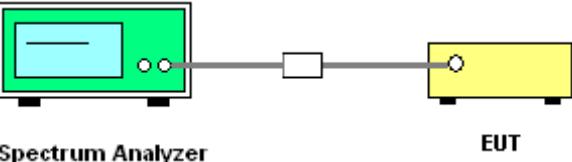
Q.P. = Quasi-Peak

AVG =average

\* is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz.

### 6.3. Conducted Output Power

### 6.3.1. Test Specification

<b>Test Requirement:</b>	FCC Part15 C Section 15.247 (b)(3)
<b>Test Method:</b>	ANSI C63.4:2009 and KDB558074
<b>Limit:</b>	30dBm
<b>Test Setup:</b>	 <p>The diagram illustrates the test setup. A green 'Spectrum Analyzer' is connected to a yellow 'EUT' (Equipment Under Test) via a grey coaxial cable. The analyzer has two red knobs on its front panel. The EUT is a simple rectangular box.</p>
<b>Test Mode:</b>	Refer to item 4.1
<b>Test Procedure:</b>	<ol style="list-style-type: none"><li>1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v03r02.</li><li>2. Set spectrum analyzer as following:<ol style="list-style-type: none"><li>a) Set the RBW <math>\geq</math> DTS bandwidth.</li><li>b) Set VBW <math>\geq 3 \times</math> RBW.</li><li>c) Set span <math>\geq 3 \times</math> RBW</li><li>d) Sweep time = auto couple.</li><li>e) Detector = peak.</li><li>f) Trace mode = max hold.</li><li>g) Allow trace to fully stabilize.</li><li>h) Use peak marker function to determine the peak amplitude level.</li></ol></li></ol>
<b>Test Result:</b>	PASS

### 6.3.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100060	Oct. 21, 2015

**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

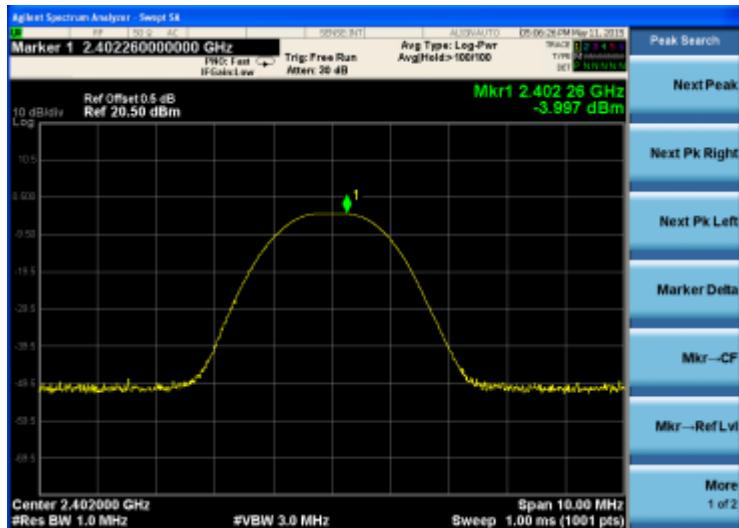
**6.3.3. Test Data**

BT LE mode			
Test channel	Maximum Conducted Output Power (dBm)	Limit (dBm)	Result
Lowest	-3.997	30.00	PASS
Middle	-3.882	30.00	PASS
Highest	-3.943	30.00	PASS

