



## **STC Test Report**

Date: 2014-08-01

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No.: DM115948

**Applicant (SZL030):** TAI TWUN ENTERPRISE CO., LTD  
13F, NO880, Zhongzheng Road, Zhonghe Dist, New Taipei  
City 235, Taiwan

**Manufacturer:** Shenzhen L&Y Audio Co., Ltd.  
2 Bldg, Tong Fu Yu Industrial, 2nd Industrial Zone, Tang  
Xia Yong Songgang, Baoan District, Shenzhen, Guangdong,  
China PC:518105

**Description of Sample(s):** Product: Bluetooth mono speaker  
Brand Name: GOTTA  
Model Number: WaveCast 2  
FCC ID: 2ACUI-WAVECAST2

**Date Sample(s) Received:** 2014-06-25

**Date Tested:** 2014-06-30 to 2014-07-10

**Investigation Requested:** Perform ElectroMagnetic Interference measurement in  
accordance with FCC 47CFR [Codes of Federal Regulations]  
Part 15: 2012 and ANSI C63.4: 2009 for FCC Certification.

**Conclusion(s):** The submitted product COMPLIED with the requirements of  
Federal Communications Commission [FCC] Rules and  
Regulations Part 15. The tests were performed in accordance  
with the standards described above and on Section 2.2 in this  
Test Report.

**Remark(s):** For additional model(s) details, see page 4



LONG Yun Jian, Along  
Authorized Signatory  
ElectroMagnetic Compatibility Department  
For and on behalf of  
STC (Dongguan) Company Limited

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### **1.0 General Details**

#### **1.1 Test Laboratory**

STC (Dongguan) Company Limited  
EMC Laboratory  
68 Fumin Nan Road, Dalang, Dongguan, China

Telephone: (86 769) 81119888  
Fax: (86 769) 81116222

#### **1.2 Equipment Under Test [EUT] Description of Sample(s)**

Product:	Bluetooth mono speaker
Manufacturer:	Shenzhen L&Y Audio Co., Ltd. 2 Bldg, Tong Fu Yu Industrial, 2nd Industrial Zone, Tang Xia Yong Songgang, Baoan District, Shenzhen, Guangdong, China PC:518105
Brand Name:	GOTTA
Model Number:	WaveCast 2
Additional Model Number:	V1
Rating:	5.0Vd.c. (Powered by PC USB port) / rechargeable battery x1 = 3.7Vd.c

##### **1.2.1 Description of EUT Operation**

The Equipment Under Test (EUT) is a Bluetooth mono speaker of Shenzhen L&Y Audio Co., Ltd., it is Audio System, modulation by IC; and type is frequency hopping speed spectrum Modulation.

#### **1.3 Date of Order**

2014-06-25

#### **1.4 Submitted Sample(s):**

1 Sample

#### **1.5 Test Duration**

2014-06-30 to 2014-07-10

#### **1.6 Country of Origin** China

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### **1.7 RF Module Details**

Module Model Number:	F-3066
Module FCC ID:	N/A
Module Transmission Type:	Bluetooth V3.0+EDR
Modulation:	FHSS (GFSK / $\pi/4$ -DQPSK / 8DPSK)
Data Rates:	1MBps: GFSK 2 MBps: $\pi/4$ -DQPSK 3 MBps: 8DPSK
Frequency Range:	2400-2483.5MHz
Carrier Frequencies:	2402MHz – 2480MHz

Module Specification (specification provided by manufacturer)

### **1.8 Antenna Details**

Antenna Type:	Trace Antenna Module
Antenna Gain:	0dBi

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### **2.0 Technical Details**

#### **2.1 Investigations Requested**

Perform Electromagnetic Interference measurements in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2012 Regulations. FCC Pubic Notice DA 00-705 and ANSI C63.4: 2009 for FCC Certification.

#### **2.2 Test Standards and Results Summary Tables**

<b>EMISSION Results Summary</b>						
Test Condition	Test Requirement	Test Method	Class / Severity	Test Result		
				Pass	Fail	N/A
Maximum Peak Conducted Output Power	FCC 47CFR 15.247(b)(1)	FCC Pubic Notice DA 00-705	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Radiated Spurious Emissions	FCC 47CFR 15.209	ANSI C63.4:2009	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AC Mains Conducted Emissions	FCC 47CFR 15.207	ANSI C63.4:2009	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Number of Hopping Frequency	FCC 47CFR 15.247(a)(2)(b)(1)	FCC Pubic Notice DA 00-705	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20dB Bandwidth	FCC 47CFR 15.247(a)(2)	FCC Pubic Notice DA 00-705	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hopping Channel Separation	FCC 47CFR 15.247(a)(1)	FCC Pubic Notice DA 00-705	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Band-edge compliance of RF Conducted Emission	FCC 47CFR 15.247(c)	FCC Pubic Notice DA 00-705	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pseudorandom Hopping Algorithm	FCC 47CFR 15.247(a)(1)	N/A	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Time of Occupancy (Dwell Time)	FCC 47CFR 15.247(a)(1)(iii)	FCC Pubic Notice DA 00-705	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Antenna requirement	FCC 47CFR 15.203	N/A	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
RF Exposure	FCC 47CFR 15.247(i)	N/A	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Note: N/A – Not Applicable

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### **2.3 Table of Test Modes**

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate 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.

<b>Test Items</b>	<b>Mode</b>	<b>Data Rate</b>
Maximum Peak Conducted Output Power	GFSK / $\pi/4$ -DQPSK / 8DPSK	1MBps / 2MBps / 3MBps
Hopping Channel Separation	GFSK / $\pi/4$ -DQPSK / 8DPSK	1MBps / 2MBps / 3MBps
Number of Hopping Frequency	GFSK / $\pi/4$ -DQPSK / 8DPSK	2MBps
Time of Occupancy(Dwell Time)	8DPSK (DH1 / DH3 / DH5)	2MBps
Radiated Spurious Emissions	GFSK / $\pi/4$ -DQPSK / 8DPSK	1MBps / 2MBps / 3MBps
Band-edge compliance of Conducted Emission	GFSK / $\pi/4$ -DQPSK / 8DPSK	2MBps

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### **3.0 Test Results**

#### **3.1 Emission**

##### **3.1.1 Maximum Peak Conducted Output Power**

Test Requirement:	FCC 47CFR 15.247(b)(1)
Test Method:	FCC Public Notice DA 00-705
Test Date:	2014-07-10
Mode of Operation:	Tx mode

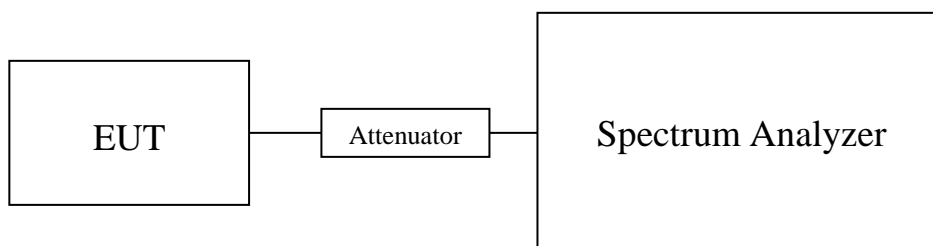
##### **Test Method:**

The RF output of the EUT was connected to the spectrum analyzer. All the attenuation or cable loss will be added to the measured maximum output power. The results are recorded in dBm.

##### **Spectrum Analyzer Setting:**

RBW = 3 MHz, VBW = 3MHz, Sweep = Auto, Span = 10MHz  
Detector = Peak, Trace = Max. hold

##### **Test Setup:**



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### **Limits for Maximum Peak Conducted Output Power [FCC 47CFR 15.247]:**

The maximum peak output power shall not exceed the following limits:  
For frequency hopping systems employing at least 75 hopping channels: 1 Watt  
For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 Watts  
For Digital Transmission systems in 2400-2483.5 MHz Band: 1 Watt

### **Results of Bluetooth Communication mode (GFSK) (Fundamental Power): Pass**

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2402	0.00158

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2441	0.00150

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.00155

### **Results of Bluetooth Communication mode ( $\pi/4$ -DQPSK) (Fundamental Power): Pass**

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2402	0.00115

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2441	0.00112

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.00118

### **Results of Bluetooth Communication mode (8 DPSK) (Fundamental Power): Pass**

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2402	0.00119

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2441	0.00114

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.00115

Calculated measurement uncertainty : 30MHz to 1GHz 1.7dB  
1GHz to 18GHz 1.7dB

#### **Remark:**

1. All test data for each data rate were verified, but only the worst case was reported.
2. The EUT is programmed to transmit signals continuously for all testing.

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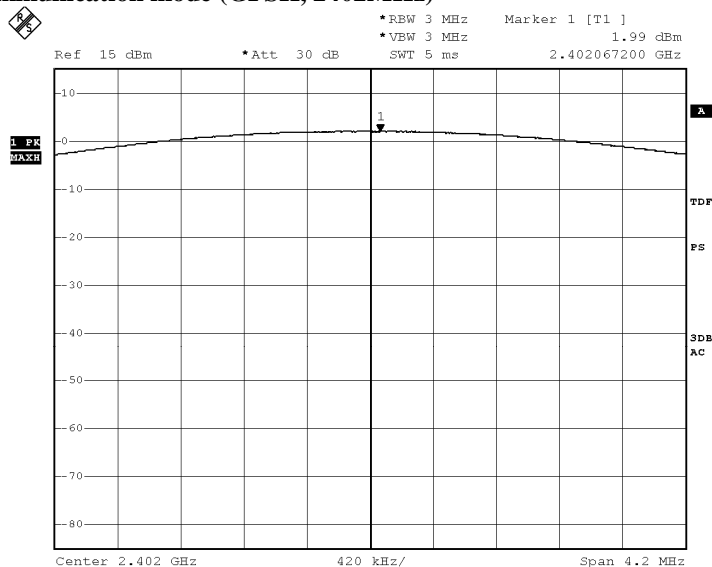
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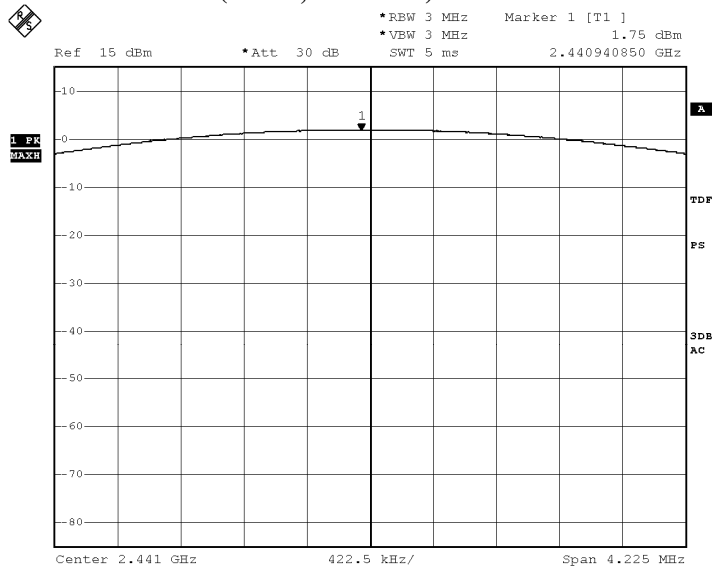
No.: DM115948

### Test plot of Maximum Peak Conducted Output Power : Bluetooth Communication mode (GFSK, 2402MHz)



Date: 9.JUL.2014 20:40:21

### Bluetooth Communication mode (GFSK, 2441MHz)



Date: 9.JUL.2014 20:41:43

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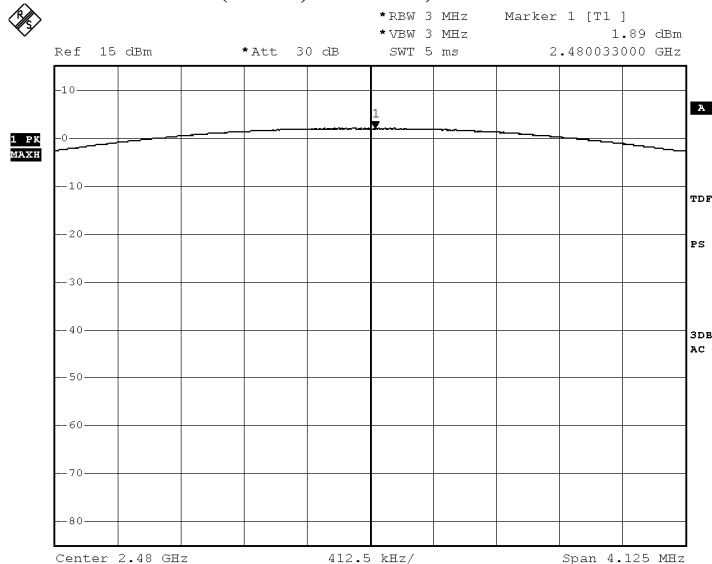
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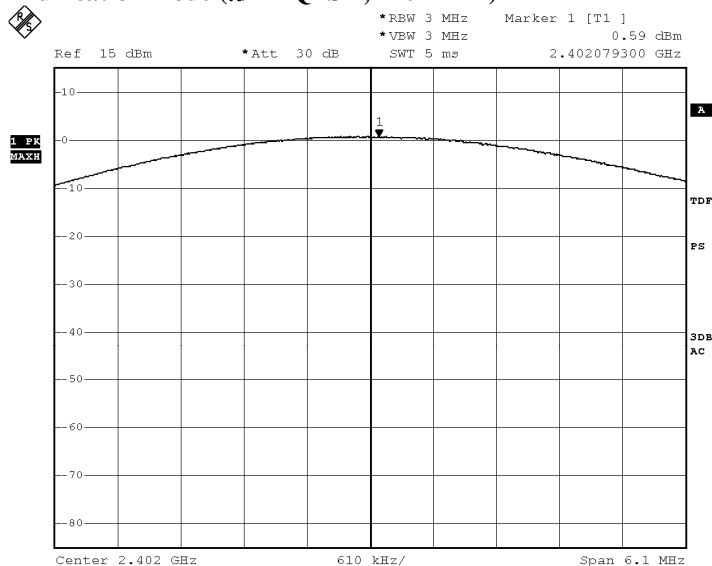
No.: DM115948

### Bluetooth Communication mode (GFSK, 2480MHz)



Date: 9.JUL.2014 20:42:26

### Bluetooth Communication mode ( $\pi/4$ -DQPSK, 2402MHz)



Date: 9.JUL.2014 20:45:09

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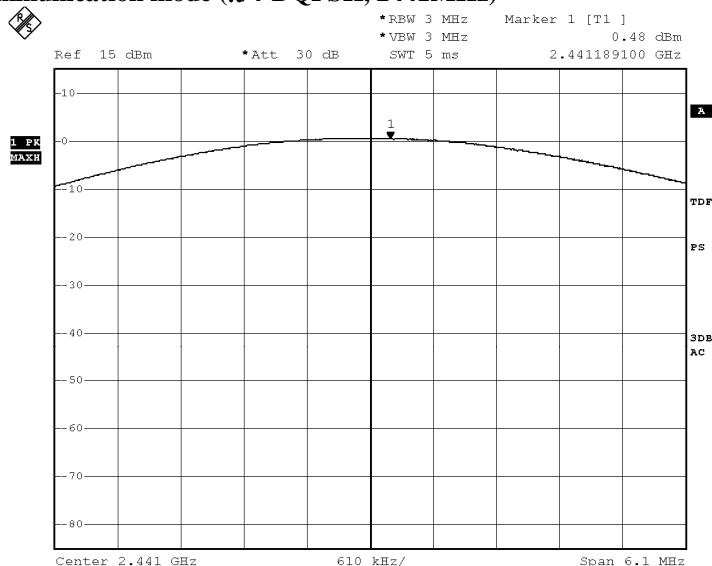
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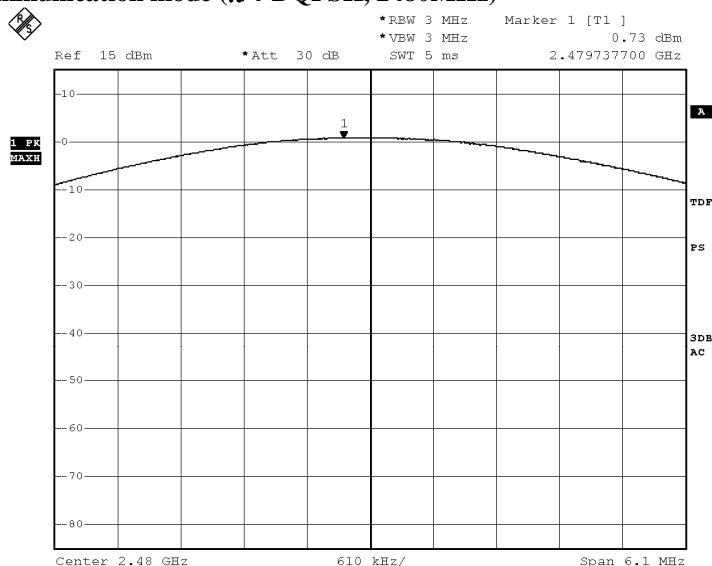
No.: DM115948

### Bluetooth Communication mode ( $\pi/4$ -DQPSK, 2441MHz)



Date: 9.JUL.2014 20:44:14

### Bluetooth Communication mode ( $\pi/4$ -DQPSK, 2480MHz)



Date: 9.JUL.2014 20:43:34

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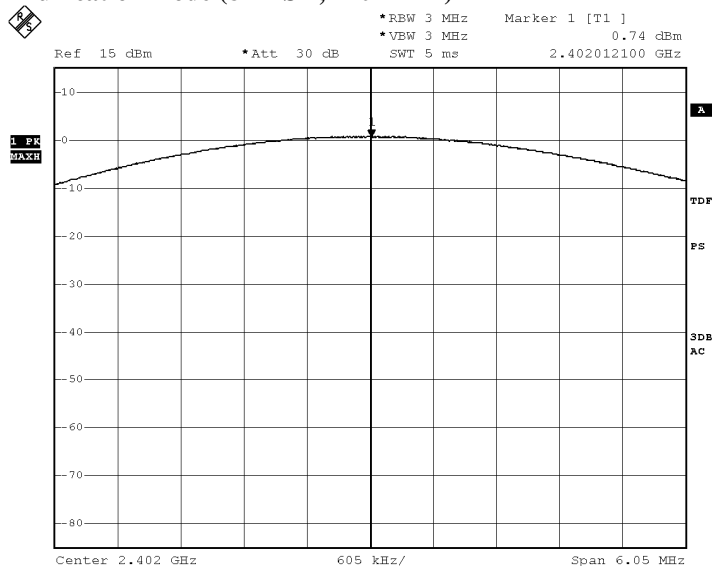
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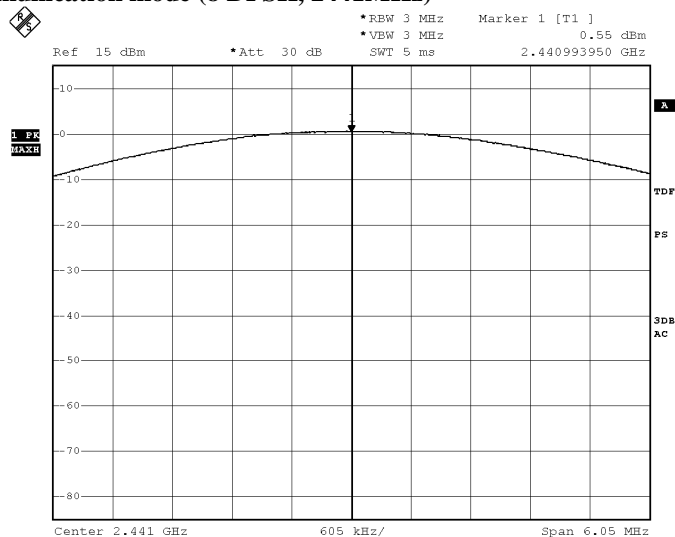
No.: DM115948

### Bluetooth Communication mode (8 DPSK, 2402MHz)



Date: 9.JUL.2014 20:45:36

### Bluetooth Communication mode (8 DPSK, 2441MHz)



Date: 9.JUL.2014 20:46:16

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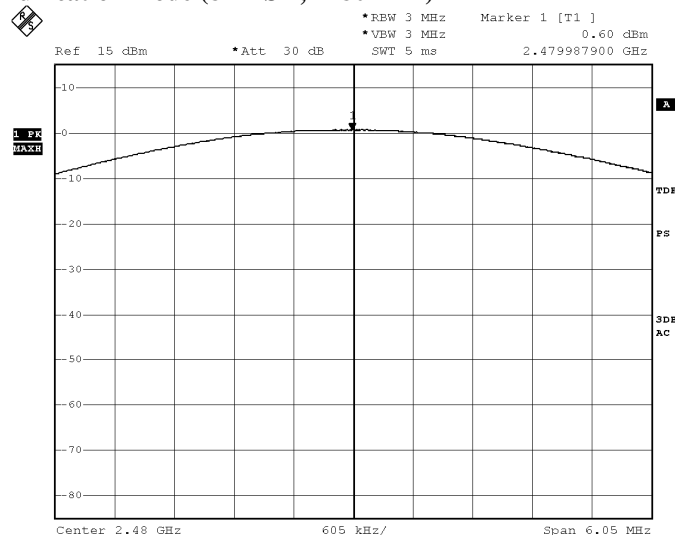
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### Bluetooth Communication mode (8 DPSK, 2480MHz)



Date: 9.JUL.2014 20:46:55

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### **3.1.2 Radiated Spurious Emissions**

Test Requirement:	FCC 47CFR 15.209
Test Method:	ANSI C63.4:2009
Test Date:	2014-06-30 to 2014-07-09
Mode of Operation:	Tx mode / Bluetooth Communication + Charging mode (GFSK / $\pi/4$ -DQPSK/ 8DPSK)

#### **Test Method:**

The sample was placed 0.8m above the ground plane of semi-anechoic 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, considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating 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.

