



## Test Report

Date : 2017-03-17

No. : DM126835

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**Applicant** : Innovative Technology Electronics LLC.  
1 Channel Drive, Port Washington, NY 11050, USA

**Supplier / Manufacturer** : Powerbeauty (Dongguan) Industrial Co., Ltd.  
No.1, Eastern Industry Park, Shujiu Village, Changping Town,  
Dongguan City, China

**Description of Sample(s)** : Submitted sample(s) said to be  
Product: Glowing Bluetooth Pool Speaker  
Brand Name: IT  
Model No.: ITSBO-512  
FCC ID: 2AFHW-SBO512

**Date Samples Received** : 2017-03-10

**Date Tested** : 2017-03-10 to 2017-03-14

**Investigation Requested** : Perform ElectroMagnetic Interference measurement in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2015 and ANSI C63.10:2013 for FCC Certification.

**Conclusions** : 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.

**Remarks** : Bluetooth FHSS (GFSK/  $\pi/4$ -DQPSK/ 8DPSK)

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

### STC (Dongguan) Company Limited

68 Fumin Nan Road, Dalang, Dongguan, Guangdong, China. Zip Code: 523770

Tel : (86 769) 81119888 Fax : (86 769) 81116222 Email : dgstc@dgstc.org Website : www.dgstc.org

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### **1.0 General Details**

#### **1.1 Test Laboratory**

STC (Dongguan) Company Limited

EMC Laboratory

68 Fumin Nan Road, Dalang, Dongguan, Guangdong, China

Telephone: (86 769) 81119888

Fax: (86 769) 81116222

#### **1.2 Equipment Under Test [EUT]**

##### **Description of Sample(s)**

Product: Glowing Bluetooth Pool Speaker

Manufacturer: Powerbeauty (Dongguan) Industrial Co., Ltd.

No.1, Eastern Industry Park, Shujiu Village, Changping Town,  
Dongguan City, China

Brand Name: IT

Model Number: ITSBO-512

Rating: 3.7V Li-ion battery 2000mAh

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

The Equipment Under Test (EUT) is a Glowing Bluetooth Pool Speaker. The transmission signal is digital modulated with channel frequency range 2402-2480MHz. The R.F. signal was modulated by IC; the type of modulation used was frequency hopping spread spectrum Modulation.

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

2017-03-10

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

1 Sample

#### **1.5 Test Duration**

2017-03-10 to 2017-03-14

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

China

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### 1.7 RF Module Details

Module Model Number: F-6888  
Module FCC ID: N/A  
Module Transmission Type: Bluetooth V2.1+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: PCB antenna  
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: 2015 Regulations and ANSI C63.10:2013 for FCC Certification.

According FCC KDB 558074 D01 DTS Meas Guidance v04, Duty cycle  $\geq 98\%$ .

The device was realized by test software.

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

<b>EMISSION Results Summary</b>						
Test Condition	Test Requirement	Test Method	Class / Severity	Test Result		
				Pass	Failed	N/A
Maximum Peak Conducted Output Power	FCC 47CFR 15.247(b)(1)	ANSI C63.10: 2013	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Radiated Spurious Emissions	FCC 47CFR 15.209	ANSI C63.10: 2013	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AC Mains Conducted Emissions	FCC 47CFR 15.207	ANSI C63.10: 2013	N/A	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Number of Hopping Frequency	FCC 47CFR 15.247 (b)(1)	ANSI C63.10: 2013	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20dB Bandwidth	FCC 47CFR 15.247(a)(2)	ANSI C63.10: 2013	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hopping Channel Separation	FCC 47CFR 15.247(a)(1)	ANSI C63.10: 2013	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Band-edge measurement (Radiated)	FCC 47CFR 15.247(d)	ANSI C63.10: 2013	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)	ANSI C63.10: 2013	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"/>

Note: N/A - Not Applicable

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### 2.3 Table for 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 device was realized by test software.

The following table is a list of the test modes shown in this test report.