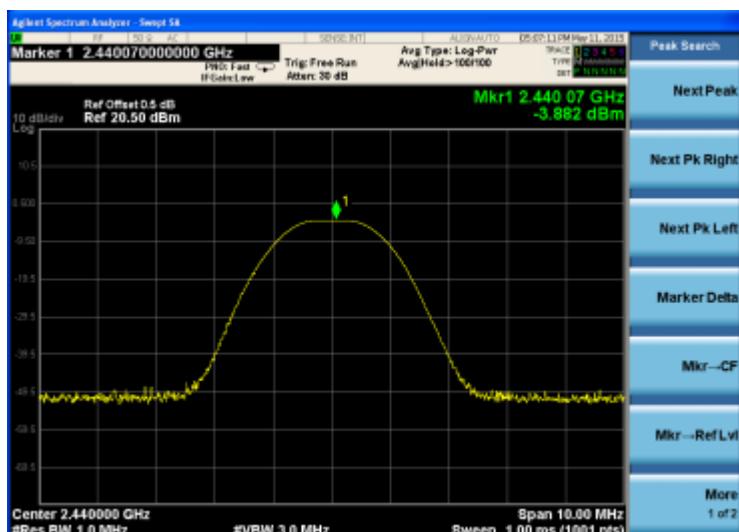
**Test plots as follows:**

## BT LE mode

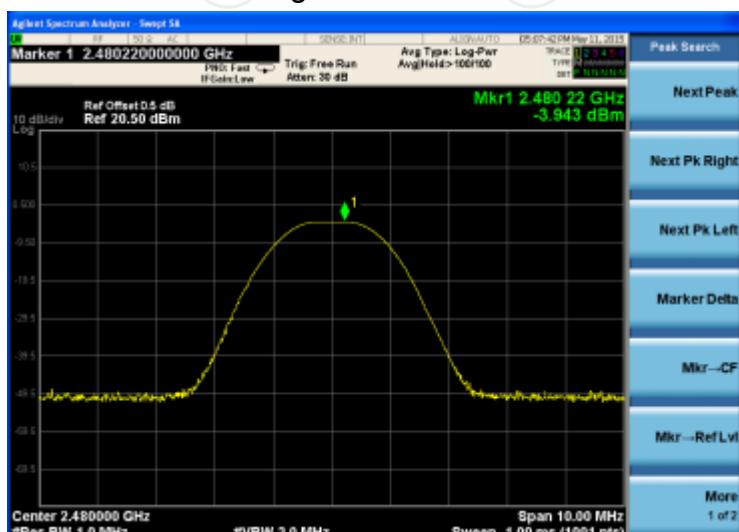
### Lowest channel



### Middle channel

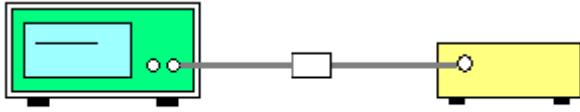


### Highest channel



## 6.4. Emission Bandwidth

### 6.4.1. Test Specification

<b>Test Requirement:</b>	FCC Part15 C Section 15.247 (a)(2)
<b>Test Method:</b>	ANSI C63.4:2009 and KDB558074
<b>Limit:</b>	>500kHz
<b>Test Setup:</b>	 <p style="text-align: center;"><b>Spectrum Analyzer</b>                                    <b>EUT</b></p>
<b>Test Mode:</b>	Refer to item 4.1
<b>Test Procedure:</b>	<ol style="list-style-type: none"> <li>1. The testing follows FCC KDB Publication No. 558074 DTS D01 Meas. Guidance v03r02.</li> <li>2. The testing follows FCC KDB Publication No. 558074 DTS D01 Meas. Guidance v03r02.</li> <li>3. Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>4. 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 6dB bandwidth must be greater than 500 kHz.</li> <li>5. Measure and record the results in the test report.</li> </ol>
<b>Test Result:</b>	PASS

### 6.4.2. Test Instruments

RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100060	Oct. 21, 2015

**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

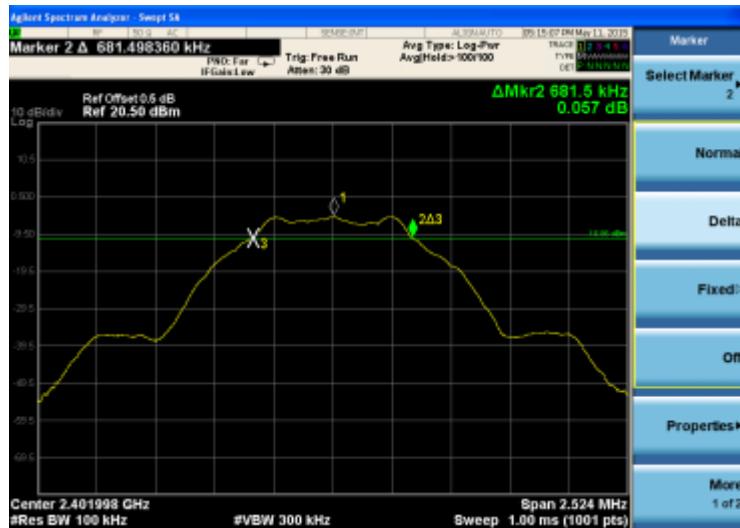
**6.4.3. Test data**

Test channel	6dB Emission Bandwidth (kHz)		
	BT LE mode	Limit	Result
Lowest	681.5	>500k	PASS
Middle	686.5	>500k	
Highest	681.5	>500k	

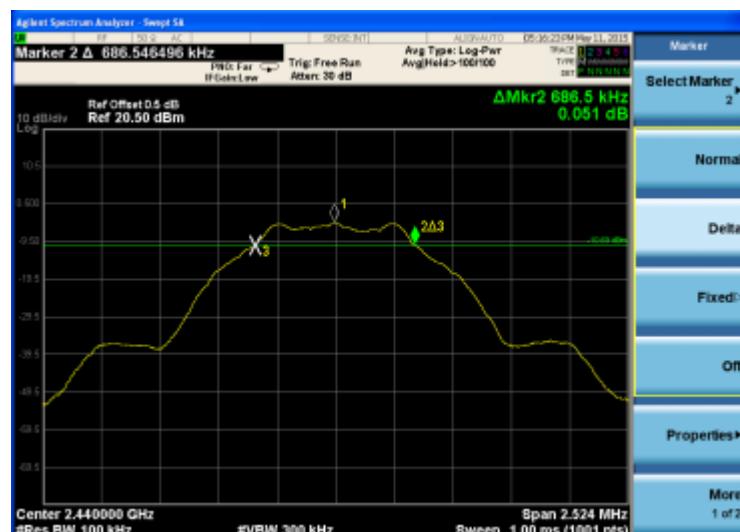
**Test plots as follows:**

## BT LE mode

### Lowest channel



### Middle channel

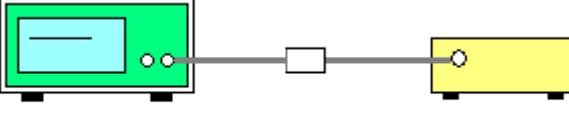


### Highest channel



## 6.5. Power Spectral Density

## 6.6. Test Specification

<b>Test Requirement:</b>	FCC Part15 C Section 15.247 (e)
<b>Test Method:</b>	ANSI C63.4:2009 and KDB558074
<b>Limit:</b>	The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.
<b>Test Setup:</b>	 <p><b>Spectrum Analyzer</b>                                    <b>EUT</b></p>
<b>Test Mode:</b>	Refer to item 4.1
<b>Test Procedure:</b>	<ol style="list-style-type: none"> <li>1. The testing follows Measurement Procedure 10.2 Method PKPSD of FCC KDB Publication No.558074 D01 DTS Meas. Guidance v03r02</li> <li>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.</li> <li>3. Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW): <math>3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}</math>. Video bandwidth <math>\text{VBW} \geq 3 \times \text{RBW}</math>. In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)</li> <li>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.</li> <li>6. Measure and record the results in the test report.</li> </ol>
<b>Test Result:</b>	PASS