- \*: Semi-anechoic chamber located on the STC (Dongguan) Company Ltd. 68 Fumin Nan Road, Dalang, Dongguan, Guangdong, PRC with a metal ground plane filed with the FCC pursuant to section 2.948 of the FCC rules, with Registration Number: 629686.

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### **Spectrum Analyzer Setting:**

9KHz – 30MHz (Pk & Av)

RBW: 10kHz  
VBW: 30kHz  
Sweep: Auto  
Span: Fully capture the emissions being measured  
Trace: Max. hold

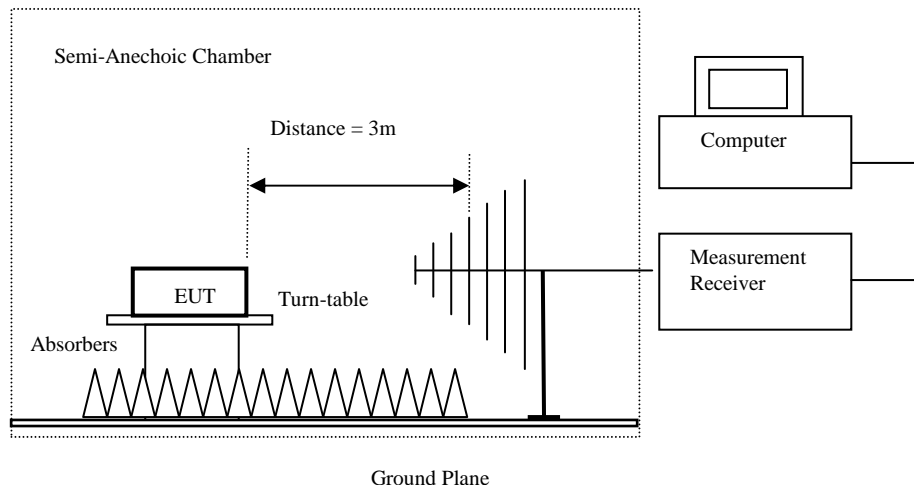
30MHz – 1GHz (QP)

RBW: 120kHz  
VBW: 120kHz  
Sweep: Auto  
Span: Fully capture the emissions being measured  
Trace: Max. hold

Above 1GHz (Pk & Av)

RBW: 1MHz  
VBW: 3MHz  
Sweep: Auto  
Span: Fully capture the emissions being measured  
Trace: Max. hold

### **Test Setup:**



- Absorbers placed on top of the ground plane are for measurements above 1000MHz only.
- Measurements between 30MHz to 1000MHz made with Bi-log antennas, above 1000MHz horn antennas are used, 9kHz to 30MHz loop antennas are used.

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### Limits for Radiated Emissions [FCC 47 CFR 15.209 Class B]:

Frequency Range	Quasi-Peak Limits
[MHz]	[ $\mu\text{V/m}$ ]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above 960	500

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

### Result of Tx mode (2402.0 MHz) (GFSK mode) (9kHz – 30MHz): Pass

Field Strength of Spurious Emissions						
Average Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	$\text{dB}\mu\text{V}$	$\text{dB/m}$	$\text{dB}\mu\text{V/m}$	$\mu\text{V/m}$	$\mu\text{V/m}$	
Emissions detected are more than 20 dB below the FCC Limits						

### Result of Tx mode (2402.0 MHz) (GFSK mode) (30MHz – 1GHz): Pass

Field Strength of Spurious Emissions						
Average Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	$\text{dB}\mu\text{V}$	$\text{dB/m}$	$\text{dB}\mu\text{V/m}$	$\mu\text{V/m}$	$\mu\text{V/m}$	
Emissions detected are more than 20 dB below the FCC Limits						

### Result of Tx mode (2402.0 MHz) (GFSK mode) (Above 1GHz): Pass

Field Strength of Spurious Emissions						
Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	$\text{dB}\mu\text{V}$	$\text{dB/m}$	$\text{dB}\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$	
4804.0	13.7	41.5	55.2	74.0	18.8	Vertical
4804.0	13.4	42.4	55.8	74.0	18.2	Horizontal
7206.0	10.5	45.1	55.6	74.0	18.4	Vertical
7206.0	9.3	46.2	55.5	74.0	18.5	Horizontal
9608.0	7.6	48.0	55.6	74.0	18.4	Vertical
9608.0	7.2	48.8	56.0	74.0	18.0	Horizontal
12010.0	3.9	51.5	55.4	74.0	18.6	Vertical
12010.0	3.8	52.4	56.2	74.0	17.8	Horizontal

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**Result of Tx mode (2402.0 MHz) (GFSK mode) (Above 1GHz): Pass**

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level @3m dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB $\mu$ V/m	E-Field Polarity
4804.0	0.4	41.5	41.9	54.0	12.1	Vertical
4804.0	-2.4	42.4	40.0	54.0	14.0	Horizontal
7206.0	-4.7	45.1	40.4	54.0	13.6	Vertical
7206.0	-7.0	46.2	39.2	54.0	14.8	Horizontal
9608.0	-7.8	48.0	40.2	54.0	13.8	Vertical
9608.0	-7.5	48.8	41.3	54.0	12.7	Horizontal
12010.0	-11.1	51.5	40.4	54.0	13.6	Vertical
12010.0	-10.6	52.4	41.8	54.0	12.2	Horizontal

**Result of Tx mode (2441.0 MHz) (GFSK mode) (9kHz – 30MHz): Pass**

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Field Strength $\mu$ V/m	Limit $\mu$ V/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

**Results of Tx mode (2441.0 MHz) (GFSK mode) (30MHz – 1000MHz): PASS**

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Field Strength $\mu$ V/m	Limit $\mu$ V/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

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### **Result of Tx mode (2441.0 MHz) (GFSK mode) (Above 1GHz): Pass**

Field Strength of Spurious Emissions						
Peak Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4882.0	14.2	41.6	55.8	74.0	18.2	Vertical
4882.0	12.2	42.5	54.7	74.0	19.3	Horizontal
7323.0	9.8	45.2	55.0	74.0	19.0	Vertical
7323.0	8.7	46.3	55.0	74.0	19.0	Horizontal
9764.0	7.2	48.1	55.3	74.0	18.7	Vertical
9764.0	5.2	48.9	54.1	74.0	19.9	Horizontal
12205.0	3.9	51.6	55.5	74.0	18.5	Vertical
12205.0	3.3	52.5	55.8	74.0	18.2	Horizontal

### **Result of Tx mode (2441.0 MHz) (GFSK mode) (Above 1GHz): Pass**

Field Strength of Spurious Emissions						
Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4882.0	-1.8	41.6	39.8	54.0	14.2	Vertical
4882.0	-3.0	42.5	39.5	54.0	14.5	Horizontal
7323.0	-5.1	45.2	40.1	54.0	13.9	Vertical
7323.0	-6.4	46.3	39.9	54.0	14.1	Horizontal
9764.0	-7.9	48.1	40.2	54.0	13.8	Vertical
9764.0	-8.9	48.9	40.0	54.0	14.0	Horizontal
12205.0	-11.4	51.6	40.2	54.0	13.8	Vertical
12205.0	-11.5	52.5	41.0	54.0	13.0	Horizontal

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**Result of Tx mode (2480.0 MHz) (GFSK mode) (9kHz – 30MHz): Pass**

Field Strength of Spurious Emissions						
Average Value						
Frequency MHz	Measured Level dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Field Strength $\mu$ V/m	Limit $\mu$ V/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

**Results of Tx mode (2480.0 MHz) (GFSK mode) (30MHz – 1000MHz): PASS**

Field Strength of Spurious Emissions						
Average Value						
Frequency MHz	Measured Level dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Field Strength $\mu$ V/m	Limit $\mu$ V/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

**Result of Tx mode (2480.0 MHz) (GFSK mode) (Above 1GHz): Pass**

Field Strength of Spurious Emissions						
Peak Value						
Frequency MHz	Measured Level @3m dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB $\mu$ V/m	E-Field Polarity
4960.0	14.5	41.4	55.9	74.0	18.1	Vertical
4960.0	12.6	42.7	55.3	74.0	18.7	Horizontal
7440.0	9.6	45.6	55.2	74.0	18.8	Vertical
7440.0	9.0	46.5	55.5	74.0	18.5	Horizontal
9920.0	7.0	48.6	55.6	74.0	18.4	Vertical
9920.0	5.8	49.7	55.5	74.0	18.5	Horizontal
12400.0	3.6	51.7	55.3	74.0	18.7	Vertical
12400.0	3.2	52.7	55.9	74.0	18.1	Horizontal

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**Result of Tx mode (2480.0 MHz) (GFSK mode) (Above 1GHz): Pass**

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4960.0	-1.5	41.4	39.9	54.0	14.1	Vertical
4960.0	-2.4	42.7	40.3	54.0	13.7	Horizontal
7440.0	-5.2	45.6	40.4	54.0	13.6	Vertical
7440.0	-5.3	46.5	41.2	54.0	12.8	Horizontal
9920.0	-8.8	48.6	39.8	54.0	14.2	Vertical
9920.0	-9.6	49.7	40.1	54.0	13.9	Horizontal
12400.0	-10.5	51.7	41.2	54.0	12.8	Vertical
12400.0	-12.0	52.7	40.7	54.0	13.3	Horizontal

**Result of Tx mode (2402.0 MHz) ( $\pi/4$ -DQPSK mode) (9kHz – 30MHz): Pass**

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Field Strength $\mu$ V/m	Limit $\mu$ V/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

**Result of Tx mode (2402.0 MHz) ( $\pi/4$ -DQPSK mode) (30MHz – 1GHz): Pass**

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Field Strength $\mu$ V/m	Limit $\mu$ V/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

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**Result of Tx mode (2402.0 MHz) ( $\pi/4$ -DQPSK mode) (Above 1GHz): Pass**

Field Strength of Spurious Emissions						
Peak Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4804.0	14.3	41.5	55.8	74.0	18.2	Vertical
4804.0	12.0	42.4	54.4	74.0	19.6	Horizontal
7206.0	9.3	45.1	54.4	74.0	19.6	Vertical
7206.0	9.2	46.2	55.4	74.0	18.6	Horizontal
9608.0	7.2	48.0	55.2	74.0	18.8	Vertical
9608.0	7.1	48.8	55.9	74.0	18.1	Horizontal
12010.0	4.5	51.5	56.0	74.0	18.0	Vertical
12010.0	3.4	52.4	55.8	74.0	18.2	Horizontal

**Result of Tx mode (2402.0 MHz) ( $\pi/4$ -DQPSK mode) (Above 1GHz): Pass**

Field Strength of Spurious Emissions						
Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4804.0	-0.8	41.5	40.7	54.0	13.3	Vertical
4804.0	-3.6	42.4	38.8	54.0	15.2	Horizontal
7206.0	-5.3	45.1	39.8	54.0	14.2	Vertical
7206.0	-5.7	46.2	40.5	54.0	13.5	Horizontal
9608.0	-7.5	48.0	40.5	54.0	13.5	Vertical
9608.0	-7.8	48.8	41.0	54.0	13.0	Horizontal
12010.0	-9.8	51.5	41.7	54.0	12.3	Vertical
12010.0	-11.0	52.4	41.4	54.0	12.6	Horizontal

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**Result of Tx mode (2441.0 MHz) ( $\pi/4$ -DQPSK mode) (9kHz – 30MHz): Pass**

Field Strength of Spurious Emissions						
Average Value						
Frequency MHz	Measured Level dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Field Strength $\mu$ V/m	Limit $\mu$ V/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

**Results of Tx mode (2441.0 MHz) ( $\pi/4$ -DQPSK mode) (30MHz – 1000MHz): PASS**

Field Strength of Spurious Emissions						
Average Value						
Frequency MHz	Measured Level dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Field Strength $\mu$ V/m	Limit $\mu$ V/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

**Result of Tx mode (2441.0 MHz) ( $\pi/4$ -DQPSK mode) (Above 1GHz): Pass**

Field Strength of Spurious Emissions						
Peak Value						
Frequency MHz	Measured Level @3m dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB $\mu$ V/m	E-Field Polarity
4882.0	14.5	41.6	56.1	74.0	17.9	Vertical
4882.0	12.1	42.5	54.6	74.0	19.4	Horizontal
7323.0	9.9	45.2	55.1	74.0	18.9	Vertical
7323.0	8.4	46.3	54.7	74.0	19.3	Horizontal
9764.0	7.8	48.1	55.9	74.0	18.1	Vertical
9764.0	6.3	48.9	55.2	74.0	18.8	Horizontal
12205.0	4.5	51.6	56.1	74.0	17.9	Vertical
12205.0	3.1	52.5	55.6	74.0	18.4	Horizontal

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### **Result of Tx mode (2441.0 MHz) ( $\pi/4$ -DQPSK mode) (Above 1GHz): Pass**

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4882.0	0.2	41.6	41.8	54.0	12.2	Vertical
4882.0	-1.7	42.5	40.8	54.0	13.2	Horizontal
7323.0	-4.0	45.2	41.2	54.0	12.8	Vertical
7323.0	-5.8	46.3	40.5	54.0	13.5	Horizontal
9764.0	-6.6	48.1	41.5	54.0	12.5	Vertical
9764.0	-8.6	48.9	40.3	54.0	13.7	Horizontal
12205.0	-10.8	51.6	40.8	54.0	13.2	Vertical
12205.0	-11.2	52.5	41.3	54.0	12.7	Horizontal

### **Result of Tx mode (2480.0 MHz) ( $\pi/4$ -DQPSK mode) (9kHz – 30MHz): Pass**

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Field Strength $\mu$ V/m	Limit $\mu$ V/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

### **Results of Tx mode (2480.0 MHz) ( $\pi/4$ -DQPSK mode) (30MHz – 1000MHz): PASS**

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Field Strength $\mu$ V/m	Limit $\mu$ V/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

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**Result of Tx mode (2480.0 MHz) ( $\pi/4$ -DQPSK mode) (Above 1GHz): Pass**

Field Strength of Spurious Emissions						
Peak Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4960.0	14.6	41.4	56.0	74.0	18.0	Vertical
4960.0	12.8	42.7	55.5	74.0	18.5	Horizontal
7440.0	9.6	45.6	55.2	74.0	18.8	Vertical
7440.0	8.8	46.5	55.3	74.0	18.7	Horizontal
9920.0	6.8	48.6	55.4	74.0	18.6	Vertical
9920.0	5.6	49.7	55.3	74.0	18.7	Horizontal
12400.0	4.5	51.7	56.2	74.0	17.8	Vertical
12400.0	3.1	52.7	55.8	74.0	18.2	Horizontal

**Result of Tx mode (2480.0 MHz) ( $\pi/4$ -DQPSK mode) (Above 1GHz): Pass**

Field Strength of Spurious Emissions						
Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4960.0	0.7	41.4	42.1	54.0	11.9	Vertical
4960.0	-3.0	42.7	39.7	54.0	14.3	Horizontal
7440.0	-4.0	45.6	41.6	54.0	12.4	Vertical
7440.0	-6.4	46.5	40.1	54.0	13.9	Horizontal
9920.0	-7.8	48.6	40.8	54.0	13.2	Vertical
9920.0	-8.3	49.7	41.4	54.0	12.6	Horizontal
12400.0	-10.0	51.7	41.7	54.0	12.3	Vertical
12400.0	-12.1	52.7	40.6	54.0	13.4	Horizontal

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### **Result of Tx mode (2402.0 MHz) (8DPSK) (9kHz – 30MHz): Pass**

Field Strength of Spurious Emissions						
Average Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dB $\mu$ V	dB/m	dB $\mu$ V/m	$\mu$ V/m	$\mu$ V/m	
Emissions detected are more than 20 dB below the FCC Limits						

### **Result of Tx mode (2402.0 MHz) (8DPSK) (30MHz – 1GHz): Pass**

Field Strength of Spurious Emissions						
Average Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dB $\mu$ V	dB/m	dB $\mu$ V/m	$\mu$ V/m	$\mu$ V/m	
Emissions detected are more than 20 dB below the FCC Limits						

### **Result of Tx mode (2402.0 MHz) (8DPSK) (Above 1GHz): Pass**

Field Strength of Spurious Emissions						
Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dB $\mu$ V	dB/m	dB $\mu$ V/m	dB $\mu$ V/m	dB $\mu$ V/m	
4804.0	14.3	41.5	55.8	74.0	18.2	Vertical
4804.0	11.5	42.4	53.9	74.0	20.1	Horizontal
7206.0	9.7	45.1	54.8	74.0	19.2	Vertical
7206.0	9.0	46.2	55.2	74.0	18.8	Horizontal
9608.0	7.4	48.0	55.4	74.0	18.6	Vertical
9608.0	6.4	48.8	55.2	74.0	18.8	Horizontal
12010.0	4.6	51.8	56.4	74.0	17.6	Vertical
12010.0	3.6	52.4	56.0	74.0	18.0	Horizontal

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**Result of Tx mode (2402.0 MHz) (8DPSK) (Above 1GHz): Pass**

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4804.0	0.0	41.5	41.5	54.0	12.5	Vertical
4804.0	-4.9	42.4	37.5	54.0	16.5	Horizontal
7206.0	-5.5	45.1	39.6	54.0	14.4	Vertical
7206.0	-5.5	46.2	40.7	54.0	13.3	Horizontal
9608.0	-7.2	48.0	40.8	54.0	13.2	Vertical
9608.0	-8.0	48.8	40.8	54.0	13.2	Horizontal
12010.0	-12.3	51.8	39.5	54.0	14.5	Vertical
12010.0	-10.5	52.4	41.9	54.0	12.1	Horizontal

**Result of Tx mode (2441.0 MHz) (8DPSK) (9kHz – 30MHz): Pass**

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level dBμV	Correction Factor dB/m	Field Strength dBμV/m	Field Strength μV/m	Limit μV/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

**Results of Tx mode (2441.0 MHz) (8DPSK) (30MHz – 1000MHz): PASS**

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level dBμV	Correction Factor dB/m	Field Strength dBμV/m	Field Strength μV/m	Limit μV/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

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### **Result of Tx mode (2441.0 MHz) (8DPSK) (Above 1GHz): Pass**

<b>Field Strength of Spurious Emissions</b>						
<b>Peak Value</b>						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4882.0	14.1	41.6	55.7	74.0	18.3	Vertical
4882.0	11.5	42.5	54.0	74.0	20.0	Horizontal
7323.0	10.2	45.2	55.4	74.0	18.6	Vertical
7323.0	8.3	46.3	54.6	74.0	19.4	Horizontal
9764.0	7.3	48.1	55.4	74.0	18.6	Vertical
9764.0	6.2	48.9	55.1	74.0	18.9	Horizontal
12205.0	3.9	51.6	55.5	74.0	18.5	Vertical
12205.0	3.6	52.5	56.1	74.0	17.9	Horizontal

### **Result of Tx mode (2441.0 MHz) (8DPSK) (Above 1GHz): Pass**

<b>Field Strength of Spurious Emissions</b>						
<b>Average Value</b>						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4882.0	-1.0	41.6	40.6	54.0	13.4	Vertical
4882.0	-2.3	42.5	40.2	54.0	13.8	Horizontal
7323.0	5.1	45.2	50.3	54.0	3.7	Vertical
7323.0	-6.3	46.3	40.0	54.0	14.0	Horizontal
9764.0	-8.2	48.1	39.9	54.0	14.1	Vertical
9764.0	-8.5	48.9	40.4	54.0	13.6	Horizontal
12205.0	-11.6	51.6	40.0	54.0	14.0	Vertical
12205.0	-10.6	52.5	41.9	54.0	12.1	Horizontal

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**Result of Tx mode (2480.0 MHz) (8DPSK) (9kHz – 30MHz): Pass**

Field Strength of Spurious Emissions						
Average Value						
Frequency MHz	Measured Level dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Field Strength $\mu$ V/m	Limit $\mu$ V/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

**Results of Tx mode (2480.0 MHz) (8DPSK) (30MHz – 1000MHz): PASS**

Field Strength of Spurious Emissions						
Average Value						
Frequency MHz	Measured Level dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Field Strength $\mu$ V/m	Limit $\mu$ V/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

**Result of Tx mode (2480.0 MHz) (8DPSK) (Above 1GHz): Pass**

Field Strength of Spurious Emissions						
Peak Value						
Frequency MHz	Measured Level @3m dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB $\mu$ V/m	E-Field Polarity
4960.0	14.1	41.4	55.5	74.0	18.5	Vertical
4960.0	11.8	42.7	54.5	74.0	19.5	Horizontal
7440.0	9.6	45.6	55.2	74.0	18.8	Vertical
7440.0	8.3	46.5	54.8	74.0	19.2	Horizontal
9920.0	6.7	48.6	55.3	74.0	18.7	Vertical
9920.0	5.3	49.7	55.0	74.0	19.0	Horizontal
12400.0	4.5	51.7	56.2	74.0	17.8	Vertical
12400.0	2.8	52.7	55.5	74.0	18.5	Horizontal

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### **Result of Tx mode (2480.0 MHz) (8DPSK) (Above 1GHz): Pass**

<b>Field Strength of Spurious Emissions</b>						
<b>Average Value</b>						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4960.0	-0.2	41.4	41.2	54.0	12.8	Vertical
4960.0	-2.9	42.7	39.8	54.0	14.2	Horizontal
7440.0	-4.1	45.6	41.5	54.0	12.5	Vertical
7440.0	-7.0	46.5	39.5	54.0	14.5	Horizontal
9920.0	-7.4	48.6	41.2	54.0	12.8	Vertical
9920.0	-9.6	49.7	40.1	54.0	13.9	Horizontal
12400.0	-10.6	51.7	41.1	54.0	12.9	Vertical
12400.0	-10.8	52.7	41.9	54.0	12.1	Horizontal

#### Remarks:

- \* Denotes restricted band of operation.  
Measurements were made using a peak detector. Any emission less than 1000MHz and falling within the restricted bands of FCC Rules Part 15 Section 15.205 and the limits of FCC Rules Part 15 Section 15.209 were applied.