Test Items	Mode	Data Rate
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	1MBps / 2MBps/ 3MBps
Time of Occupancy(Dwell Time)	8DPSK (DH1 / DH3 / DH5)	3MBps
Radiated Spurious Emissions	GFSK / $\pi/4$ -DQPSK/ 8DPSK	1MBps / 2MBps /3MBps
Band-edge compliance of Conducted Emission	GFSK / $\pi/4$ -DQPSK / 8DPSK	1MBps / 2MBps /3MBps

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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:	ANSI C63.10: 2013
Test Date:	2017-03-15
Mode of Operation:	Tx mode

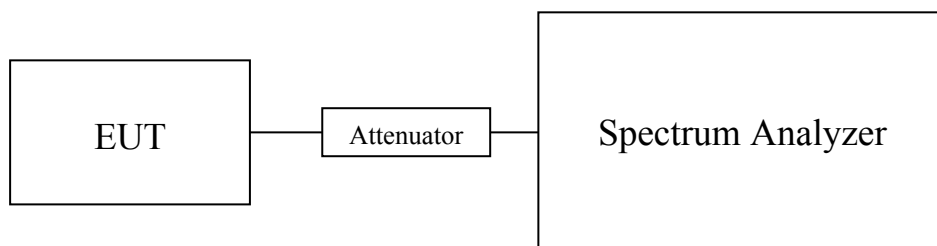
#### **Test Method:**

A temporary antenna connector was soldered to the RF output. 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 Watt.

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

RBW = 3 MHz, VBW = 3 MHz, Sweep = Auto, Span: Approximately five times the 20 dB bandwidth  
Detector = Peak, Trace = Max. hold

#### **Test Setup:**



Note: a temporary antenna connector was soldered to the RF output.

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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 Digital Transmission systems in 2400-2483.5 MHz Band: 1 Watt  
Results of Bluetooth Communication mode (GFSK) (Fundamental Power): Pass

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

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2402	0.000614

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2441	0.000562

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.000601

The maximum peak output power shall not exceed the following limits:  
For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 Watts  
Results of Bluetooth Communication mode ( $\pi/4$ -DQPSK) (Fundamental Power): Pass

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2402	0.000395

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2441	0.000348

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.000368

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

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2402	0.000441

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2441	0.000365

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.000353

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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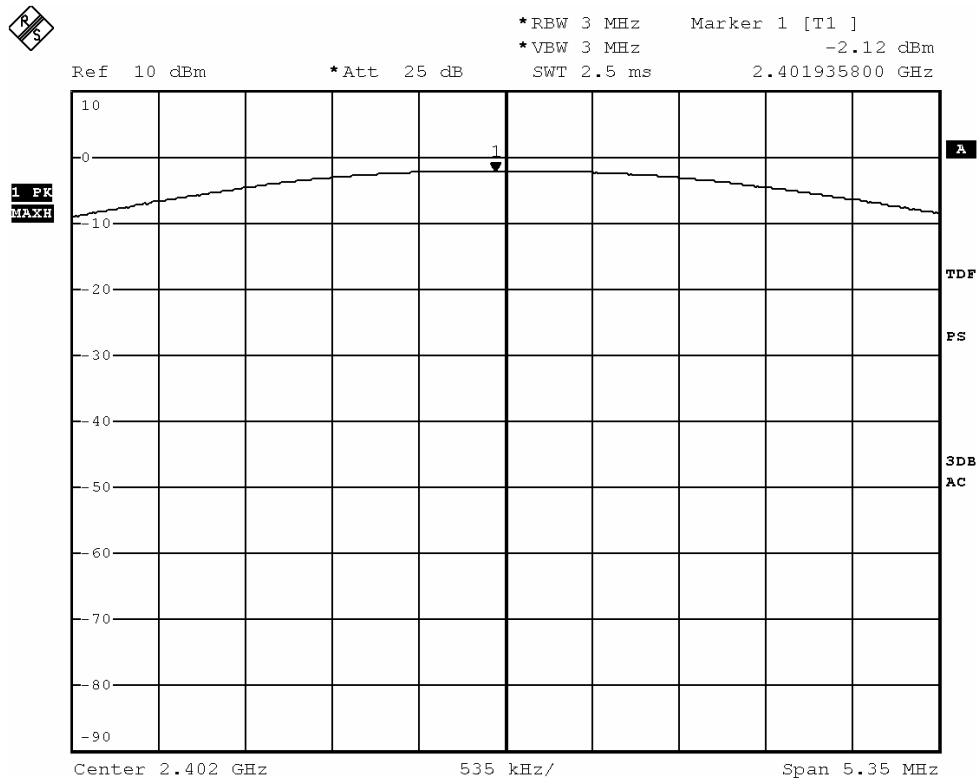
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Test plot of Maximum Peak Conducted Output Power :