### 6.6.1. Test Instruments

RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100060	Oct. 21, 2015

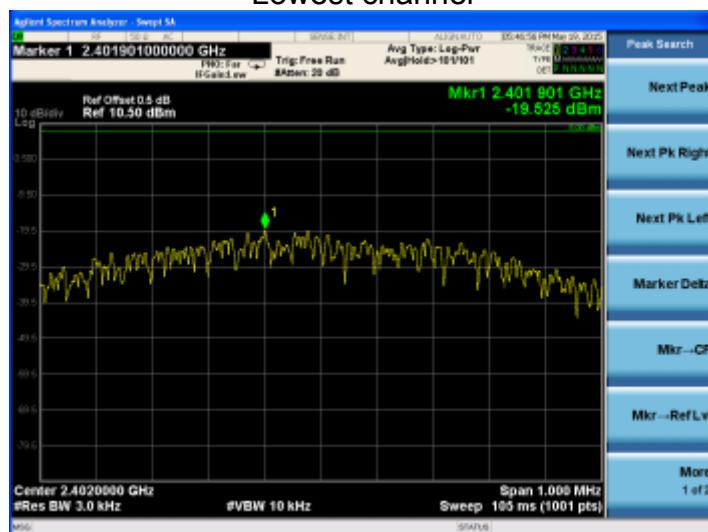
**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

**6.6.2. Test data**

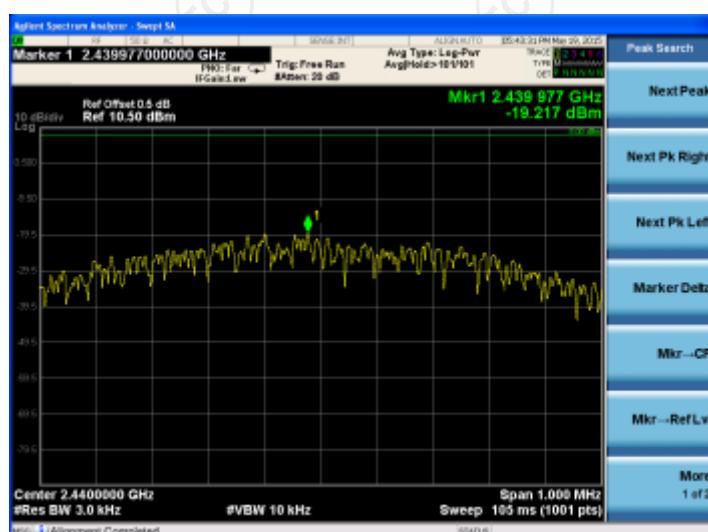
Test channel	Power Spectral Density (dBm/3kHz)		
	BT LE mode	Limit	Result
Lowest	-19. 525	8 dBm/3kHz	PASS
Middle	-19.217	8 dBm/3kHz	
Highest	-19. 258	8 dBm/3kHz	