Correction Factor included Antenna Factor and Cable Attenuation.

Calculated measurement uncertainty: (9kHz - 30MHz): 3.3dB  
(30MHz - 1GHz): 4.6dB  
(1GHz - 26GHz): 4.4dB

Emissions in the vertical and horizontal polarizations have been investigated and the worst-case test results are recorded in this report.

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### Limits for Radiated Emissions [FCC 47 CFR 15.209 Class B]:

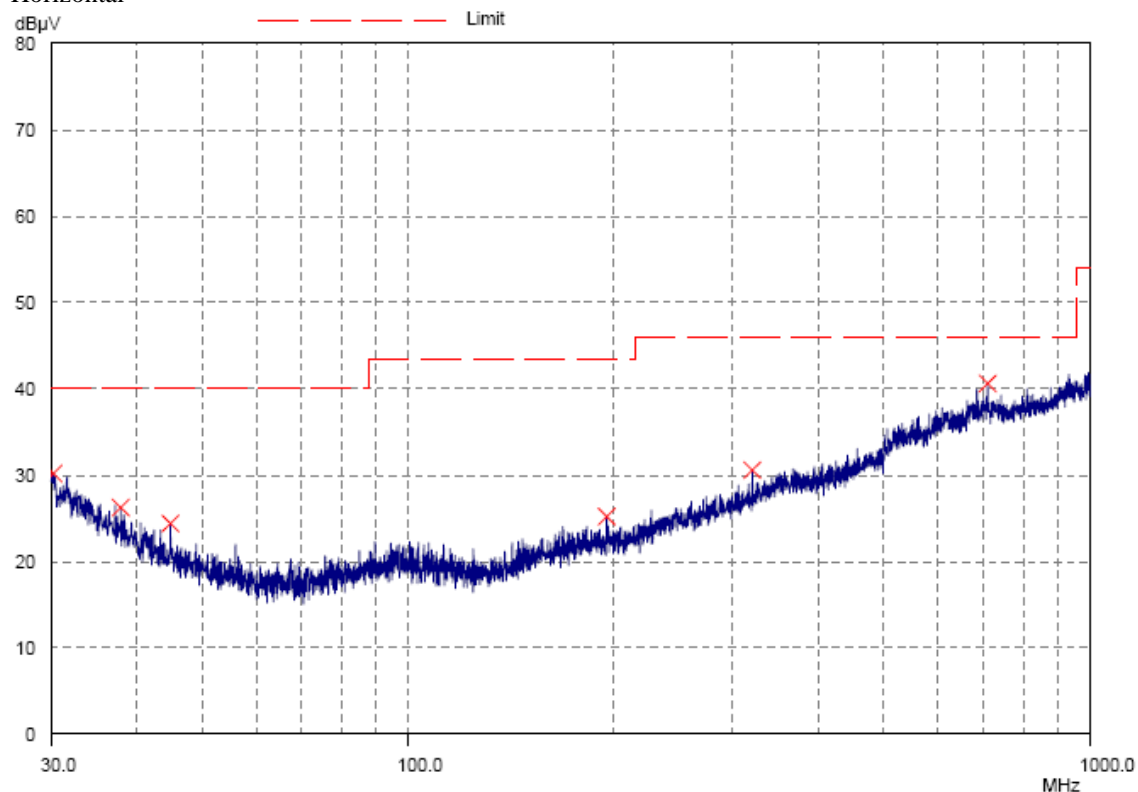
Frequency Range	Quasi-Peak Limits
[MHz]	[ $\mu\text{V/m}$ ]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

### Result of Bluetooth Communication mode (EUT paired with iPod) (GFSK / $\pi/4$ -DQPSK/ 8DPSK) (30MHz – 1GHz): Pass

Please refer to the following table for result details

#### Horizontal



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**Result of Bluetooth Communication mode (EUT paired with iPod) (GFSK /  $\pi/4$ -DQPSK/ 8DPSK)  
(30MHz – 1GHz): Pass**

<b>Radiated Emissions</b>					
<b>Quasi-Peak</b>					
Emission Frequency MHz	E-Field Polarity	Level @3m dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Level @3m $\mu$ V/m	Limit @3m $\mu$ V/m
30.3	Horizontal	30.2	43.5	32.3	150
38.0	Horizontal	26.3	43.5	20.6	150
44.9	Horizontal	24.4	43.5	16.6	150
196.0	Horizontal	25.2	46.0	18.2	200
320.4	Horizontal	30.6	46.0	33.9	200
709.4	Horizontal	40.6	46.0	107.2	200

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### Limits for Radiated Emissions [FCC 47 CFR 15.209 Class B]:

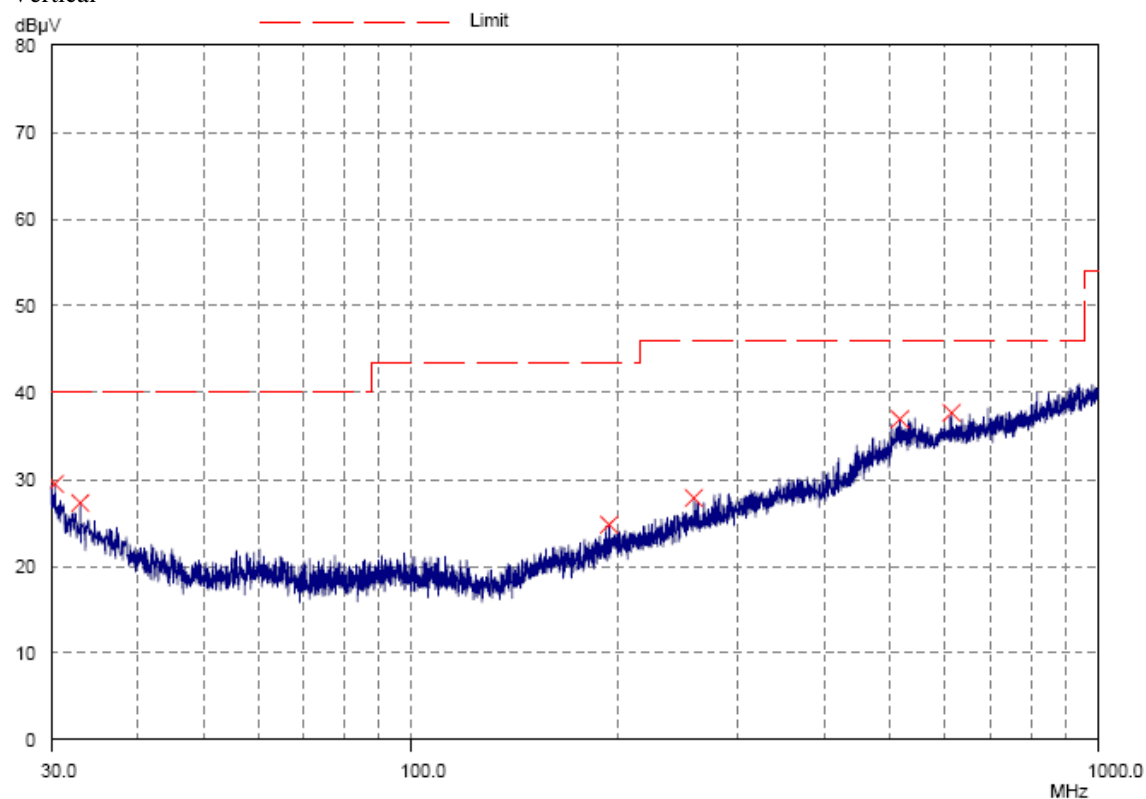
Frequency Range	Quasi-Peak Limits
[MHz]	[ $\mu\text{V/m}$ ]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

### Result of Bluetooth Communication mode (EUT paired with iPod) (GFSK / $\pi/4$ -DQPSK/ 8DPSK) (30MHz – 1GHz): Pass

Please refer to the following table for result details

Vertical



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**Result of Bluetooth Communication mode (EUT paired with iPod) (GFSK /  $\pi/4$ -DQPSK/ 8DPSK)  
(30MHz – 1GHz): Pass**

<b>Radiated Emissions Quasi-Peak</b>					
Emission Frequency MHz	E-Field Polarity	Level @3m dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Level @3m $\mu$ V/m	Limit @3m $\mu$ V/m
30.4	Vertical	29.5	43.5	29.9	150
33.1	Vertical	27.3	43.5	23.2	150
194.6	Vertical	24.8	46.0	17.4	200
258.4	Vertical	27.9	46.0	24.8	200
515.6	Vertical	36.9	46.0	70.0	200
613.3	Vertical	37.7	46.0	76.7	200

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### **Limits for Radiated Emissions [FCC 47 CFR 15.209 Class B]:**

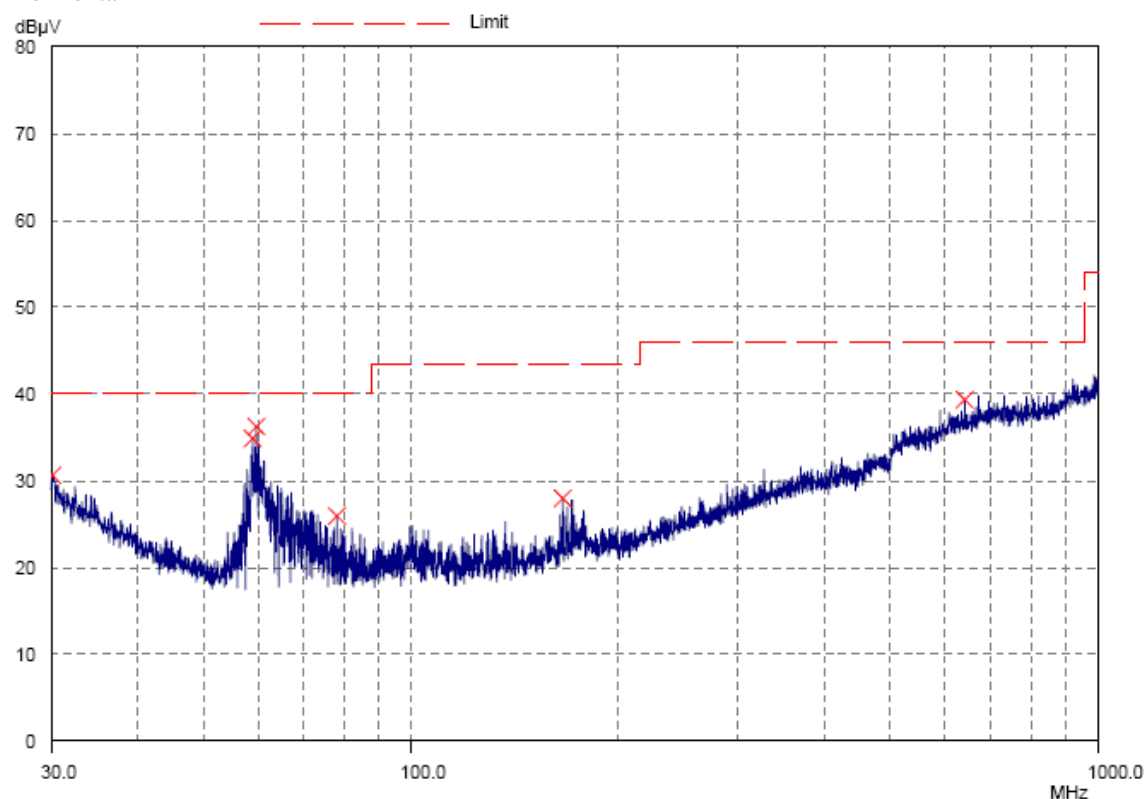
Frequency Range	Quasi-Peak Limits
[MHz]	[ $\mu$ V/m]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

### **Result of Bluetooth Communication mode (EUT paired with iPod, USB port connected to PC) (GFSK / $\pi$ /4-DQPSK/ 8DPSK) (30MHz – 1GHz): Pass**

Please refer to the following table for result details

#### Horizontal



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**Result of Bluetooth Communication mode (EUT paired with iPod, USB port connected to PC)**  
**(GFSK /  $\pi$ /4-DQPSK/ 8DPSK) (30MHz – 1GHz): Pass**

<b>Radiated Emissions</b>					
<b>Quasi-Peak</b>					
Emission Frequency MHz	E-Field Polarity	Level @3m dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Level @3m $\mu$ V/m	Limit @3m $\mu$ V/m
30.1	Horizontal	30.6	43.5	33.9	150
58.9	Horizontal	34.9	43.5	55.6	150
59.7	Horizontal	35.0	43.5	56.2	150
78.1	Horizontal	26.0	46.0	20.0	200
166.6	Horizontal	28.0	46.0	25.1	200
640.5	Horizontal	39.4	46.0	93.3	200

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### Limits for Radiated Emissions [FCC 47 CFR 15.209 Class B]:

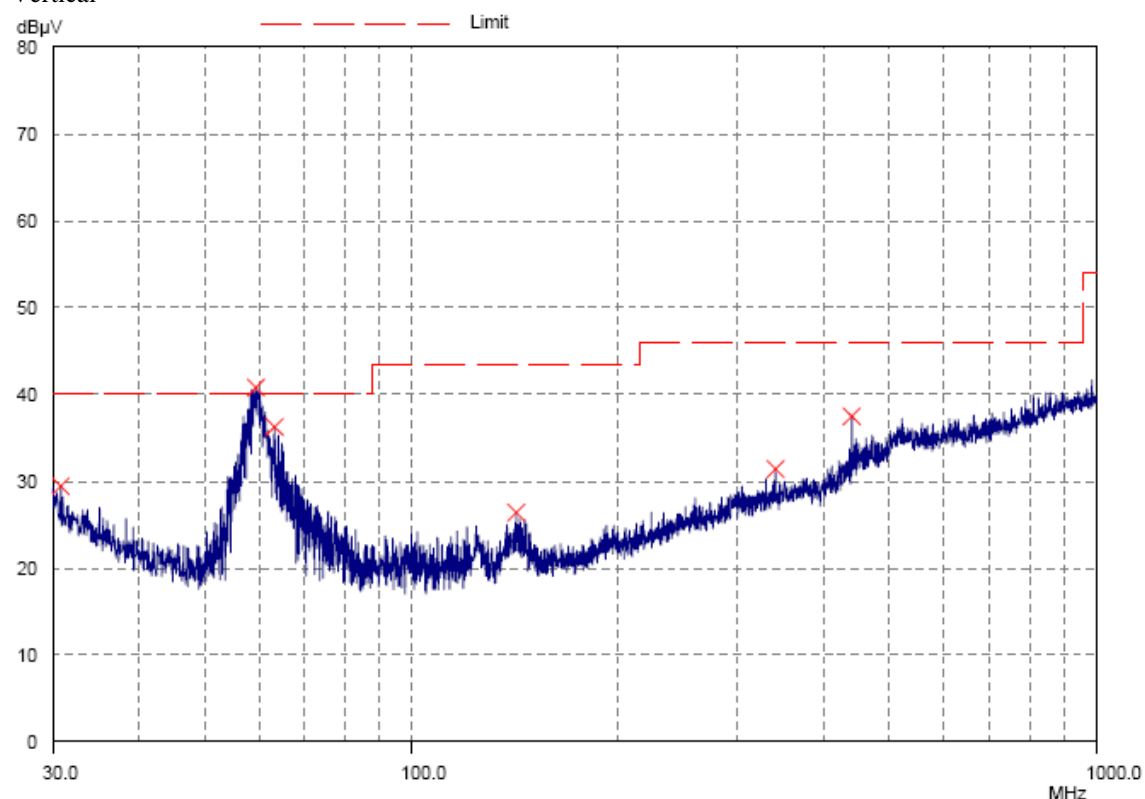
Frequency Range	Quasi-Peak Limits
[MHz]	[ $\mu$ V/m]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

### Result of Bluetooth Communication mode (EUT paired with iPod, USB port connected to PC) (GFSK / $\pi$ /4-DQPSK/ 8DPSK) (30MHz – 1GHz): Pass

Please refer to the following table for result details

Vertical



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**Result of Bluetooth Communication mode (EUT paired with iPod, USB port connected to PC)  
(GFSK /  $\pi$ /4-DQPSK/ 8DPSK) (30MHz – 1GHz): Pass**

<b>Radiated Emissions</b>					
<b>Quasi-Peak</b>					
Emission Frequency MHz	E-Field Polarity	Level @ 3m dB $\mu$ V/m	Limit @ 3m dB $\mu$ V/m	Level @ 3m $\mu$ V/m	Limit @ 3m $\mu$ V/m
30.8	Vertical	29.5	43.5	29.9	150
59.4	Vertical	39.5	43.5	94.4	150
63.3	Vertical	35.5	46.0	59.6	200
142.4	Vertical	26.4	46.0	20.9	200
340.8	Vertical	31.4	46.0	37.2	200
440.0	Vertical	37.5	46.0	75.0	200

**Remarks:**

Calculated measurement uncertainty (30MHz – 1GHz): 4.6dB

Emissions in the vertical and horizontal polarizations have been investigated and the worst-case test results are recorded in this report.

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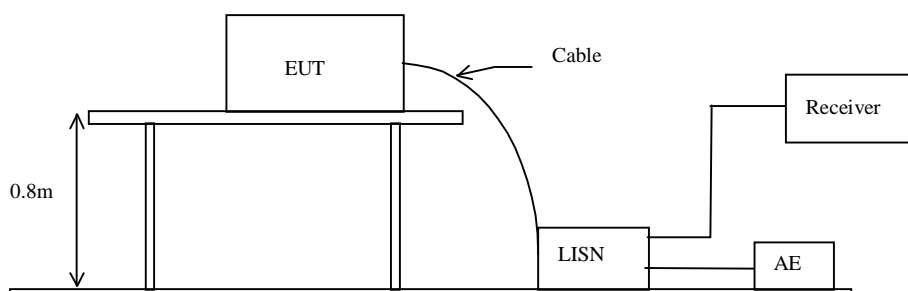
### **3.1.3 AC Mains Conducted Emissions (0.15MHz to 30MHz)**

Test Requirement:	FCC 47CFR 15.207
Test Method:	ANSI C63.4:2009
Test Date:	2014-06-30
Mode of Operation:	Bluetooth Communication mode
Test Voltage:	120Va.c., 60Hz

#### **Test Method:**

The test was performed in accordance with ANSI C63.4: 2009, with the following: an initial measurement was performed in peak and average detection mode on the live line, any emissions recorded within 30dB of the relevant limit line were re-measured using quasi-peak and average detection on the live and neutral lines with the worst case recorded in the table of results.