Bluetooth Communication mode (GFSK, 2402MHz)



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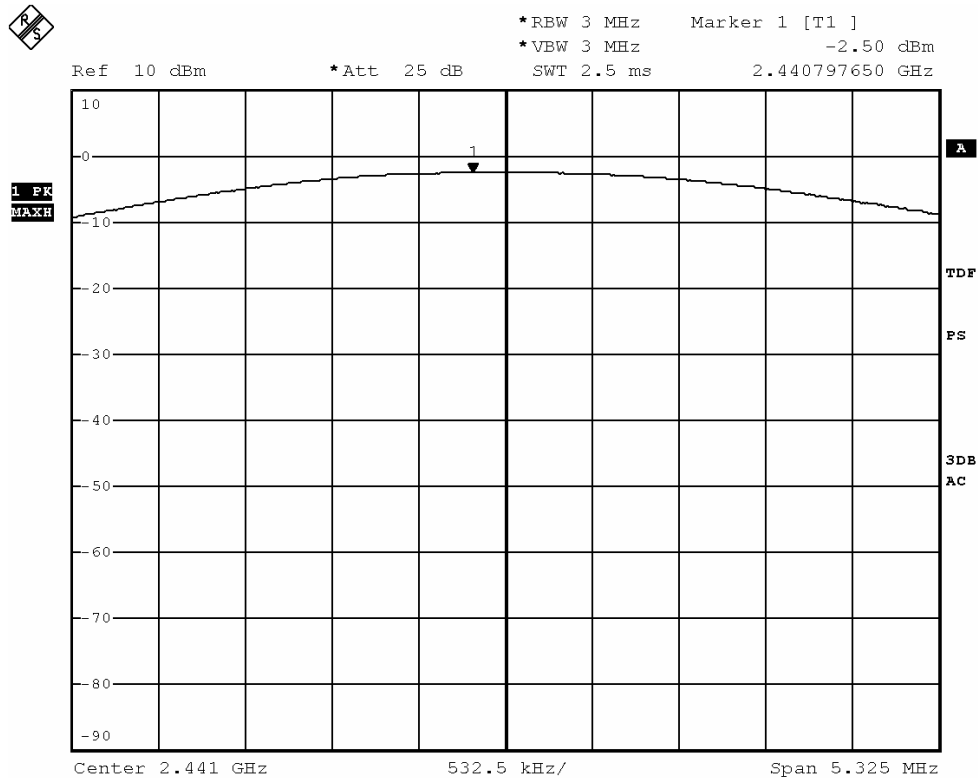
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### Bluetooth Communication mode (GFSK, 2441MHz)



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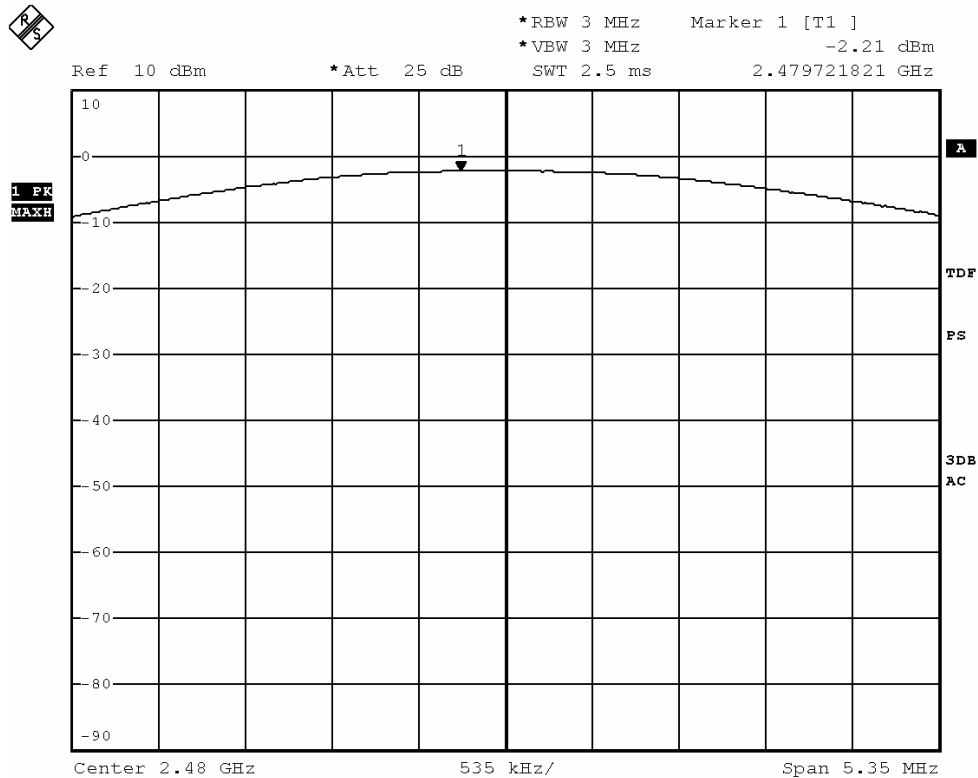
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### Bluetooth Communication mode (GFSK, 2480MHz)