**Test plots as follows:**

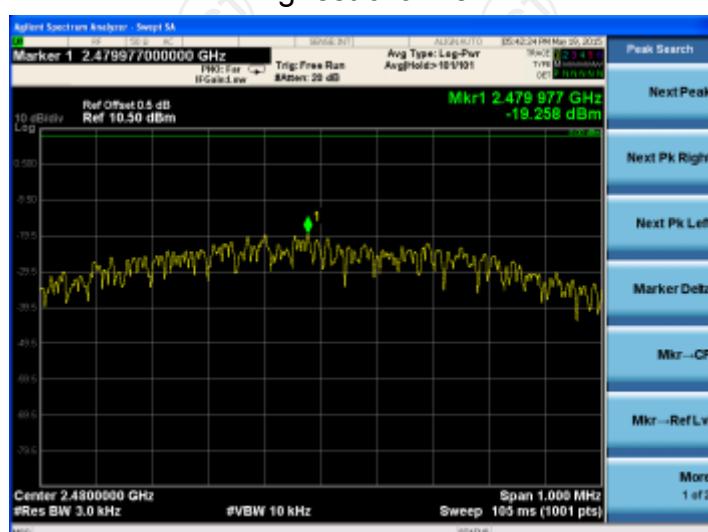
### Lowest channel



### Middle channel

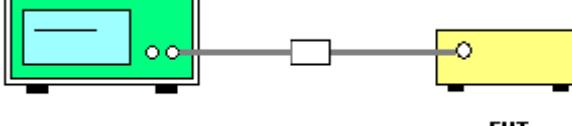


### Highest channel



## 6.7. Conducted Band Edge and Spurious Emission Measurement

### 6.7.1. Test Specification

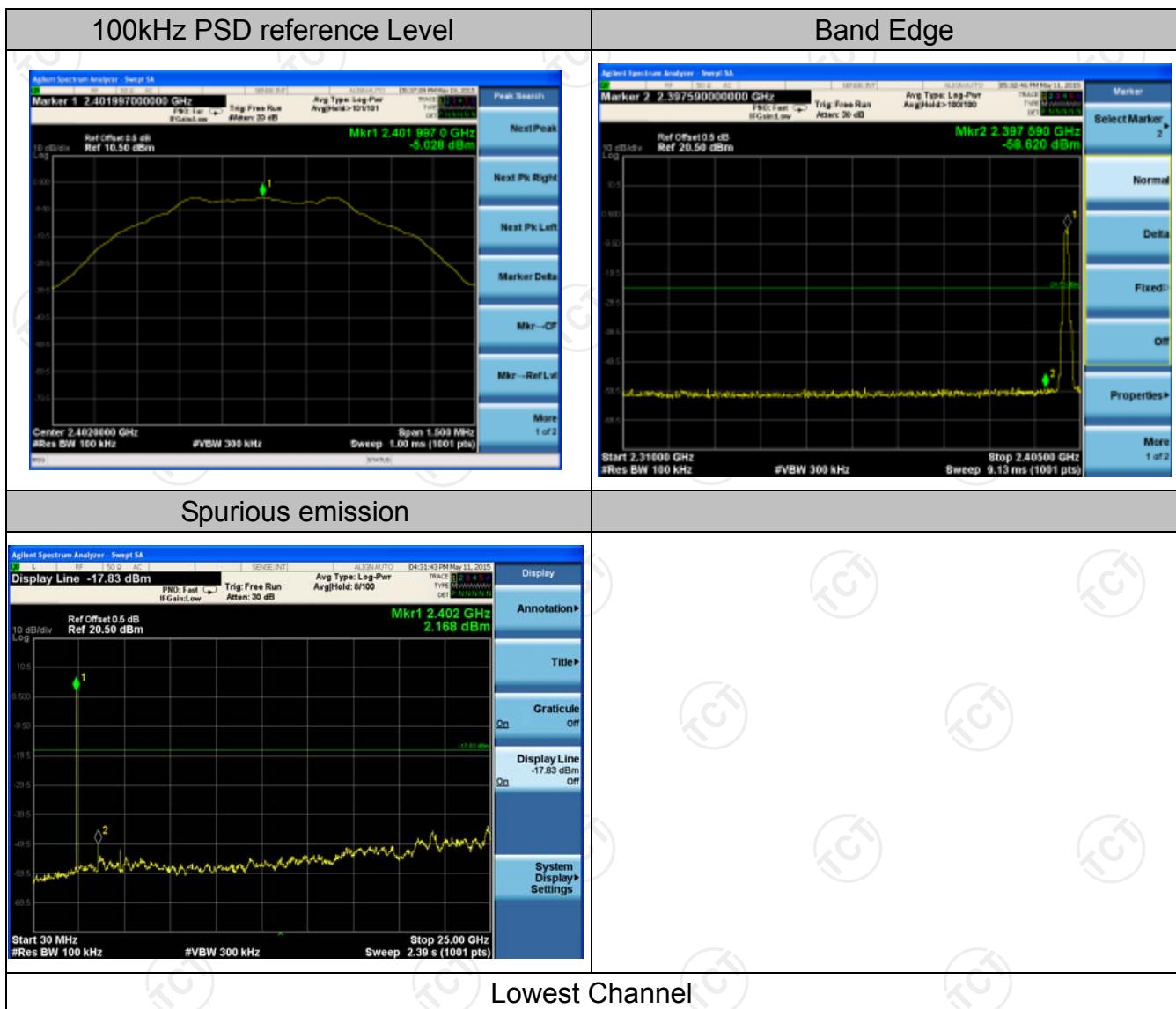
<b>Test Requirement:</b>	FCC Part15 C Section 15.247 (d)
<b>Test Method:</b>	ANSI C63.4:2009 and KDB558074
<b>Limit:</b>	In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement and radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).
<b>Test Setup:</b>	 <p style="text-align: center;"><b>Spectrum Analyzer</b>                                    <b>EUT</b></p>
<b>Test Mode:</b>	Refer to item 4.1
<b>Test Procedure:</b>	<ol style="list-style-type: none"> <li>1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r02.</li> <li>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.</li> <li>3. Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>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).</li> <li>5. Measure and record the results in the test report.</li> <li>6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.</li> </ol>
<b>Test Result:</b>	PASS