#### **Test Setup:**



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### Limit for Conducted Emissions (FCC 47 CFR 15.207):

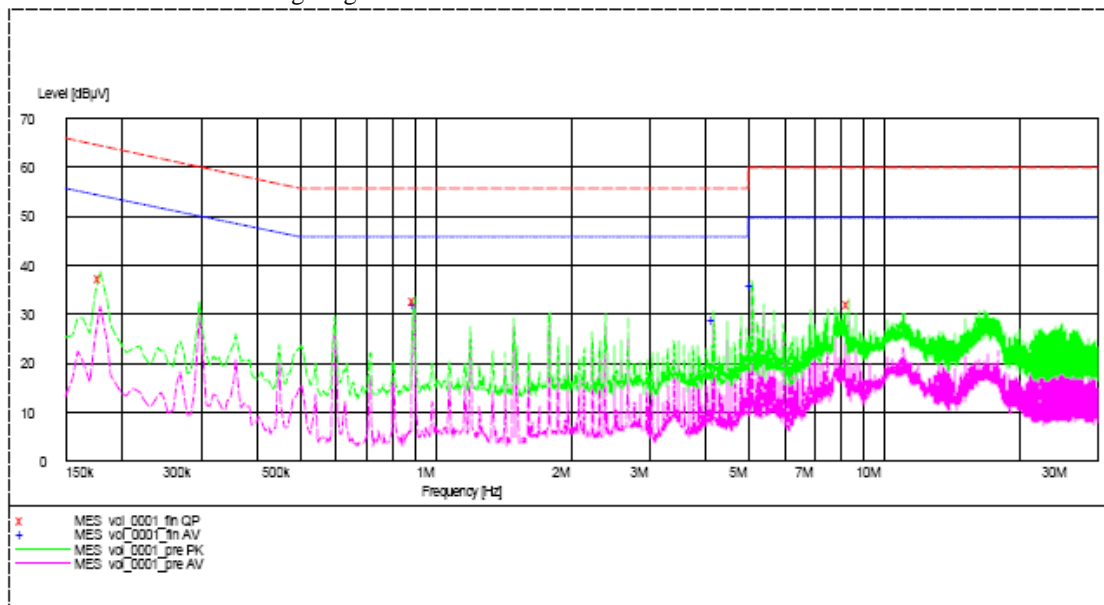
Frequency Range [MHz]	Quasi-Peak Limits [dBμV]	Average [dBμV]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

\* Decreases with the logarithm of the frequency.

Limits for Conducted Emissions Test, please refer to limit lines (Quasi-Peak and Average) in the following diagram.

### Result of Bluetooth Communication mode (EUT paired with iPod, USB port connected to PC) (L): PASS

Please refer to the following diagram for individual results.



Conductor Live or Neutral	Frequency MHz	Quasi-peak		Average	
		Level dBμV	Limit dBμV	Level dBμV	Limit dBμV
Live	0.180	37.3	65.0	-*-	-*-
Live	0.900	33.0	56.0	-*-	-*-
Live	8.395	32.2	60.0	-*-	-*-
Live	0.900	-*-	-*-	32.0	46.0
Live	4.195	-*-	-*-	28.8	46.0
Live	5.095	-*-	-*-	35.9	50.0

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### Limit for Conducted Emissions (FCC 47 CFR 15.207):

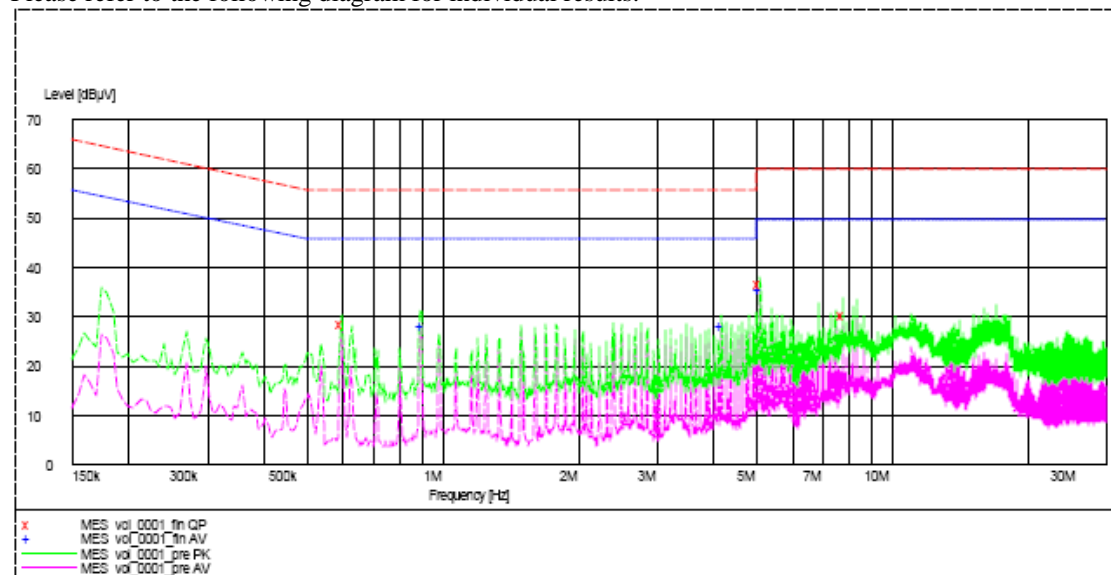
Frequency Range [MHz]	Quasi-Peak Limits [dBμV]	Average [dBμV]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

\* Decreases with the logarithm of the frequency.

Limits for Conducted Emissions Test, please refer to limit lines (Quasi-Peak and Average) in the following diagram.

### Result of Bluetooth Communication mode (EUT paired with iPod, USB port connected to PC) (N): PASS

Please refer to the following diagram for individual results.



Conductor Live or Neutral	Frequency MHz	Quasi-peak		Average	
		Level dBμV	Limit dBμV	Level dBμV	Limit dBμV
Neutral	0.600	28.5	56.0	-*-	-*-
Neutral	5.095	36.8	60.0	-*-	-*-
Neutral	7.790	30.5	60.0	-*-	-*-
Neutral	0.900	-*-	-*-	28.3	46.0
Neutral	4.195	-*-	-*-	28.4	46.0
Neutral	5.095	-*-	-*-	35.6	50.0

Remarks:

Calculated measurement uncertainty (0.15MHz – 30MHz): 3.2dB

-\*- Emission(s) that is far below the corresponding limit line.

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### 3.1.4 Number of Hopping Frequency

#### Limit of Number of Hopping Frequency

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels

#### Test Method:

The RF output of the EUT was connected to the spectrum analyzer by a low loss cable.

#### Spectrum Analyzer Setting:

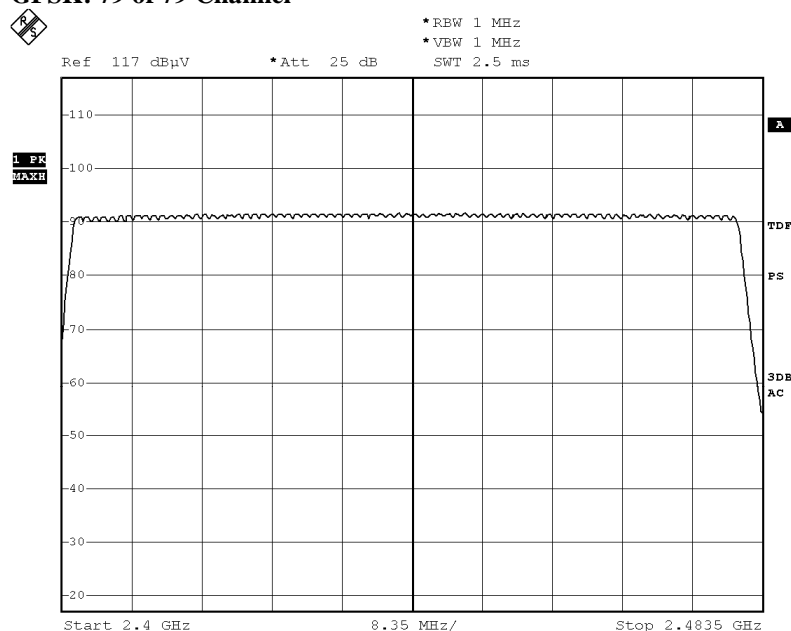
RBW = 1MHz, VBW  $\geq$  RBW, Sweep = Auto, Span = the frequency band of operation  
Detector = Peak, Trace = Max. hold

#### Test Setup:

As Test Setup of clause 3.1.1 in this test report.

#### Measurement Data:

##### GFSK: 79 of 79 Channel



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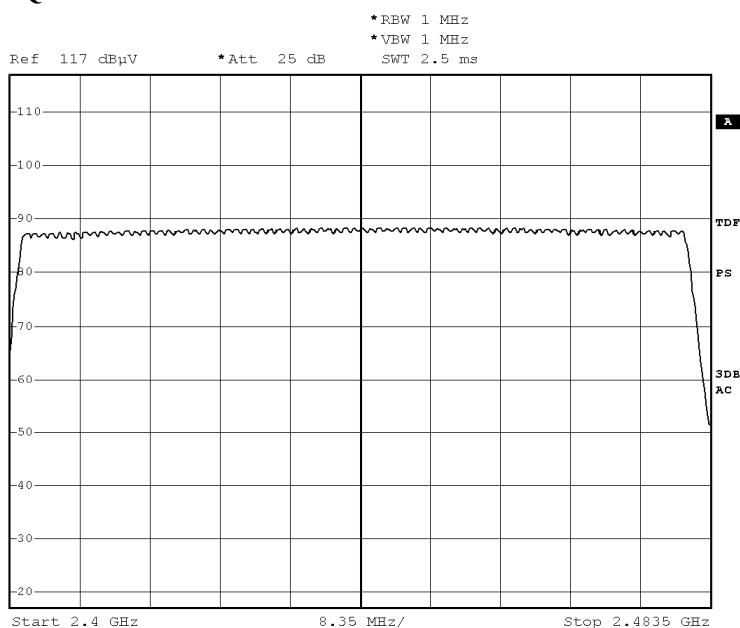
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### $\pi/4$ -DQPSK: 79 of 79 Channel



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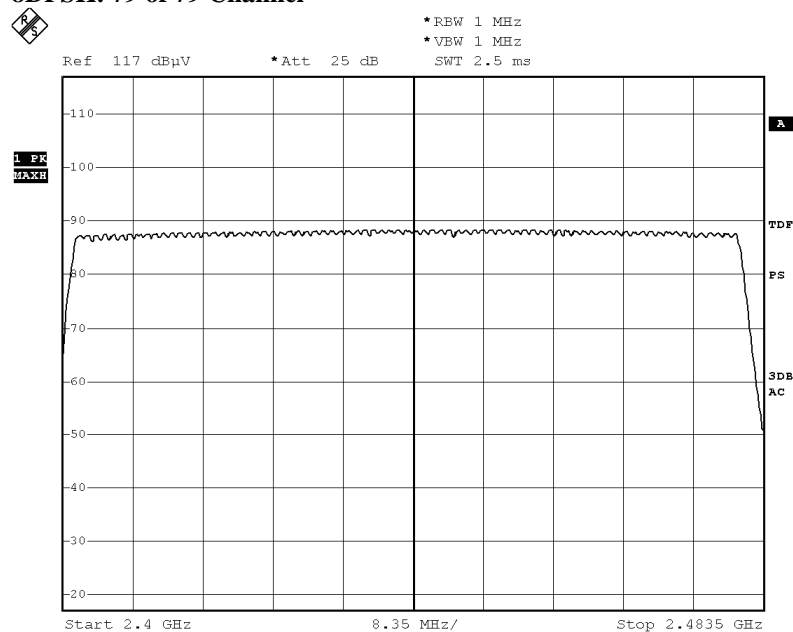
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### 8DPSK: 79 of 79 Channel



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### **3.1.5 20dB Bandwidth**

Test Requirement:	FCC 47CFR 15.247(a)(1)
Test Method:	ANSI C63.4:2009
Test Date:	2014-07-10
Mode of Operation:	Communication mode

#### **Remark:**

The result has been done on all the possible configurations for searching the worst cases.

#### **Test Method:**

The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst-case (i.e. the widest) bandwidth.

#### **Test Setup:**

As Test Setup of clause 3.1.1 in this test report.

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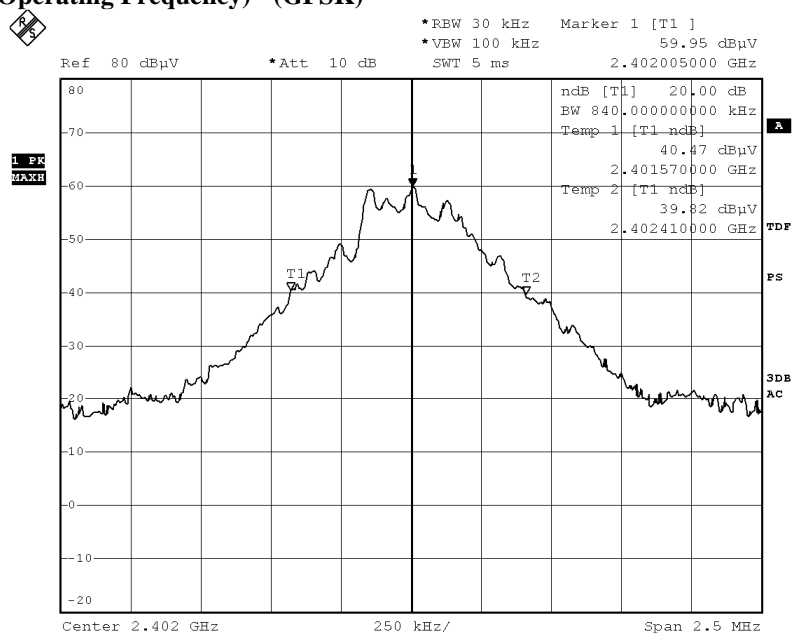
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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	0.840	Within 2400-2483.5

### (Lowest Operating Frequency) - (GFSK)



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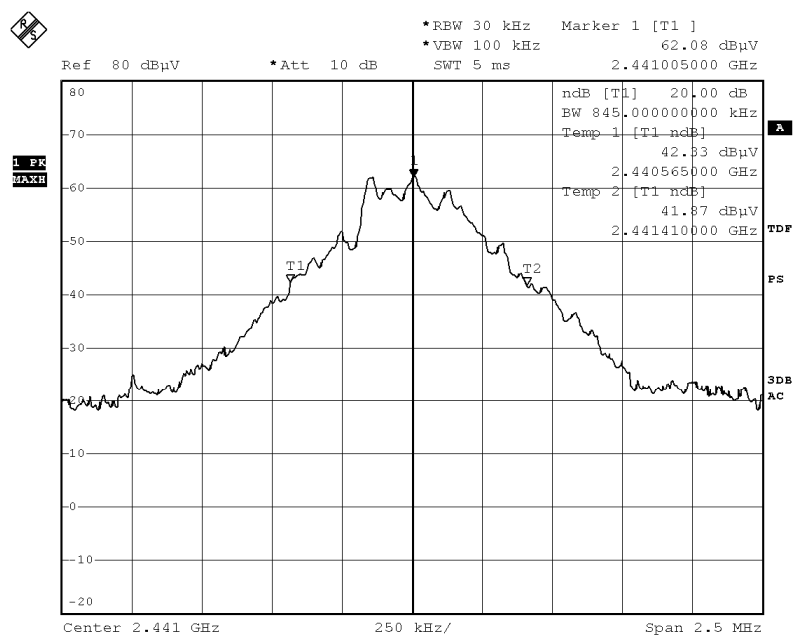
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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2441	0.845	Within 2400-2483.5

### (Middle Operating Frequency) - (GFSK)



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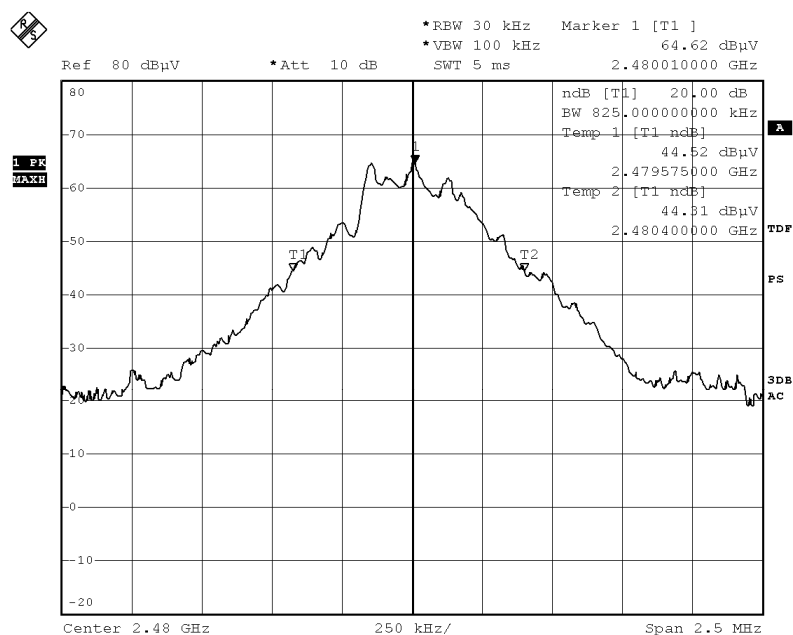
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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2480	0.825	Within 2400-2483.5

### (Highest Operating Frequency) - (GFSK)



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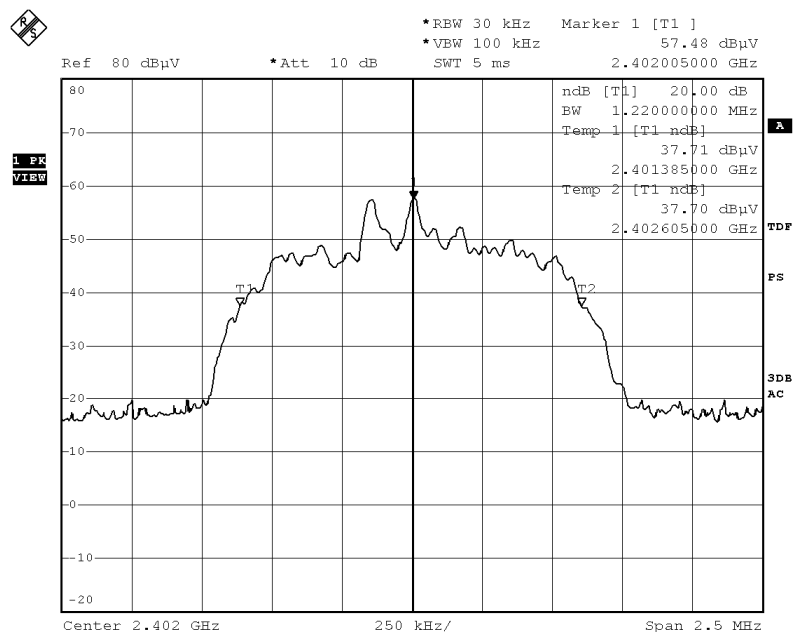
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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	1.220	Within 2400-2483.5

### (Lowest Operating Frequency) - ( $\pi/4$ -DQPSK)



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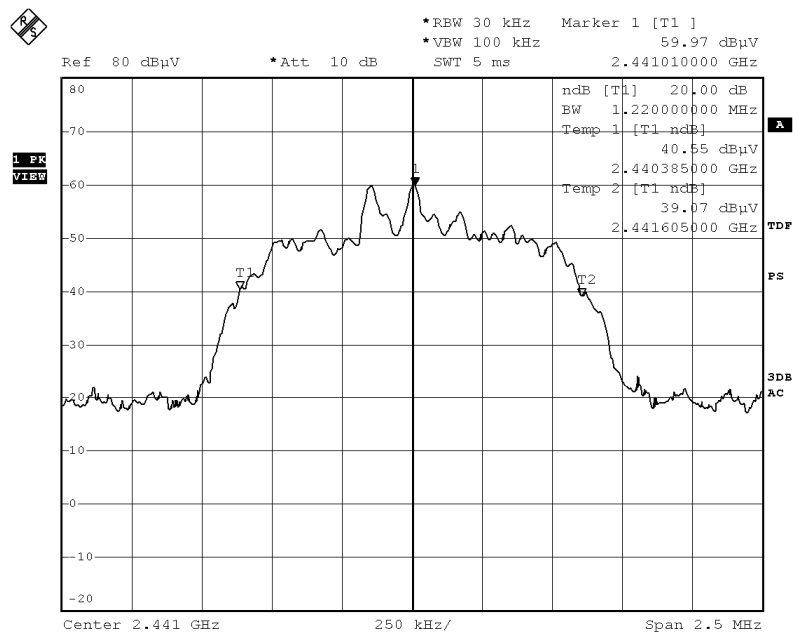
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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2441	1.220	Within 2400-2483.5