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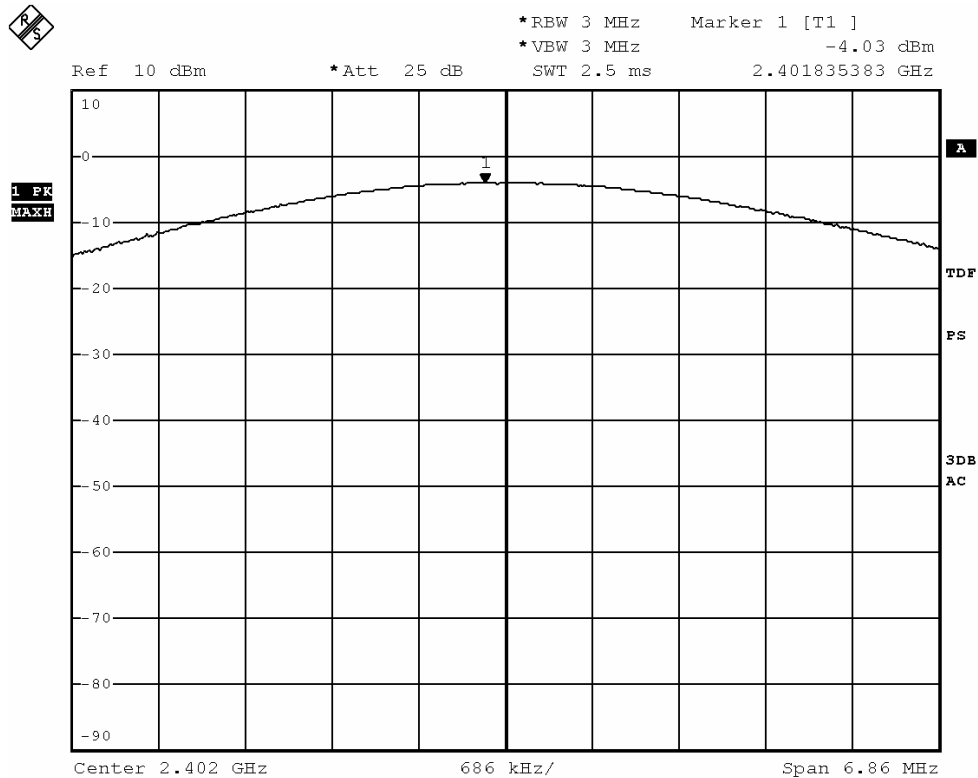
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Bluetooth Communication mode ( $\pi/4$  DQPSK, 2402MHz)