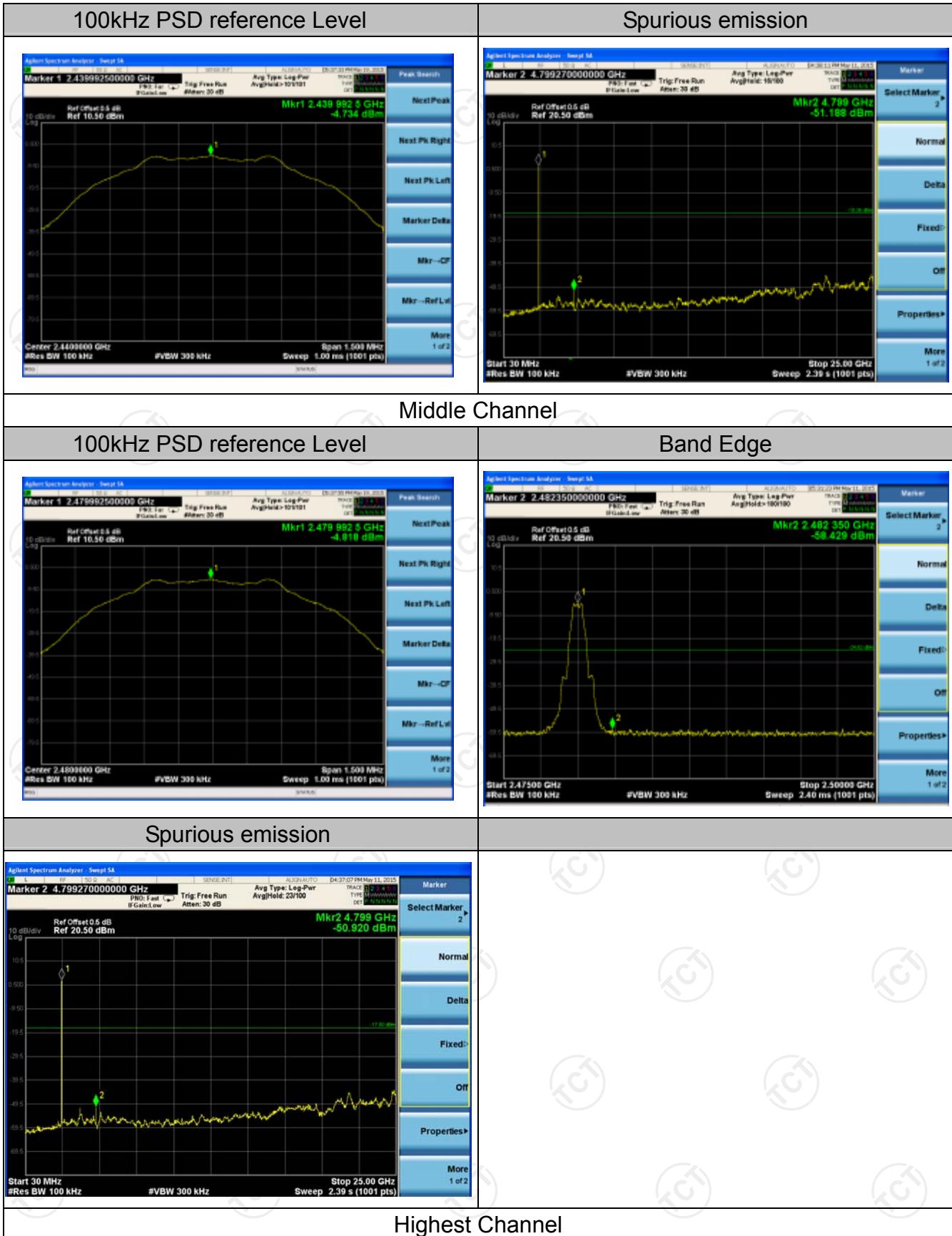
## 6.7.2. Test Instruments

RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100060	Oct. 21, 2015

**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

## 6.7.3. Test Data

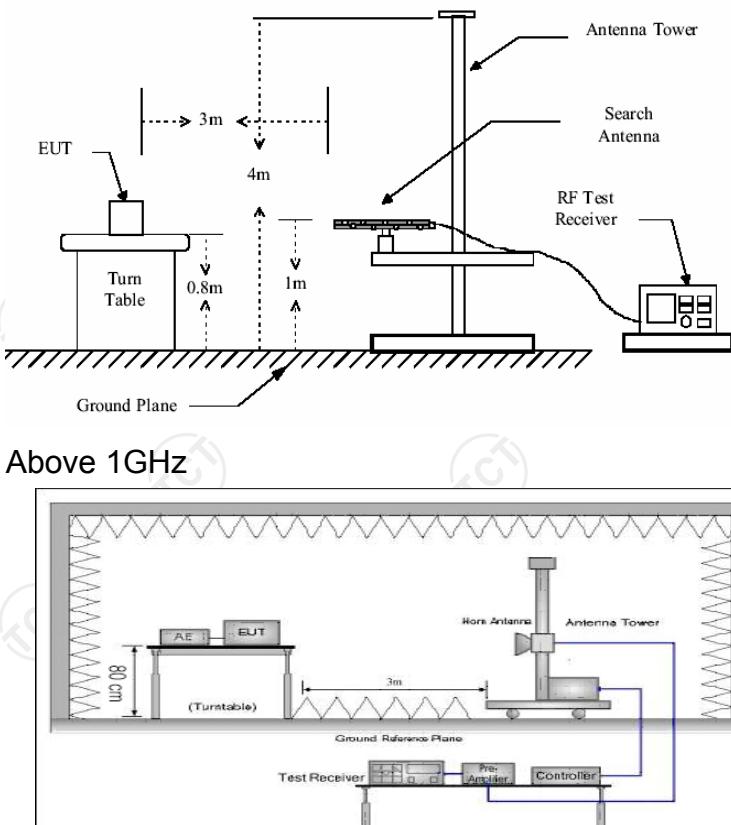




## 6.8. Radiated Spurious Emission Measurement

### 6.8.1. Test Specification

<b>Test Requirement:</b>	FCC Part15 C Section 15.209																																							
<b>Test Method:</b>	ANSI C63.4: 2009 and ANSI C63.10: 2009																																							
<b>Frequency Range:</b>	9 kHz to 25 GHz																																							
<b>Measurement Distance:</b>	3 m																																							
<b>Antenna Polarization:</b>	Horizontal & Vertical																																							
<b>Operation mode:</b>	Refer to item 4.1																																							
<b>Receiver Setup:</b>	<table border="1"> <thead> <tr> <th>Frequency</th> <th>Detector</th> <th>RBW</th> <th>VBW</th> <th>Remark</th> </tr> </thead> <tbody> <tr> <td>9kHz- 150kHz</td> <td>Quasi-peak</td> <td>200Hz</td> <td>1kHz</td> <td>Quasi-peak Value</td> </tr> <tr> <td>150kHz- 30MHz</td> <td>Quasi-peak</td> <td>9kHz</td> <td>30kHz</td> <td>Quasi-peak Value</td> </tr> <tr> <td>30MHz-1GHz</td> <td>Quasi-peak</td> <td>100KHz</td> <td>300KHz</td> <td>Quasi-peak Value</td> </tr> <tr> <td rowspan="2">Above 1GHz</td><td>Peak</td> <td>1MHz</td> <td>3MHz</td> <td>Peak Value</td> </tr> <tr> <td>Peak</td> <td>1MHz</td> <td>10Hz</td> <td>Average Value</td> </tr> </tbody> </table>					Frequency	Detector	RBW	VBW	Remark	9kHz- 150kHz	Quasi-peak	200Hz	1kHz	Quasi-peak Value	150kHz- 30MHz	Quasi-peak	9kHz	30kHz	Quasi-peak Value	30MHz-1GHz	Quasi-peak	100KHz	300KHz	Quasi-peak Value	Above 1GHz	Peak	1MHz	3MHz	Peak Value	Peak	1MHz	10Hz	Average Value						
Frequency	Detector	RBW	VBW	Remark																																				
9kHz- 150kHz	Quasi-peak	200Hz	1kHz	Quasi-peak Value																																				
150kHz- 30MHz	Quasi-peak	9kHz	30kHz	Quasi-peak Value																																				
30MHz-1GHz	Quasi-peak	100KHz	300KHz	Quasi-peak Value																																				
Above 1GHz	Peak	1MHz	3MHz	Peak Value																																				
	Peak	1MHz	10Hz	Average Value																																				
<b>Limit:</b>	<table border="1"> <thead> <tr> <th>Frequency</th> <th>Field Strength (microvolts/meter)</th> <th>Measurement Distance (meters)</th> </tr> </thead> <tbody> <tr> <td>0.009-0.490</td> <td>2400/F(KHz)</td> <td>300</td> </tr> <tr> <td>0.490-1.705</td> <td>24000/F(KHz)</td> <td>30</td> </tr> <tr> <td>1.705-30</td> <td>30</td> <td>30</td> </tr> <tr> <td>30-88</td> <td>100</td> <td>3</td> </tr> <tr> <td>88-216</td> <td>150</td> <td>3</td> </tr> <tr> <td>216-960</td> <td>200</td> <td>3</td> </tr> <tr> <td>Above 960</td> <td>500</td> <td>3</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Frequency</th> <th>Field Strength (microvolts/meter)</th> <th>Measurement Distance (meters)</th> <th>Detector</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Above 1GHz</td><td>500</td> <td>3</td> <td>Average</td> </tr> <tr> <td>5000</td> <td>3</td> <td>Peak</td> </tr> </tbody> </table>					Frequency	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	30	30	30-88	100	3	88-216	150	3	216-960	200	3	Above 960	500	3	Frequency	Field Strength (microvolts/meter)	Measurement Distance (meters)	Detector	Above 1GHz	500	3	Average	5000	3	Peak