(Middle Operating Frequency) - ( $\pi/4$  -DQPSK)



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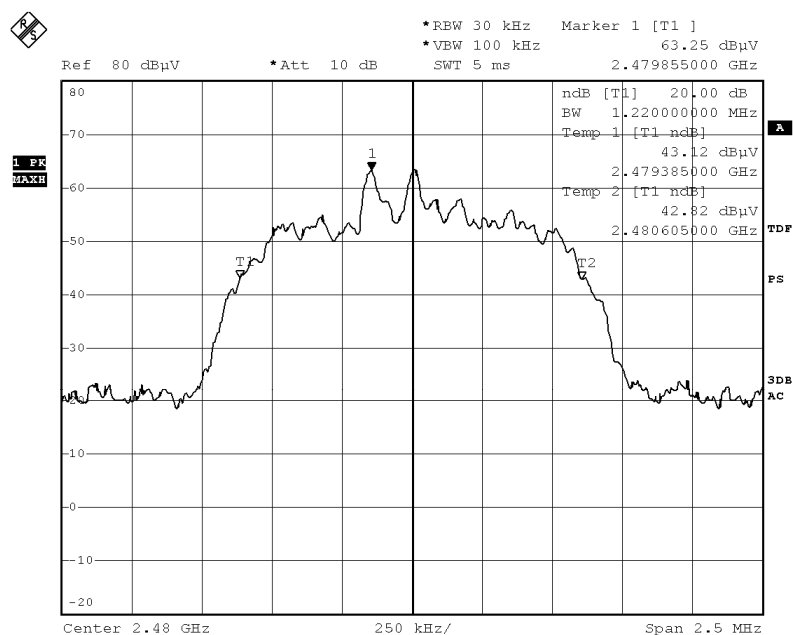
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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2480	1.220	Within 2400-2483.5

### (Highest Operating Frequency) - ( $\pi/4$ -DQPSK)



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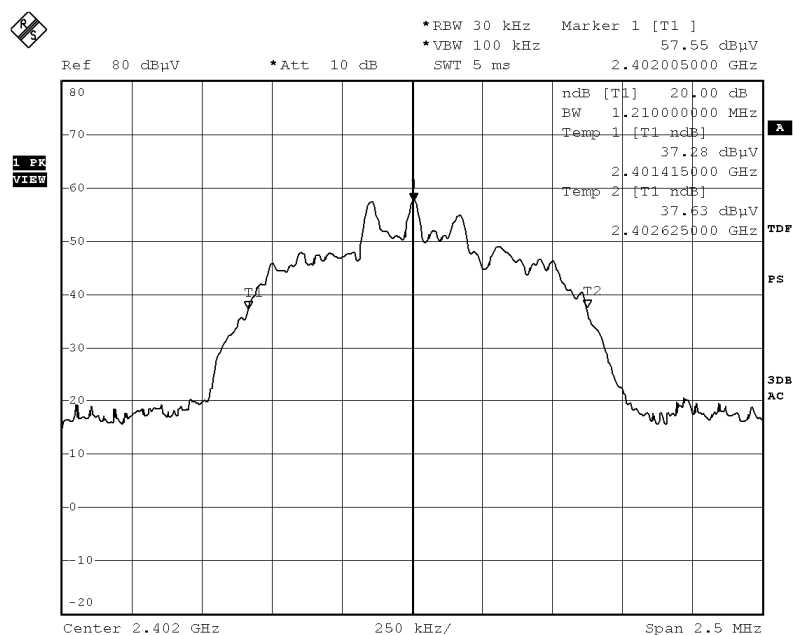
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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	1.210	Within 2400-2483.5

### (Lowest Operating Frequency) - (8DPSK)



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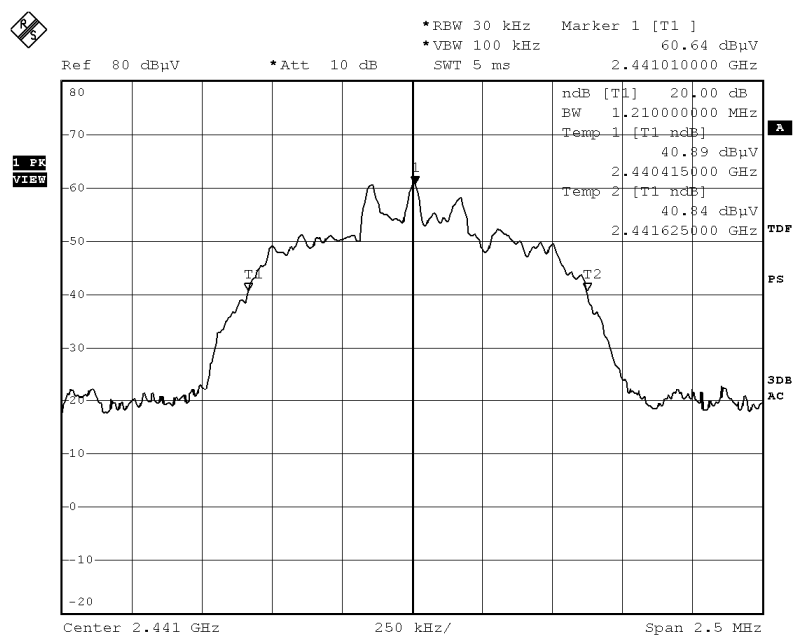
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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2441	1.210	Within 2400-2483.5

### (Middle Operating Frequency) - (8DPSK)



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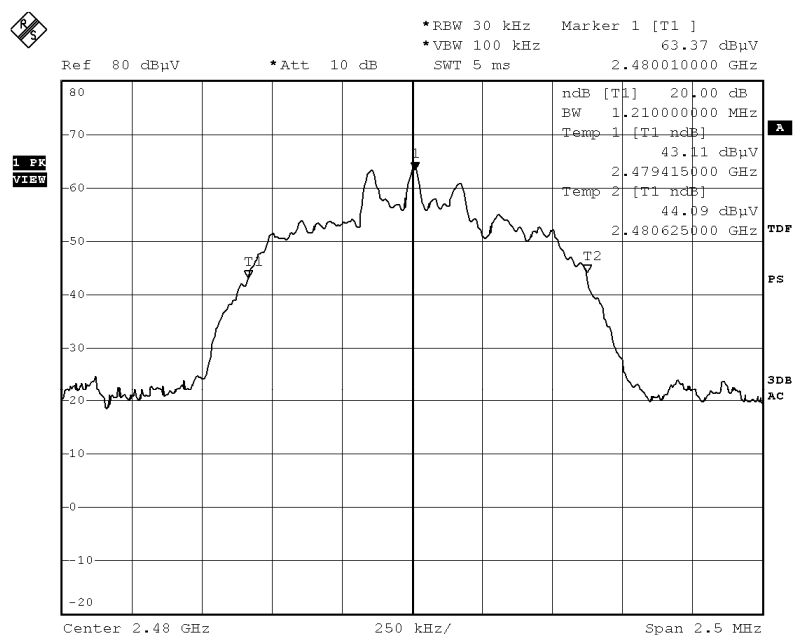
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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2480	1.210	Within 2400-2483.5

### (Highest Operating Frequency) - (8DPSK)



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### **3.1.6 Hopping Channel Separation**

#### **Requirements:**

Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

#### **Limit:**

The measured maximum bandwidth  $\times \frac{2}{3} = 1.220\text{MHz} \times \frac{2}{3} = 813.333\text{kHz}$

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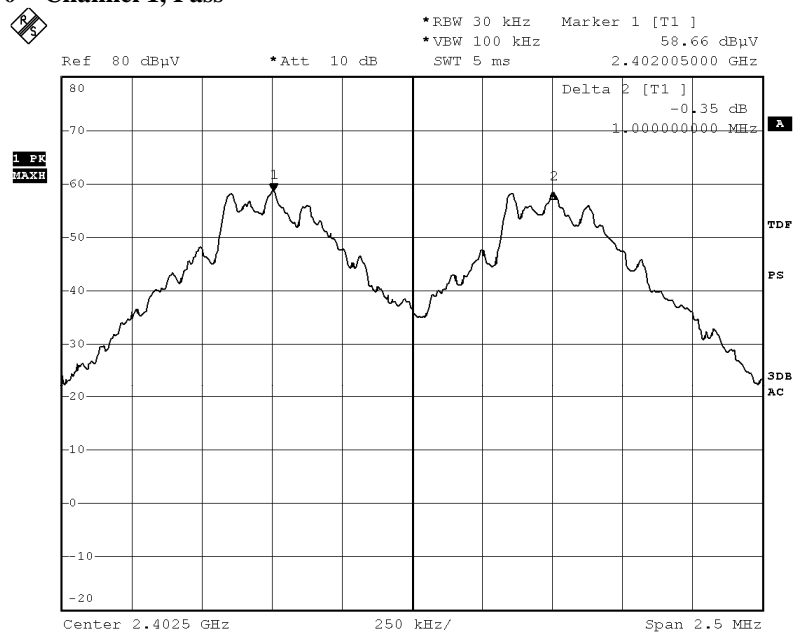
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Channel separation = 1MHz (>813.333kHz) (GFSK)

Channel 0 – Channel 1, Pass



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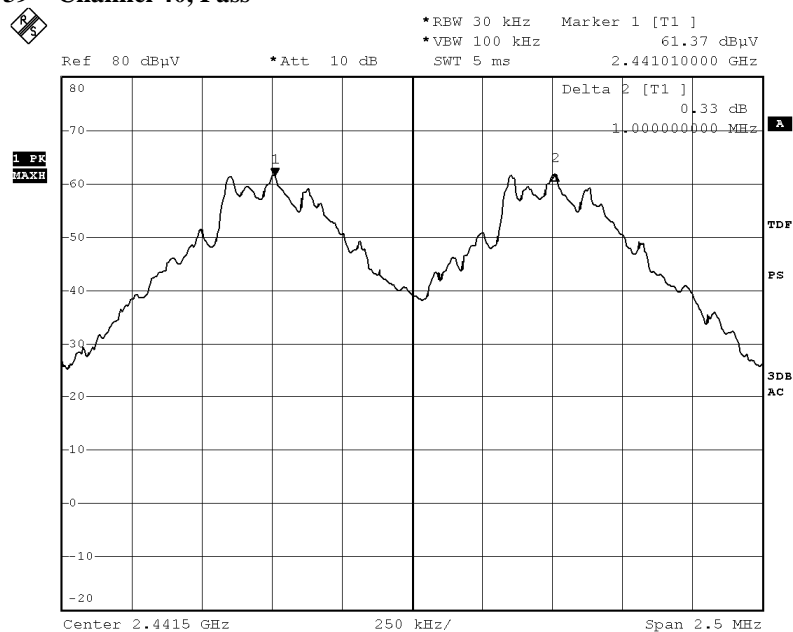
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### Channel 39 – Channel 40, Pass



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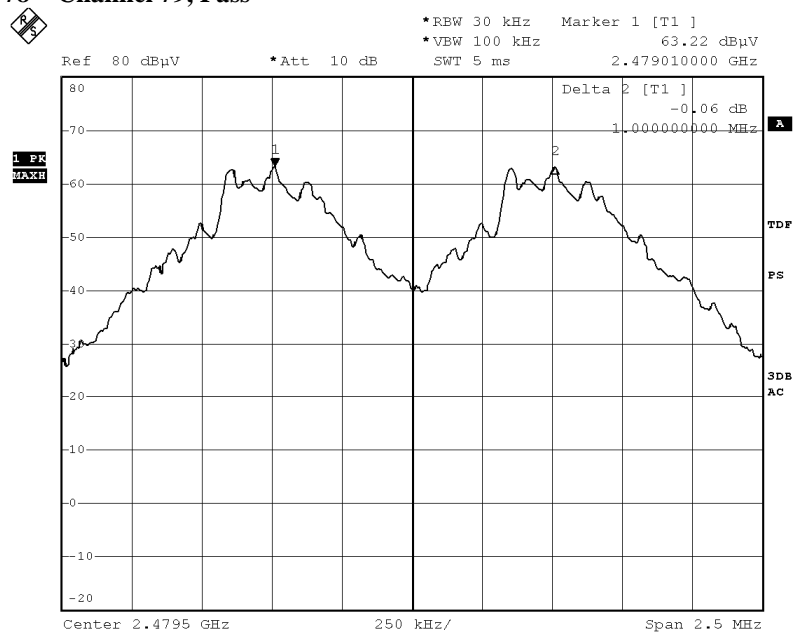
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### Channel 78 – Channel 79, Pass



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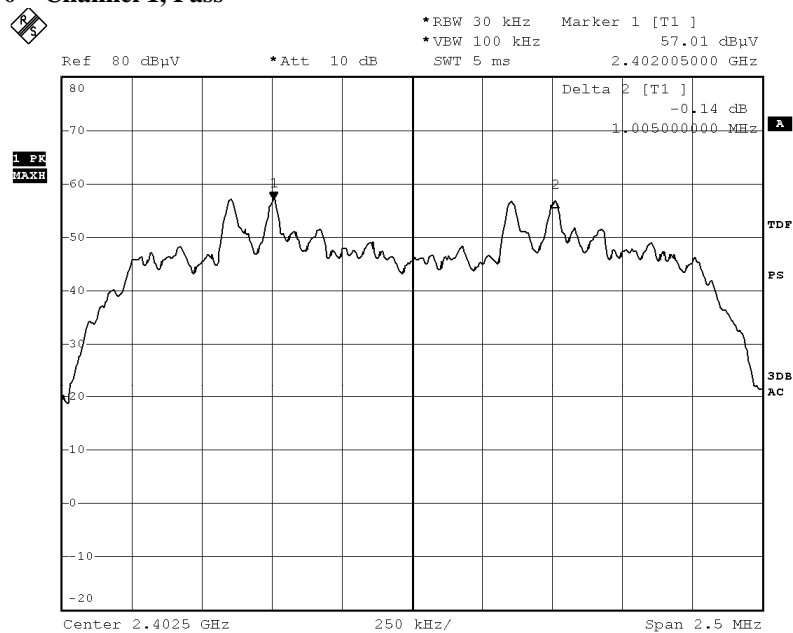
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Channel separation = 1MHz (>813.333kHz) ( $\pi/4$ - DQPSK)

Channel 0 – Channel 1, Pass



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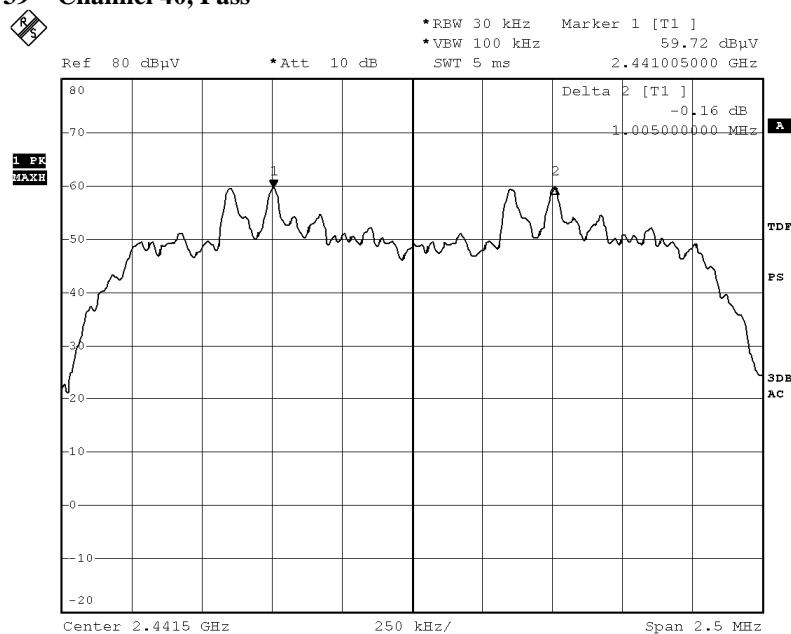
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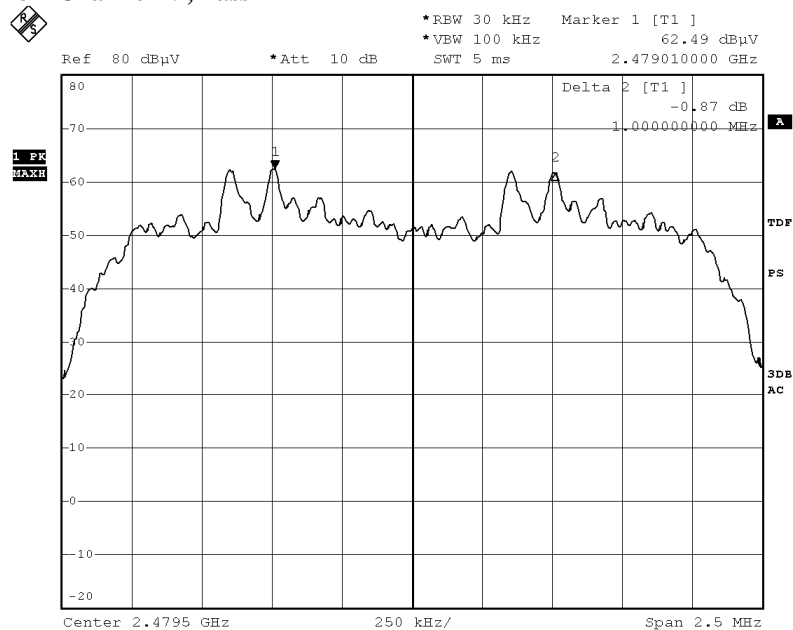
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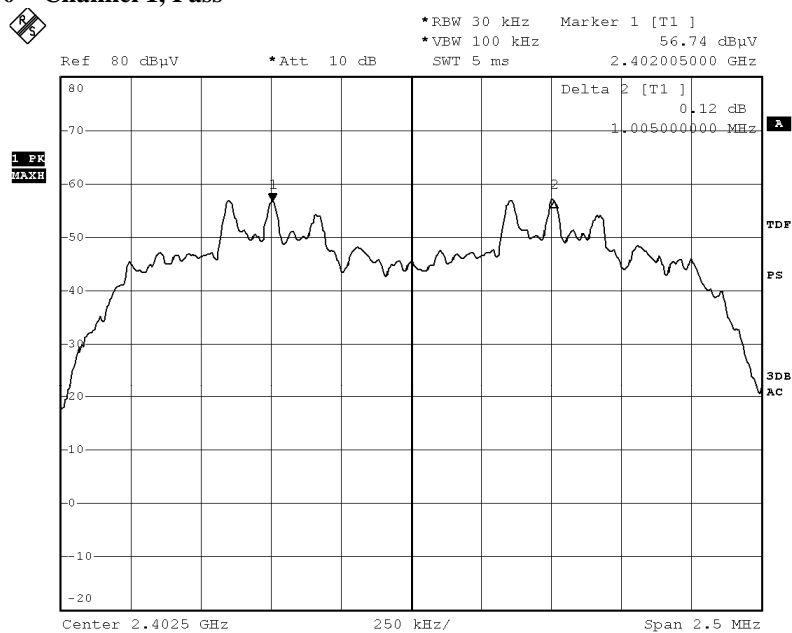
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Channel separation = 1MHz (>813.333kHz) (8DPSK)  
Channel 0 – Channel 1, Pass



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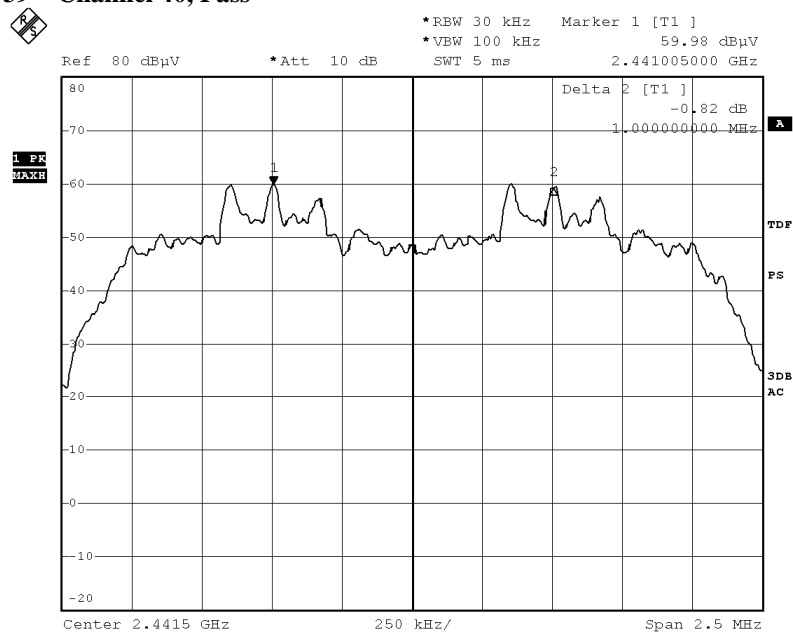
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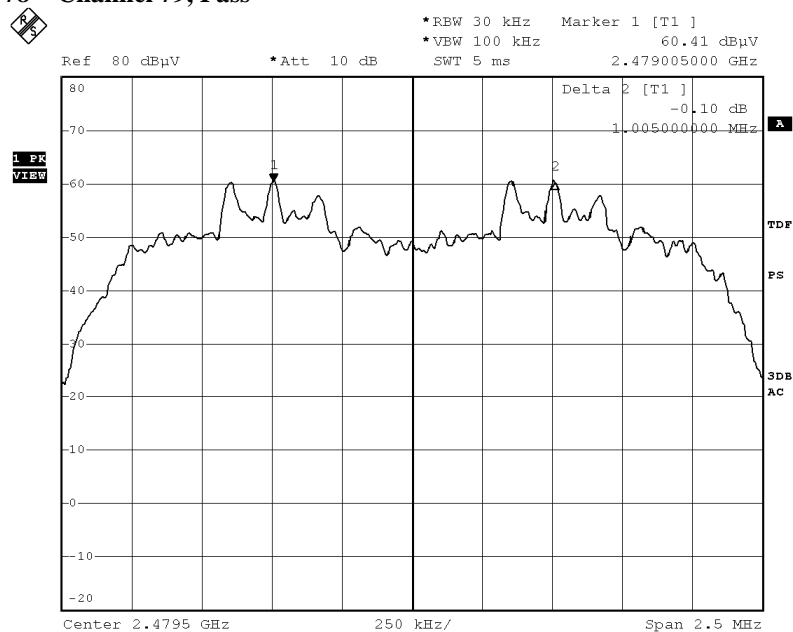
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### Channel 78 – Channel 79, Pass



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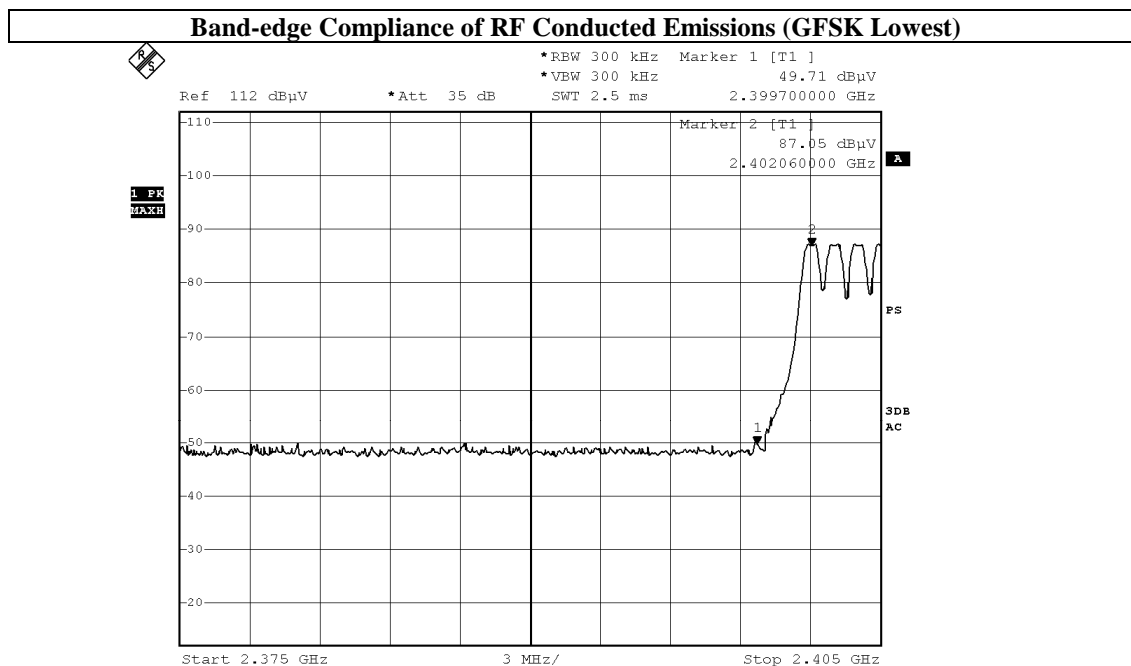
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### 3.1.7 Band-edge Compliance of RF Conducted Emissions Measurement:

#### Limit :

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	42.73



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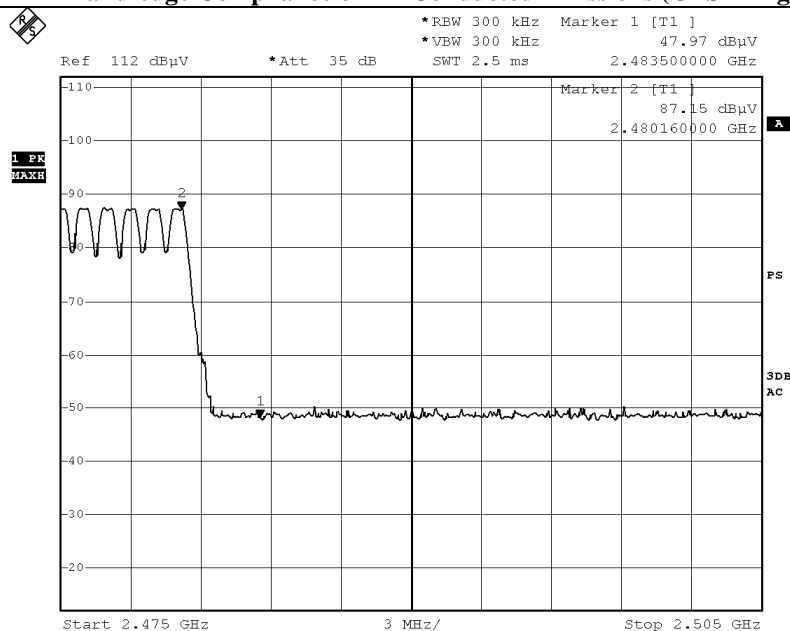
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### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range	Radiated Emission Attenuated below the Fundamental
[MHz]	[dB]
Highest Fundamental (2480) - 2483.5	39.18

### Band-edge Compliance of RF Conducted Emissions (GFSK Highest)



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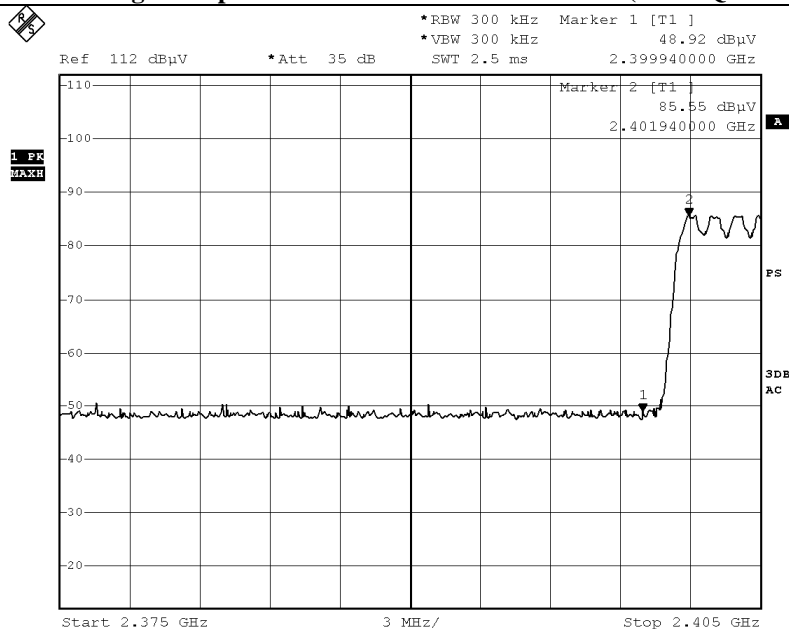
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### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range	Radiated Emission Attenuated below the Fundamental
[MHz]	[dB]
2400 - Lowest Fundamental (2402)	36.63

### Band-edge Compliance of RF Conducted Emissions ( $\pi/4$ -DQPSK Lowest)



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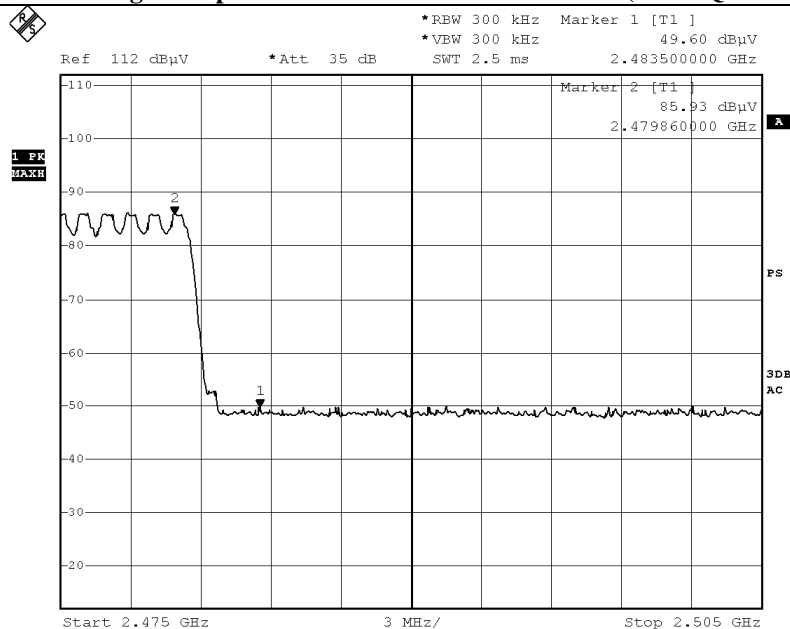
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### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range	Radiated Emission Attenuated below the Fundamental
[MHz]	[dB]
Highest Fundamental (2480) - 2483.5	36.33

### Band-edge Compliance of RF Conducted Emissions ( $\pi/4$ -DQPSK Highest)



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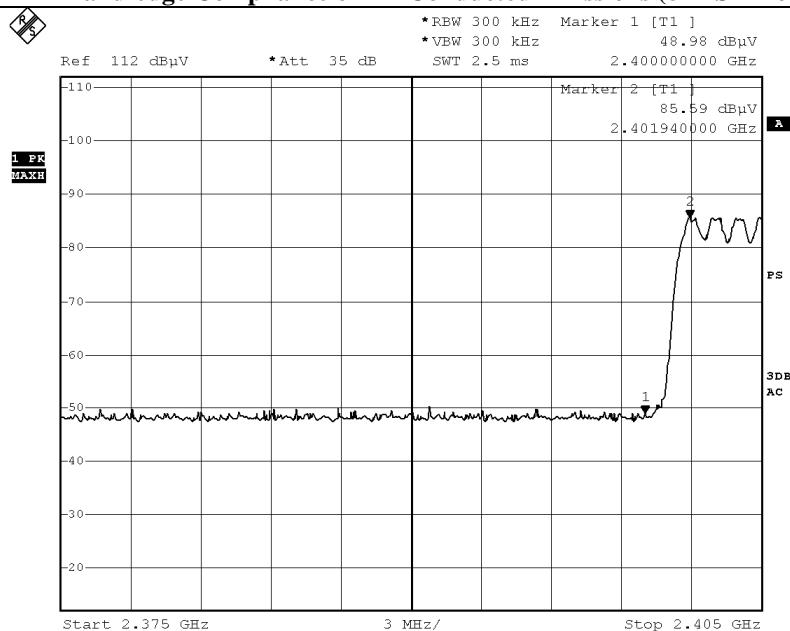
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### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range	Radiated Emission Attenuated below the Fundamental
[MHz]	[dB]
2400 - Lowest Fundamental (2402)	36.61

### Band-edge Compliance of RF Conducted Emissions (8DPSK Lowest)



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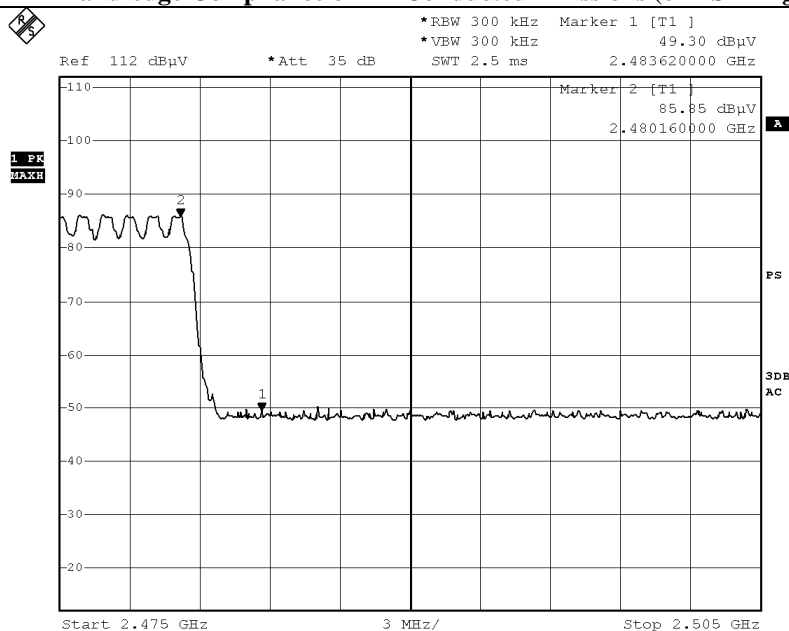
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### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range	Radiated Emission Attenuated below the Fundamental
[MHz]	[dB]
Highest Fundamental (2480) - 2483.5	36.55

### Band-edge Compliance of RF Conducted Emissions (8DPSK Highest)



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### **Band-edge Compliance of RF Radiated Emissions Measurement:**

#### **Limit :**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, 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) (see Section 5.205(c)).

### **Result: Band-edge Compliance of RF Radiated Emissions (GFSK Lowest)**

Field Strength of Band-edge Compliance Peak Value						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dBμV/m	E-Field Polarity
2400.0	18.6	35.4	54.0	74.0	20.0	Vertical
Field Strength of Band-edge Compliance Average Value						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dBμV/m	E-Field Polarity
2400.0	5.1	35.4	40.5	54.0	13.5	Vertical

### **Result: Band-edge Compliance of RF Radiated Emissions (GFSK Highest)**

Field Strength of Band-edge Compliance Peak Value						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dBμV/m	E-Field Polarity
2483.5	19.2	35.4	54.6	74.0	19.4	Horizontal
Field Strength of Band-edge Compliance Average Value						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dBμV/m	E-Field Polarity
2483.5	3.6	35.4	39.0	54.0	15.0	Horizontal

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**Result: Band-edge Compliance of RF Radiated Emissions ( $\pi/4$  -DQPSK Lowest)**

Field Strength of Band-edge Compliance Peak Value						
Frequency MHz	Measured Level @3m dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB $\mu$ V/m	E-Field Polarity
2400.0	19.3	35.4	54.7	74.0	19.3	Vertical
Field Strength of Band-edge Compliance Average Value						
Frequency MHz	Measured Level @3m dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB $\mu$ V/m	E-Field Polarity
2400.0	4.6	35.4	40.0	54.0	14.0	Vertical

**Result: Band-edge Compliance of RF Radiated Emissions ( $\pi/4$  -DQPSK Highest)**

Field Strength of Band-edge Compliance Peak Value						
Frequency MHz	Measured Level @3m dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB $\mu$ V/m	E-Field Polarity
2483.5	18.5	35.4	53.9	74.0	20.1	Horizontal
Field Strength of Band-edge Compliance Average Value						
Frequency MHz	Measured Level @3m dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB $\mu$ V/m	E-Field Polarity
2483.5	3.1	35.4	38.5	54.0	15.5	Horizontal

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**Result: Band-edge Compliance of RF Radiated Emissions (8DPSK Lowest)**

Field Strength of Band-edge Compliance Peak Value						
Frequency MHz	Measured Level @3m dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB $\mu$ V/m	E-Field Polarity
2400.0	18.9	35.4	54.3	74.0	19.7	Vertical
Field Strength of Band-edge Compliance Average Value						
Frequency MHz	Measured Level @3m dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB $\mu$ V/m	E-Field Polarity
2400.0	3.5	35.4	38.9	54.0	15.1	Vertical

**Result: Band-edge Compliance of RF Radiated Emissions (8DPSK Highest)**

Field Strength of Band-edge Compliance Peak Value						
Frequency MHz	Measured Level @3m dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB $\mu$ V/m	E-Field Polarity
2483.5	18.5	35.4	53.9	74.0	20.1	Horizontal
Field Strength of Band-edge Compliance Average Value						
Frequency MHz	Measured Level @3m dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB $\mu$ V/m	E-Field Polarity
2483.5	2.6	35.4	38.0	54.0	16.0	Horizontal

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### 3.1.8 Time of Occupancy (Dwell Time)

#### Requirements:

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

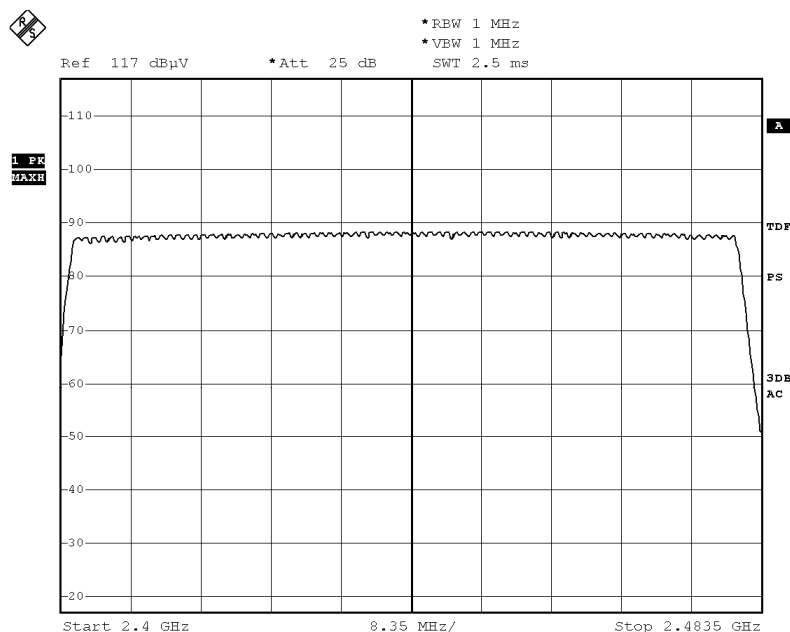
No requirements for Digital Transmission System.