Frequency	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	30	30																																						
30-88	100	3																																						
88-216	150	3																																						
216-960	200	3																																						
Above 960	500	3																																						
Frequency	Field Strength (microvolts/meter)	Measurement Distance (meters)	Detector																																					
Above 1GHz	500	3	Average																																					
	5000	3	Peak																																					
<b>Test setup:</b>	<p>For radiated emissions below 30MHz</p> <p>Distance = 3m</p> <p>EUT</p> <p>Turn table</p> <p>Ground Plane</p> <p>30MHz to 1GHz</p>																																							



<p><b>Test Procedure:</b></p>	<ol style="list-style-type: none"> <li>1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r02.</li> <li>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.</li> <li>3. The EUT was placed on a turntable with 0.8 meter above ground.</li> <li>4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.</li> <li>5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level</li> <li>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.</li> <li>7. Use the following spectrum analyzer settings:             <ol style="list-style-type: none"> <li>(1) Span shall wide enough to fully capture the emission being measured;</li> <li>(2) Set RBW=100 kHz for <math>f &lt; 1</math> GHz; <math>VBW \geq RBW</math>; Sweep = auto; Detector function = peak; Trace = max hold;</li> </ol> </li> </ol>
-------------------------------	---

	<p>(3) Set RBW = 1 MHz, VBW= 3MHz for f &gt; 1 GHz for peak measurement.</p> <p>For average measurement: VBW = 10 Hz, when duty cycle is no less than 98 percent. <math>VBW \geq 1/T</math>, 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.</p>
<b>Test results:</b>	PASS

### 6.8.2. Test Instruments

Radiated Emission Test Site (966)				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
ESPI Test Receiver	ROHDE&SCHW ARZ	ESVD	100008	Sep.16 , 2015
Spectrum Analyzer	ROHDE&SCHW ARZ	FSEM	848597/001	Sep.16 , 2015
Pre-amplifier	EM Electronics Corporation CO.,LTD	EM30265	07032613	Sep.16 , 2015
Pre-amplifier	HP	8447D	2727A05017	Sep.16 , 2015
Loop antenna	ZHINAN	ZN30900A	12024	Dec.14 , 2015
Broadband Antenna	Schwarzbeck	VULB9163	340	Sep.16 , 2015
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Sep.16 , 2015
Horn Antenna	Schwarzbeck	BBHA 9170	373	Sep.16 , 2015
Coax cable	TCT	RE-low-01	N/A	Sep.15 , 2015
Coax cable	TCT	RE-high-02	N/A	Sep.15 , 2015
Coax cable	TCT	RE-low-03	N/A	Sep.15 , 2015
Coax cable	TCT	RE-High-04	N/A	Sep.15 , 2015
Antenna Mast	CCS	CC-A-4M	N/A	Sep.15 , 2015
EMI Test Software	Shurples Technology	EZ-EMC	N/A	N/A