**Dwell Time = Pulse Duration \* hop rate / number of channel \* observation duration**

**Observed duration: 0.4s x 79 = 31.6s**

#### Measurement Data:

**Channel Occupied in 8DPSK: 79 of 79 Channel**



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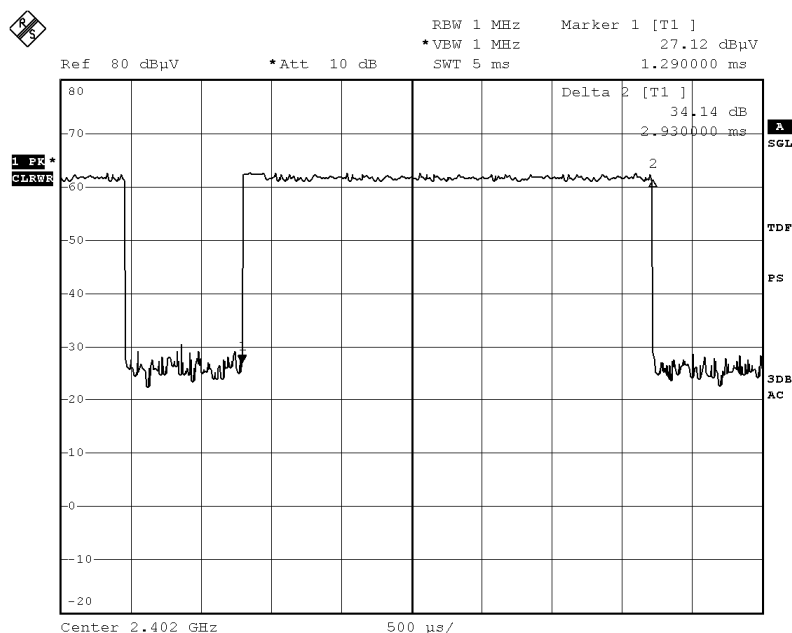
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### **DH5 Packet:**

DH5 Packet permit maximum  $1600/79/6 = 3.37$  hops per second in each channel (5 time slots RX, 1 time slot TX). The Dwell time is the time duration of the pulse times  $3.37 \times 31.6 = 106.6$  within 31.6 seconds

**Fig. A**  
**[Pulse duration of Lowest Channel]**



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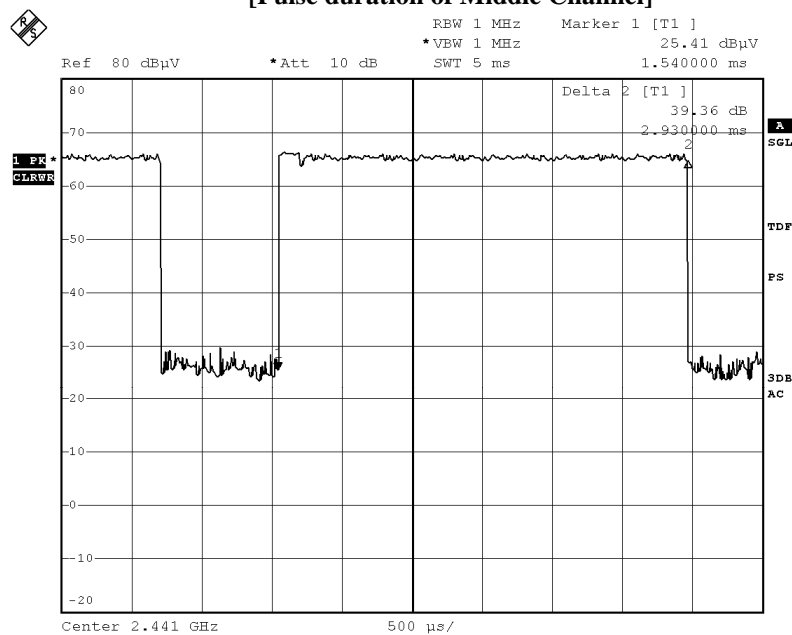
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**Fig. B**  
**[Pulse duration of Middle Channel]**



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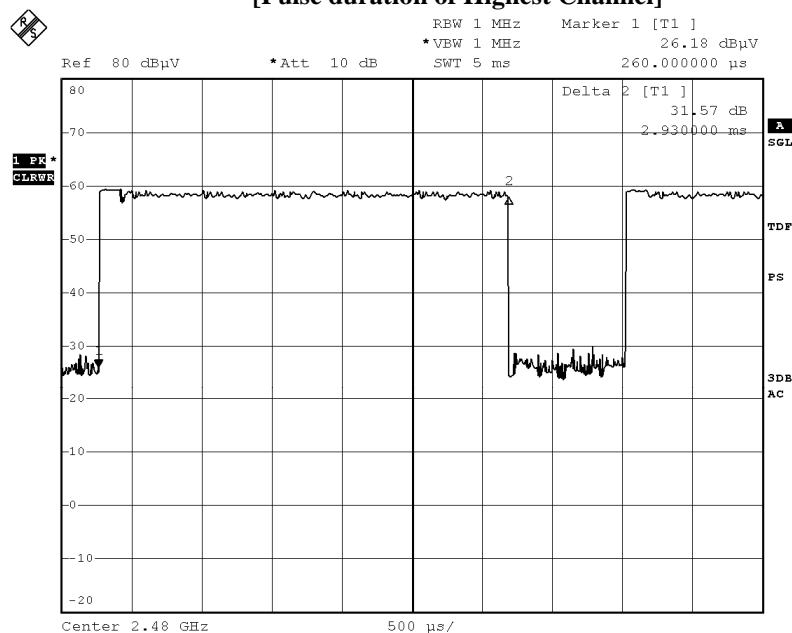
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**Fig. C**  
**[Pulse duration of Highest Channel]**



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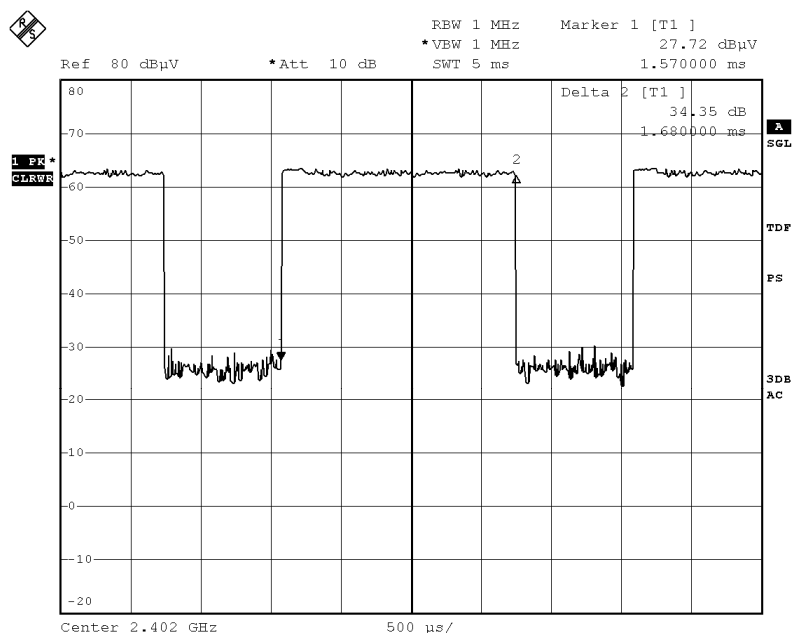
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### **DH3 Packet:**

DH3 Packet permit maximum  $1600/79/4 = 5.06$  hops per second in each channel (3 time slots RX, 1 time slot TX). The Dwell time is the time duration of the pulse times  $5.06 \times 31.6 = 160$  within 31.6 seconds

**Fig. D**  
**[Pulse duration of Lowest Channel]**



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Ref 80 dBμV      \*Att 10 dB      REW 1 MHz      Marker 1 [T1]      54.38 dBμV  
 \*VEW 1 MHz      1.040000 ms  
 Delta 2 [T1]      -26.87 dB  
 1.680000 ms

1 Fx  
 CLAW

Center 2.441 GHz      500 us/

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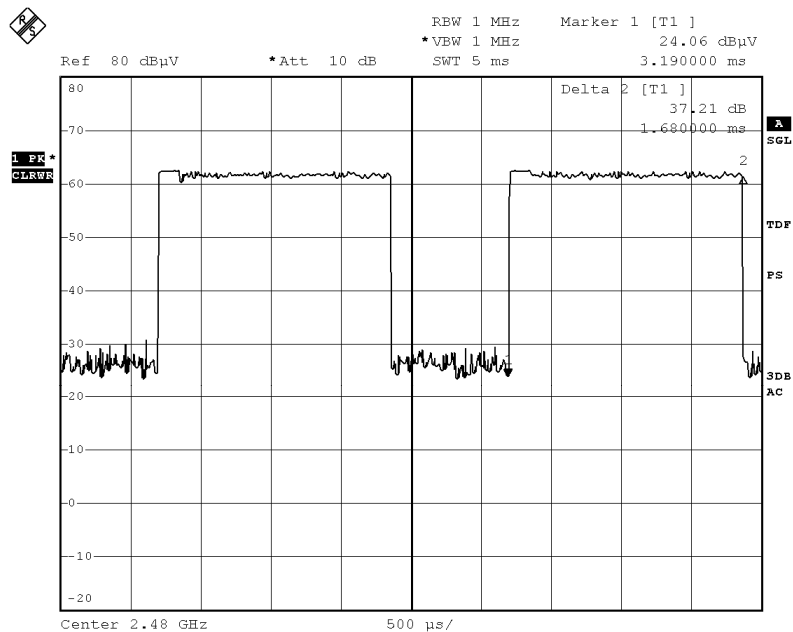
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**Fig. F**  
**[Pulse duration of Highest Channel]**



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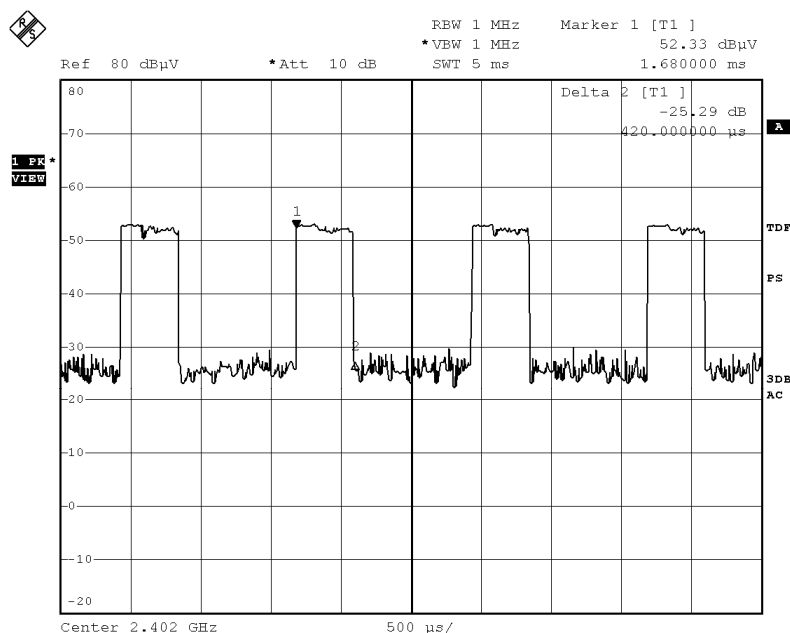
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### **DH1 Packet:**

DH1 Packet permit maximum  $1600/79/2 = 10.12$  hops per second in each channel (3 time slots RX, 1 time slot TX). The Dwell time is the time duration of the pulse times  $10.12 \times 31.6 = 320$  within 31.6 seconds

**Fig. G**  
**[Pulse duration of Lowest Channel]**



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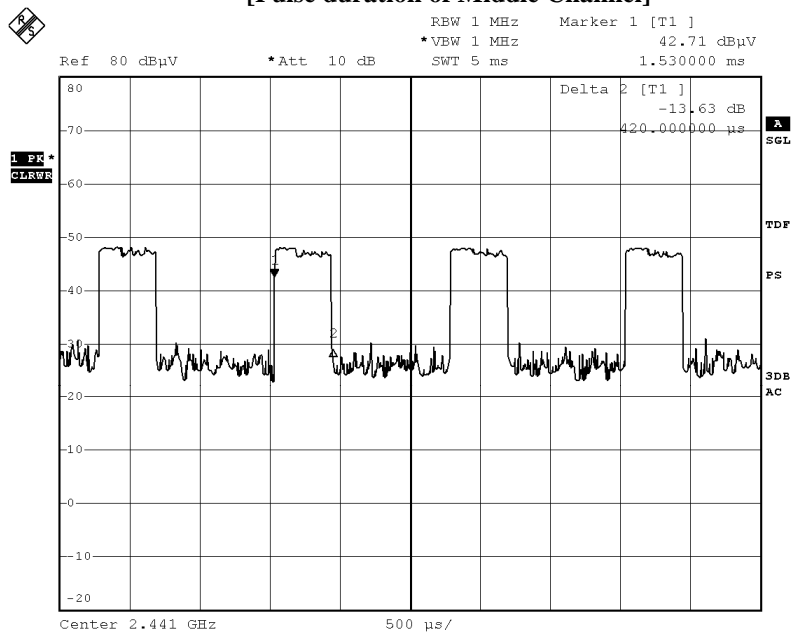
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**Fig. H**  
**[Pulse duration of Middle Channel]**



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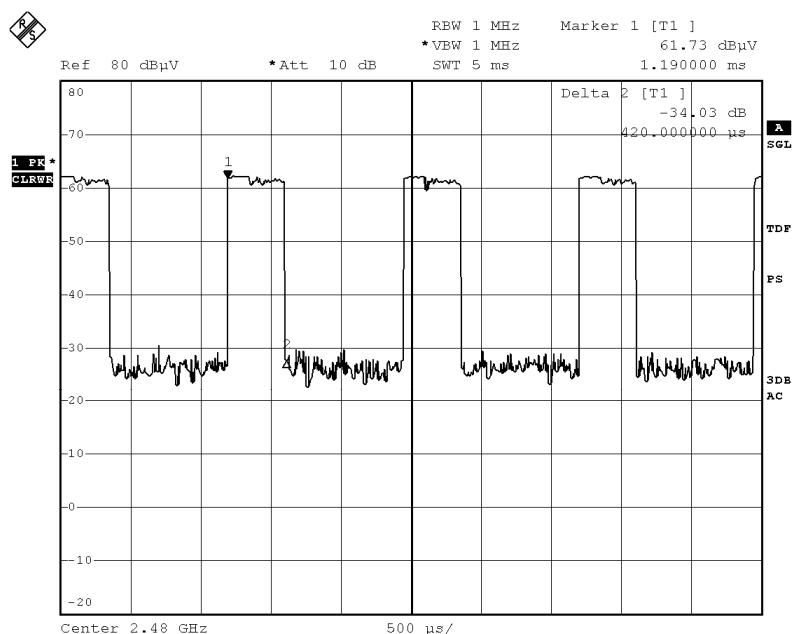
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**Fig. I**  
**[Pulse duration of Highest Channel]**



**Time of occupancy (Dwell Time):**

Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (s)	Limits (s)	Test Results
DH5	2402	2.930	0.312	0.400	Complies
DH5	2441	2.930	0.312	0.400	Complies
DH5	2480	2.930	0.312	0.400	Complies
DH3	2402	1.680	0.269	0.400	Complies
DH3	2441	1.680	0.269	0.400	Complies
DH3	2480	1.680	0.269	0.400	Complies
DH1	2402	0.420	0.134	0.400	Complies
DH1	2441	0.420	0.134	0.400	Complies
DH1	2480	0.420	0.134	0.400	Complies

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### **3.1.9 Channel Centre Frequency**

#### **Requirements:**

Frequency hopping system in the 2400-2483.5MHz band shall use at least 79 (Channel 0 to 78) non-overlapping channels.

The EUT operates in according with the Bluetooth system specification within the 2400 - 2483.5 MHz frequency band.

RF channels for Bluetooth systems are spaced 1 MHz and are ordered in channel number k. In order to comply with out-of-band regulations, a lower frequency guard band of 2.0 MHz and a higher frequency guard band of 3.5MHz is used.

The operating frequencies of each channel are as follows:

First RF channel start from 2400MHz + 2MHz guard band = 2402MHz

Frequency of RF Channel = 2402+k MHz, k = 0,...,78 (Channel separation = 1MHz)



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### **3.1.10 Pseudorandom Hopping Algorithm**

#### **Requirements:**

The channel frequencies shall be selected from a pseudorandom ordered list of hopping frequencies. Each frequency must be used equally by the transmitter.

#### **EUT Pseudorandom Hopping Algorithm**

The EUT is a Bluetooth device, the Pseudo-random hopping pattern; hopping characteristics and algorithm are based on the Bluetooth specification.

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### **3.1.11 Antenna Requirement**

#### **Test Requirements: § 15.203**

#### **Test Specification:**

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 a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

#### **Test Results:**

This is trace antenna module antenna. There is no external antenna, the antenna gain = 0dBi. User is unable to remove or changed the Antenna.

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### **3.12 RF Exposure**

Test Requirement:	FCC 47CFR 15.247(i)
Test Date:	2014-07-10
Mode of Operation:	<b>BT</b> mode
Dimension of EUT:	60mm x 60mm x 87mm

#### **Test Method:**

In 15.247(i), an equipment shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the limits in §§ 1.1310 and 2.1093 of this chapter.

Applications to the Commission for construction permits, licenses to transmit or renewals thereof, equipment authorizations or modifications in existing facilities must contain a statement confirming compliance with the limits unless the facility, operation, or transmitter is categorically excluded, as discussed below. Technical information showing the basis for this statement must be submitted to the Commission upon request.

According to KDB447498 D01 General RF Exposure Guidance v05, unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Exclusion Threshold condition.

#### **Test Results:**

#### **RF Exposure Evaluation**

The Maximum conducted output power = 1.58 mW (at frequency = 2.402 GHz)

**It's Conducted source-based time-averaging output power = 1.57 mW (at frequency = 2.402 GHz)**

**Since the SAR test exclusion thresholds for 2450MHz at test separation distances  $\leq 5$  mm = 10mW and the Conducted source-based time-averaging output power is less than 10mW.**

**Therefore, the SAR evaluation can be exempted.**

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### **Appendix A**

#### **List of Measurement Equipment**

<b>EQP NO.</b>	<b>DESCRIPTION</b>	<b>MANUFACTURER</b>	<b>MODEL NO.</b>	<b>SERIAL NO.</b>	<b>LAST CAL</b>	<b>DUE CAL</b>
EMD004	LISN	ROHDE & SCHWARZ	ESH3-Z5	100102	2013.03.15	2014.03.14
EMD022	EMI Test Receiver	ROHDE & SCHWARZ	ESCS30	100314	2013.03.15	2014.03.14
EMD035	EMI Test Receiver	ROHDE & SCHWARZ	ESCI	100441	2013.05.28	2014.05.27
EMD036	EMI Test Receiver	ROHDE & SCHWARZ	ESIB 26	100388	2013.05.28	2014.05.27
EMD041	TWO-LINE V-NETWORK	ROHDE & SCHWARZ	ENV216	100261	2013.05.28	2014.05.27
EMD061	Biconilog Antenna	ETS.LINDGREN	3142C	00060439	2012.11.03	2014.11.02
EMD062	Double-Ridged Waveguide (1GHz – 18GHz)	ETS.LINDGREN	3117	00075933	2012.11.28	2014.11.27
EMD084	MULTI-DVICE CONTROLLER	ETS.LINDGREN	2090	00060107	N/A	N/A
EMD088	Video Contol Unit	ETS.LINDGREN	Y21953A	2601073	N/A	N/A
EMD093	Monitor	ViewSonic	VA9036	Q8X064201876	N/A	N/A
EMD102	Intelligent Frequency	Ainuo Instrument Co., Ltd	AN97005SS	79707454	N/A	N/A
EMD103	Intelligent Frequency	Ainuo Instrument Co., Ltd	AN97005SS	79707455	N/A	N/A
EMD105	FACT-3 EMC Chamber	ETS.LINDGREN	FACT-3	3803	N/A	N/A
EMD106	Shielding Room #1	ETS.LINDGREN	RFD-100	3802	N/A	N/A
EMD111	Power meter	ROHDE & SCHWARZ	NRVD	102051	2013.03.15	2014.03.14
	100V Insertion Unit	ROHDE & SCHWARZ	URV5-Z4	100464	2013.03.15	2014.03.14
EMD113	Pre-Amplifier	ROHDE & SCHWARZ	N/A	1129588	2013.03.15	2014.03.14
EMD124	Loop Antenna	ETS-Lindgren	6502	00104905	2012.03.26	2014.03.25
EMD131	Standard Gain Horn Antenna (18GHz – 26.5GHz)	Chengdu AINFO Inc.	JTXSLB-42-15-C-KF	J2021100721001	2013.01.25	2015.01.24

Remarks:-

N/A Not Applicable or Not Available

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### **Appendix B**

#### **Ancillary Equipment**

ITEM NO.	DESCRIPTION	MODEL NO.	FCC ID	REMARK
1	DELL COMPUTER	DMC	N/A	N/A
2	DELL MONITOR	E177FPB	ARSCM356N	RESOLUTION 1024*768 (DURING TESTING) 1.0M UNSHIEDED POWER VORD CONNECTED TO THE COMPUTER 1.5M SHIEDED CABLE CONNECTED TO THE COMPUTER
3	DELL KEYBOARD	SK-8110	N/A	1.8M SHIEDED COILED CABLE CONNECTED TO THE COMPUTER
4	DELL MOUSE	N/A	N/A	2.4M UNSHIEDED CABLE CONNECTED TO THE COMPUTER
5	LASER PRINTER	HP LASERJET 1020 PLUS	N/A	1.8M UNSHIEDED POWER CORD 2.8M SHIEDED CABLE (BUNDLED TO 1M) CONNECTED TO THE COMPUTER
6	iPod Touch	A1367	BCG-E2407	N/A