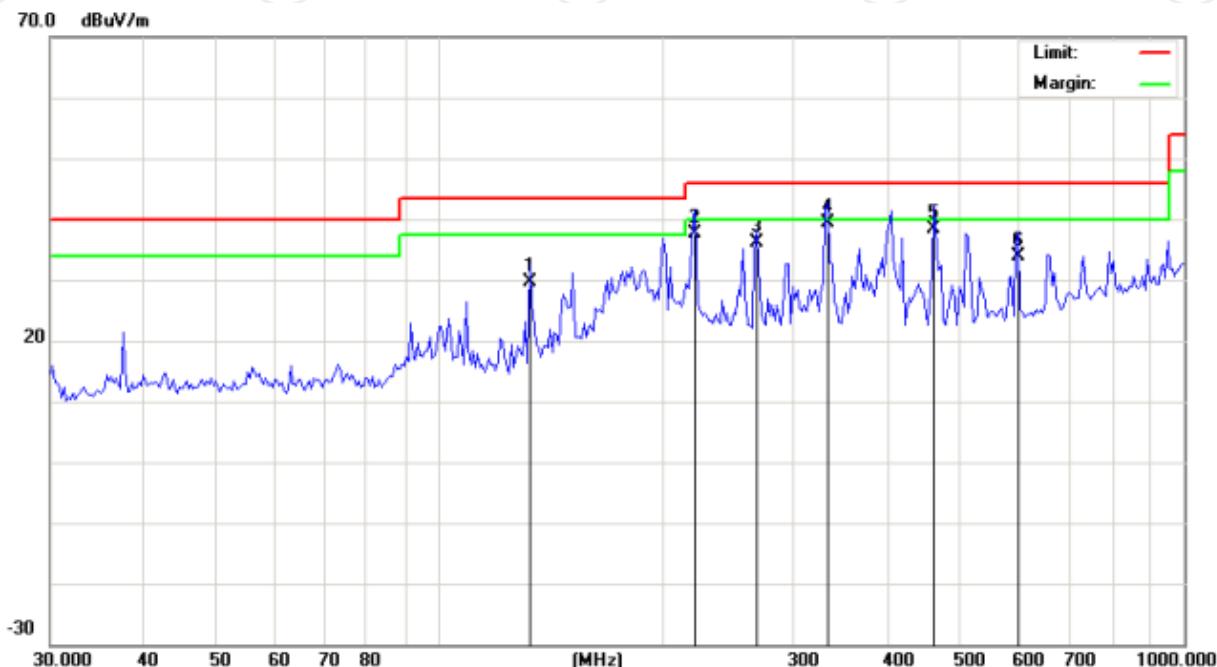
**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

### 6.8.3. Test Data

Please refer to following diagram for individual

Below 1GHz

Horizontal:



Site

Polarization: **Horizontal**

Temperature: 25

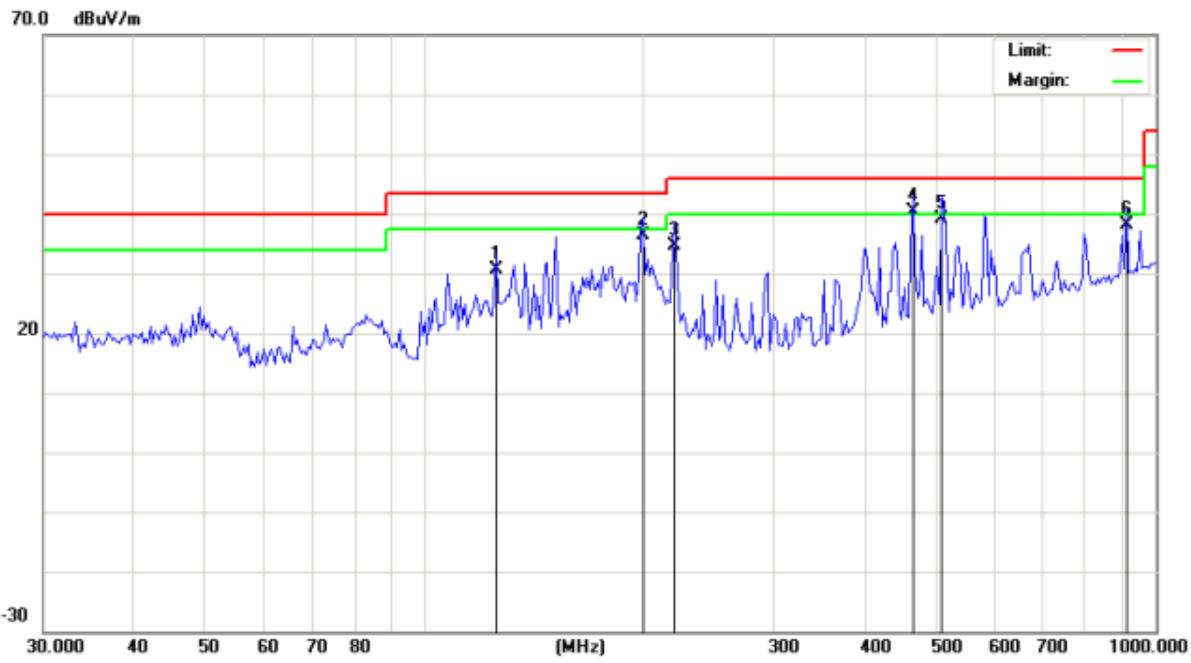
Limit: FCC Part 15B Class B RE\_3 m

Power:

Humidity: 56 %

No.	Mk.	Freq. MHz	Reading Level	Correct Factor	Measure- ment	Limit	Over	Antenna Height cm	Table Degree degree	Table Comment
			dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree
1	124.9248	48.05	-14.33	33.72	43.50	-9.78	peak		0	
2	151.0252	51.20	-15.07	36.13	43.50	-7.37	peak		0	
3	*	198.6424	51.12	-11.77	39.35	43.50	-4.15	peak		
4	!	464.8867	45.76	-4.10	41.66	46.00	-4.34	peak		
5	!	509.3560	44.45	-2.87	41.58	46.00	-4.42	peak		
6	!	912.6951	38.71	3.10	41.81	46.00	-4.19	peak		

Vertical:



Site

 Polarization: **Vertical**

Temperature: 25

Limit: FCC Part 15B Class B RE\_3 m

Power:

Humidity: 56 %

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Antenna Height cm	Table Degree	Comment
1		124.9248	45.05	-14.33	30.72	43.50	-12.78	QP		0	
2		198.6424	48.12	-11.77	36.35	43.50	-7.15	QP		0	
3		219.1785	45.63	-11.02	34.61	46.00	-11.39	QP		0	
4	*	464.8867	44.36	-4.10	40.26	46.00	-5.74	QP		0	
5		509.3560	42.05	-2.87	39.18	46.00	-6.82	QP		0	
6		912.6952	34.97	3.10	38.07	46.00	-7.93	QP		0	

**Note:** 1. The low frequency, which started from 9KHz~30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported

2. Measurements were conducted in all three channels (high, middle, low), and the worst case Mode (Highest channel) was submitted only.

The Result of Radiated Spurious at Band Edges

Modulation Type: GFSK

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dB $\mu$ V)	Correction Factor (dB/m)	Peak Final Emission level	Peak limit (dB $\mu$ V/m)	AV Limit (dB $\mu$ V/m)
2310	H	52.19	-4.20	47.99	74.00	54.00
2386.12	H	49.17	-4.20	44.97	74.00	54.00
2390	H	52.37	-3.94	48.43	74.00	54.00
2310	V	56.27	-4.20	52.07	74.00	54.00
2386.12	V	48.46	-4.20	44.26	74.00	54.00
2390	V	53.63	-3.94	49.69	74.00	54.00

Modulation Type: GFSK

Low channel: 2480MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dB $\mu$ V)	Correction Factor (dB/m)	Peak Final Emission level	Peak limit (dB $\mu$ V/m)	AV Limit (dB $\mu$ V/m)
2483.5	H	40.40	-3.60	36.80	74.00	54.00
2489.12	H	39.42	-3.50	35.92	74.00	54.00
2500	H	38.46	-3.34	35.12	74.00	54.00
2483.5	V	42.61	-3.60	39.01	74.00	54.00
2489.12	V	40.90	-3.50	37.40	74.00	54.00
2500	V	38.63	-3.34	35.29	74.00	54.00

**Above 1GHz**

Low channel: 2402 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dB $\mu$ V)	AV reading (dB $\mu$ V)	Correction Factor (dB/m)	Emission Level		Peak limit (dB $\mu$ V/m)	AV limit (dB $\mu$ V/m)	Margin (dB)
					Peak (dB $\mu$ V/m)	AV (dB $\mu$ V/m)			
4804	H	37.25	---	6.59	43.84	---	74	54	-10.16
7206	H	35.17	---	12.87	48.04	---	74	54	-5.96
---	H	---	---	---	---	---	---	---	---
4804	V	37.79	---	6.59	44.38	---	74	54	-9.62
7206	V	35.25	---	12.87	48.12	---	74	54	-5.88
---	V	---	---	---	---	---	---	---	---

Middle channel: 2440MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dB $\mu$ V)	AV reading (dB $\mu$ V)	Correction Factor (dB/m)	Emission Level		Peak limit (dB $\mu$ V/m)	AV limit (dB $\mu$ V/m)	Margin (dB)
					Peak (dB $\mu$ V/m)	AV (dB $\mu$ V/m)			
4880	H	37.63	---	7.01	44.64	---	74	54	-9.36
7320	H	36.39	---	13.21	49.60	---	74	54	-4.40
---	H	---	---	---	---	---	---	---	---
4880	V	36.55	---	7.01	43.56	---	74	54	-10.44
7320	V	36.05	---	13.21	49.26	---	74	54	-4.74
---	V	---	---	---	---	---	---	---	---

High channel: 2480 MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dB $\mu$ V)	AV reading (dB $\mu$ V)	Correction Factor (dB/m)	Emission Level		Peak limit (dB $\mu$ V/m)	AV limit (dB $\mu$ V/m)	Margin (dB)
					Peak (dB $\mu$ V/m)	AV (dB $\mu$ V/m)			
4960	H	43.47	---	7.44	50.91	---	74	54	-3.09
7440	H	37.33	---	13.54	50.87	---	74	54	-3.13
---	H	---	---	---	---	---	---	---	---
4960	V	42.72	---	7.44	50.16	---	74	54	-3.84
7440	V	36.49	---	13.54	50.03	---	74	54	-3.97
---	V	---	---	---	---	---	---	---	---

**Note:**

1. Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier
2. Margin (dB) = Emission Level (Peak) (dB $\mu$ V/m)-Average limit (dB $\mu$ V/m)
3. The emission levels of other frequencies are very lower than the limit and not show in test report.
4. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency.
5. Data of measurement shown “---” in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.

\*\*\*\*\***END OF REPORT**\*\*\*\*\*