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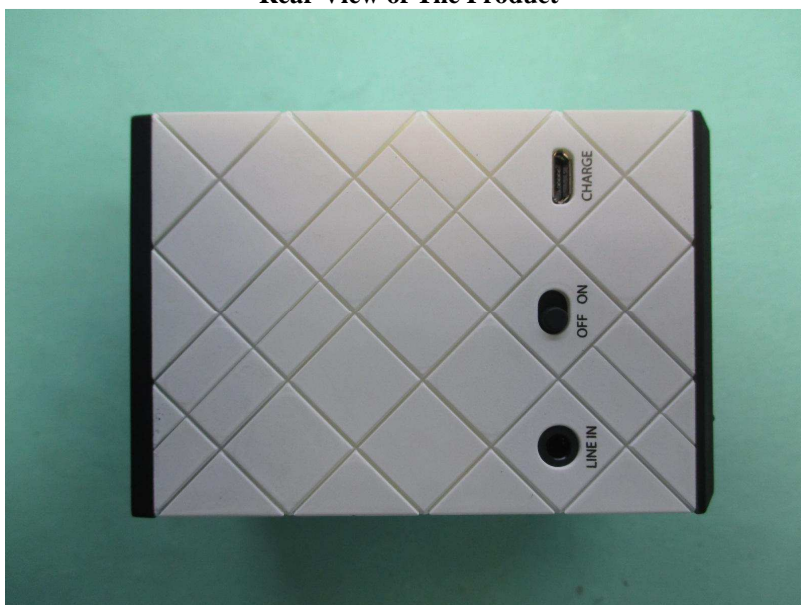
### **Appendix C**

#### **Photographs of EUT**

**Front View of The Product**



**Rear View of The Product**



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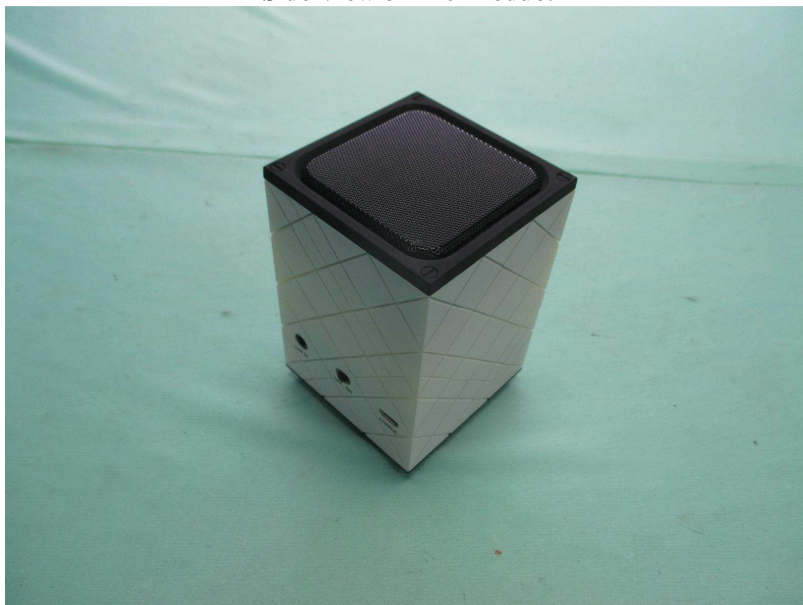
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### **Photographs of EUT**

**Side View of The Product**



**Side View of The Product**



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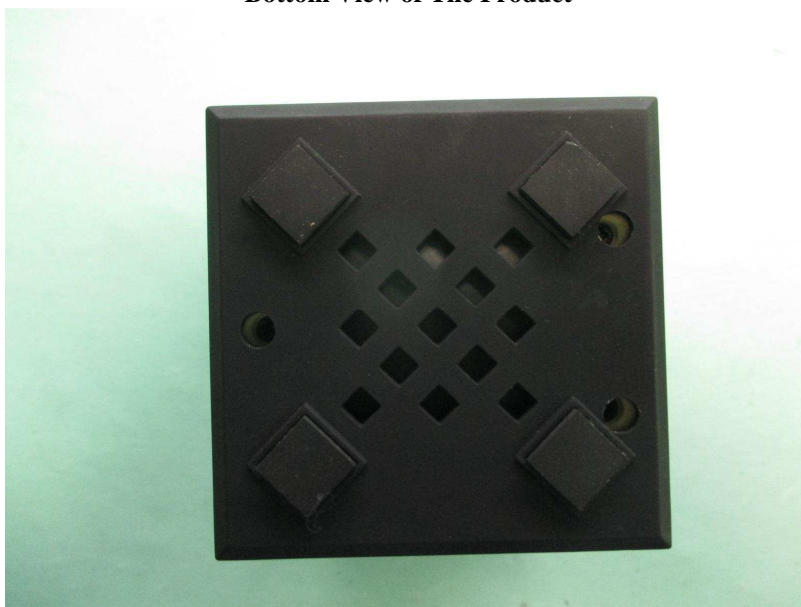
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### **Photographs of EUT**

**Top View of The Product**



**Bottom View of The Product**



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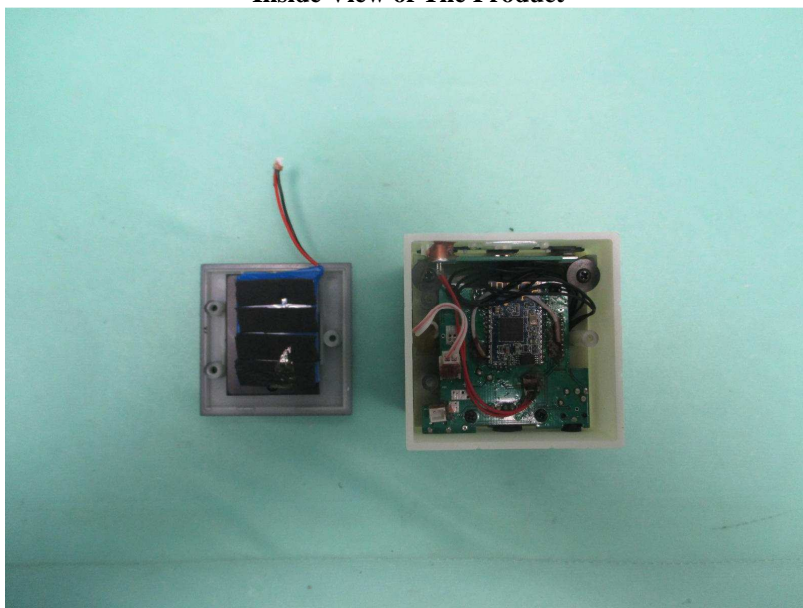
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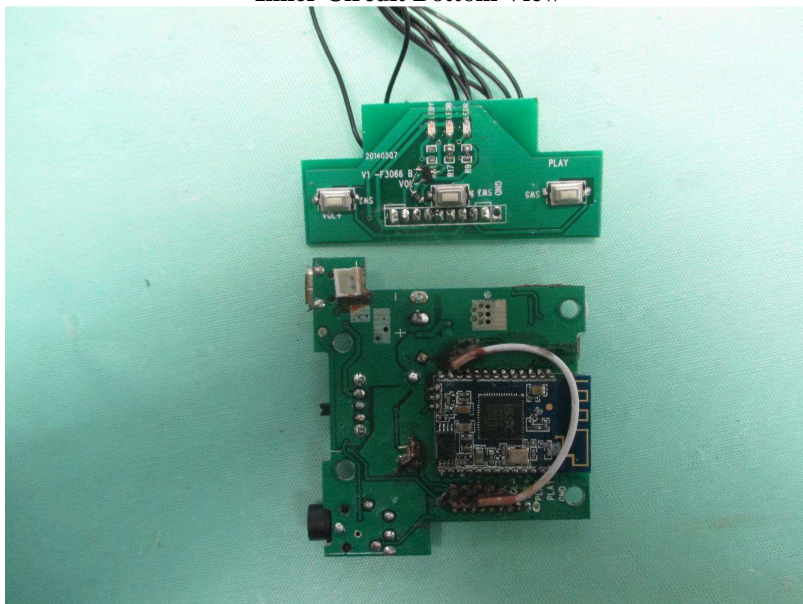
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### **Photographs of EUT**

**Inside View of The Product**



**Inner Circuit Bottom View**



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### Photographs of EUT

### Inner Circuit Top View



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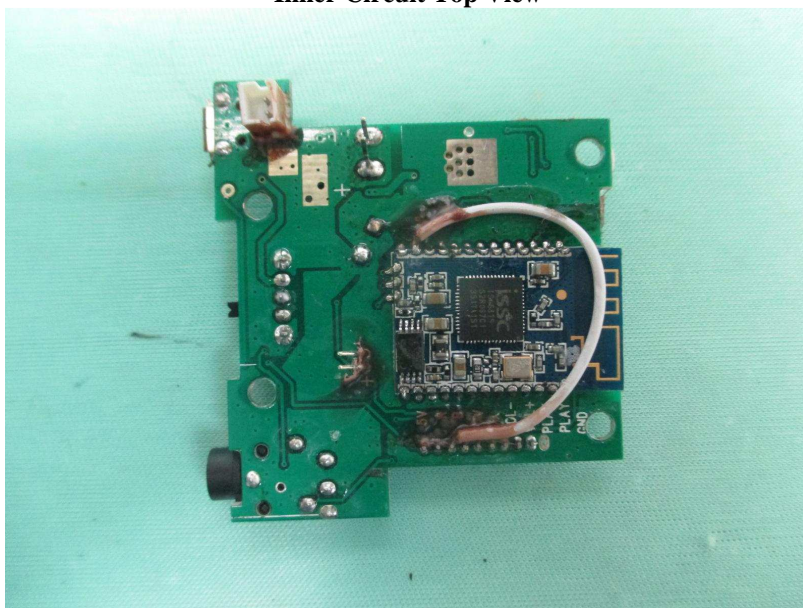
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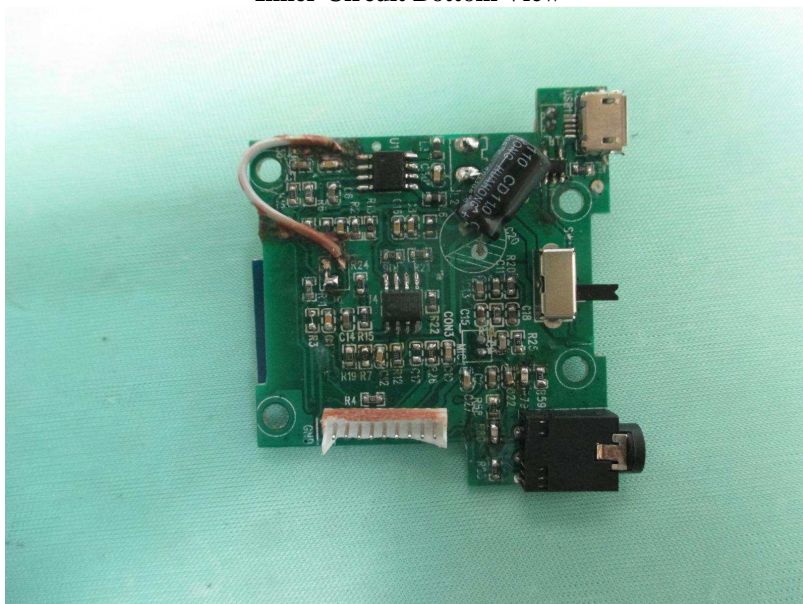
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### **Photographs of EUT**

**Inner Circuit Top View**



**Inner Circuit Bottom View**



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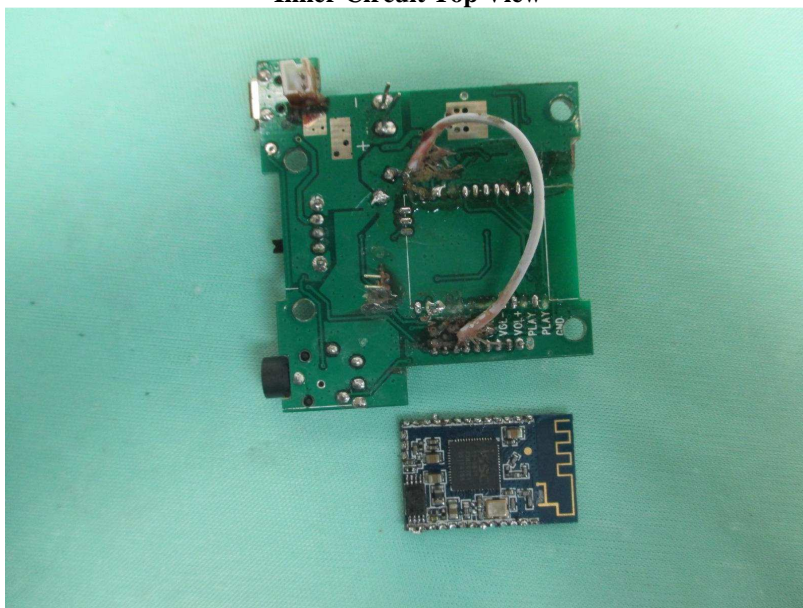
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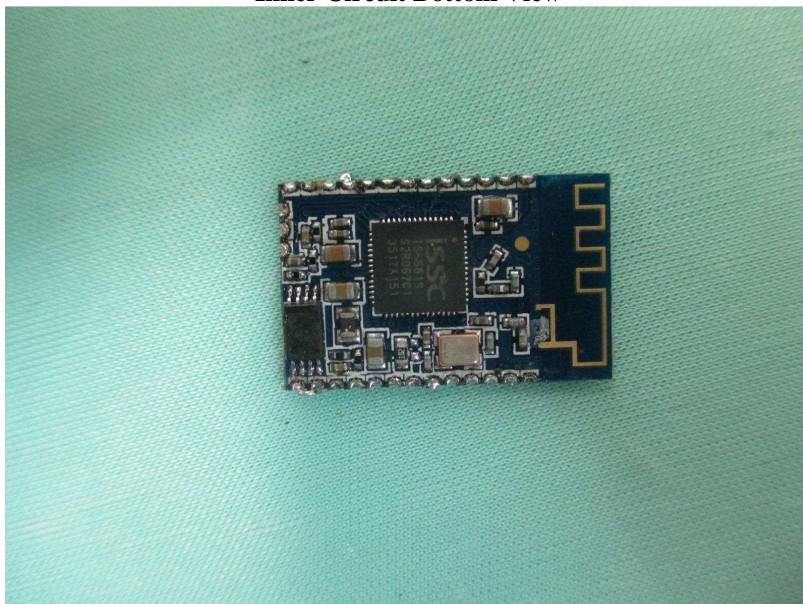
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### **Photographs of EUT**

**Inner Circuit Top View**



**Inner Circuit Bottom View**



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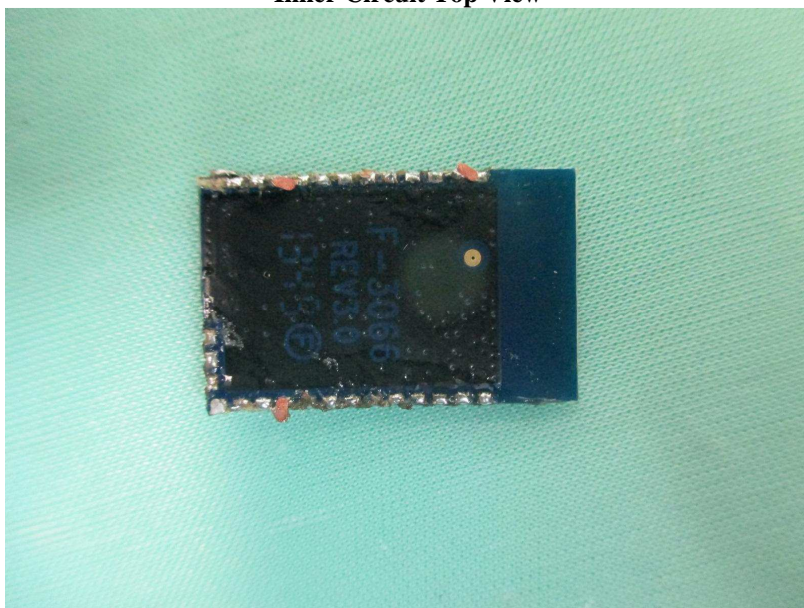
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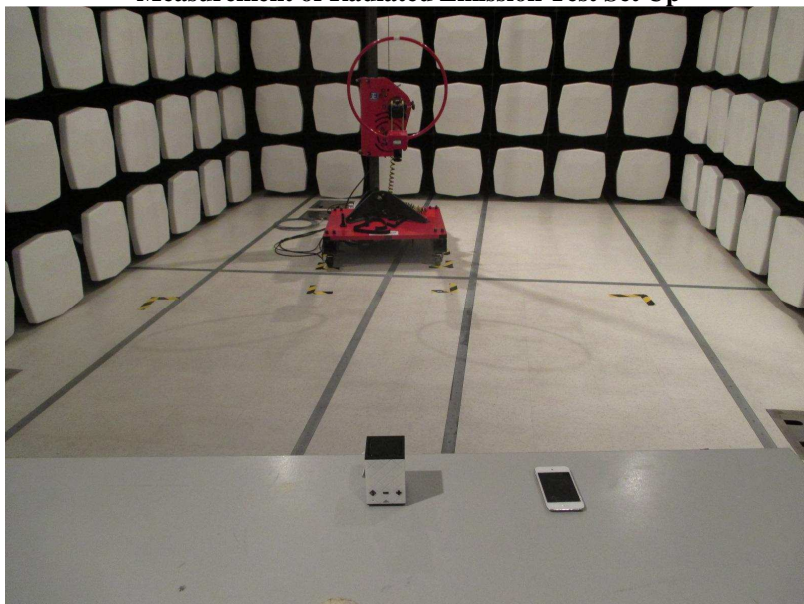
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### **Photographs of EUT**

**Inner Circuit Top View**



**Measurement of Radiated Emission Test Set Up**



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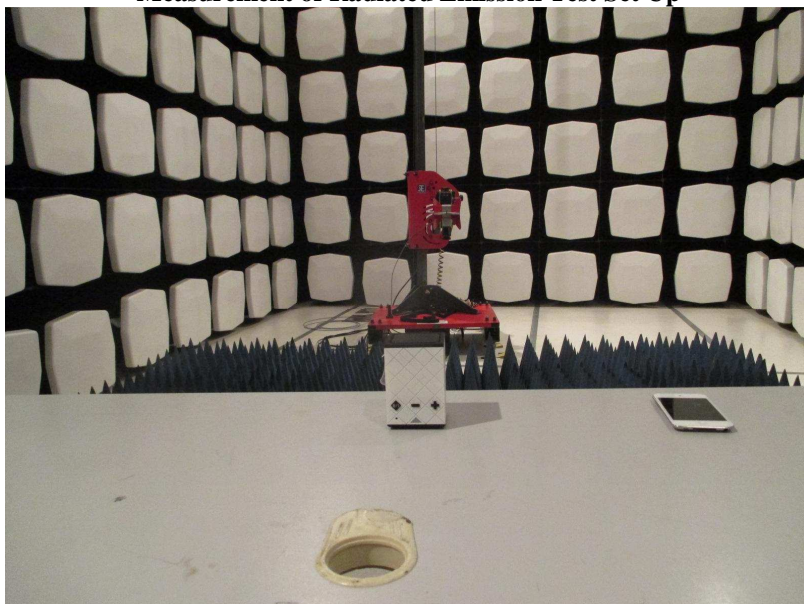
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### **Photographs of EUT**

**Measurement of Radiated Emission Test Set Up**



**Measurement of Radiated Emission Test Set Up**



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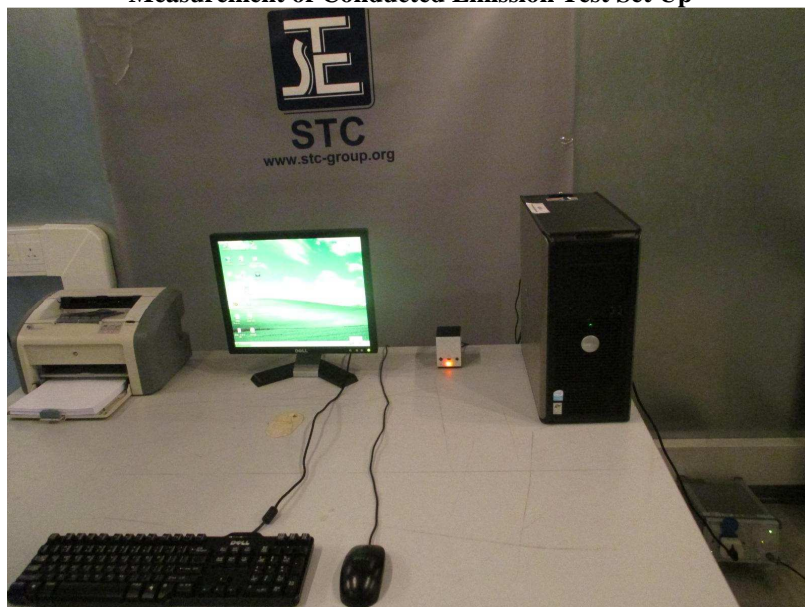
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### **Photographs of EUT**

**Measurement of Conducted Emission Test Set Up**



**\*\*\*\*\* End of Test Report \*\*\*\*\***

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