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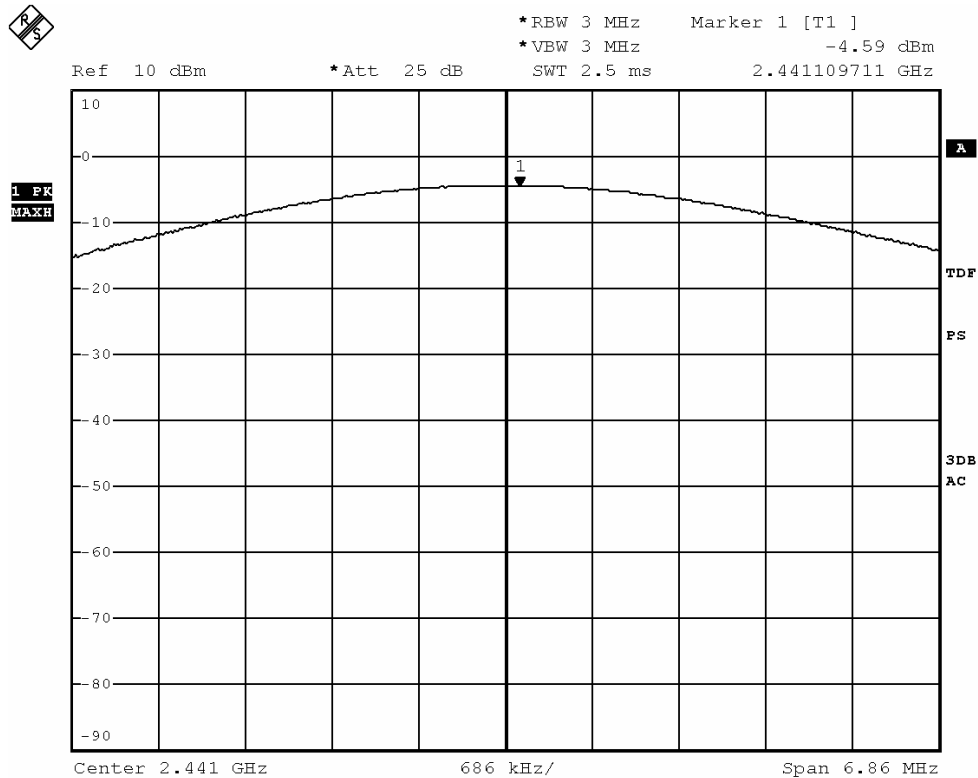
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Bluetooth Communication mode ( $\pi/4$  DQPSK, 2441MHz)



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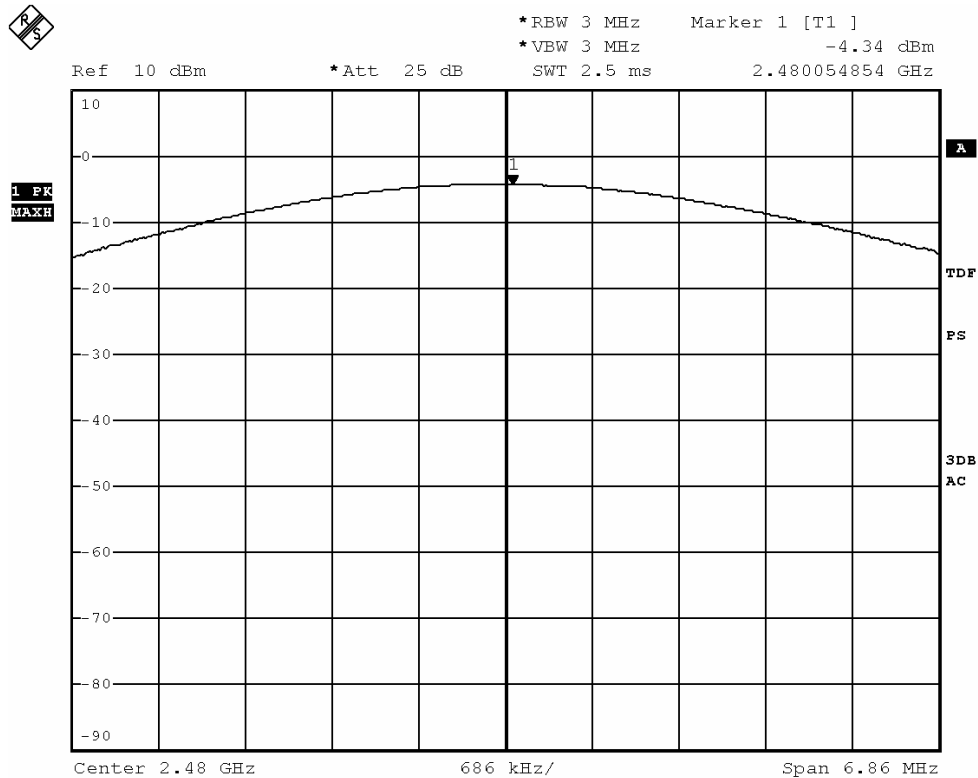
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Bluetooth Communication mode ( $\pi/4$  DQPSK, 2480MHz)



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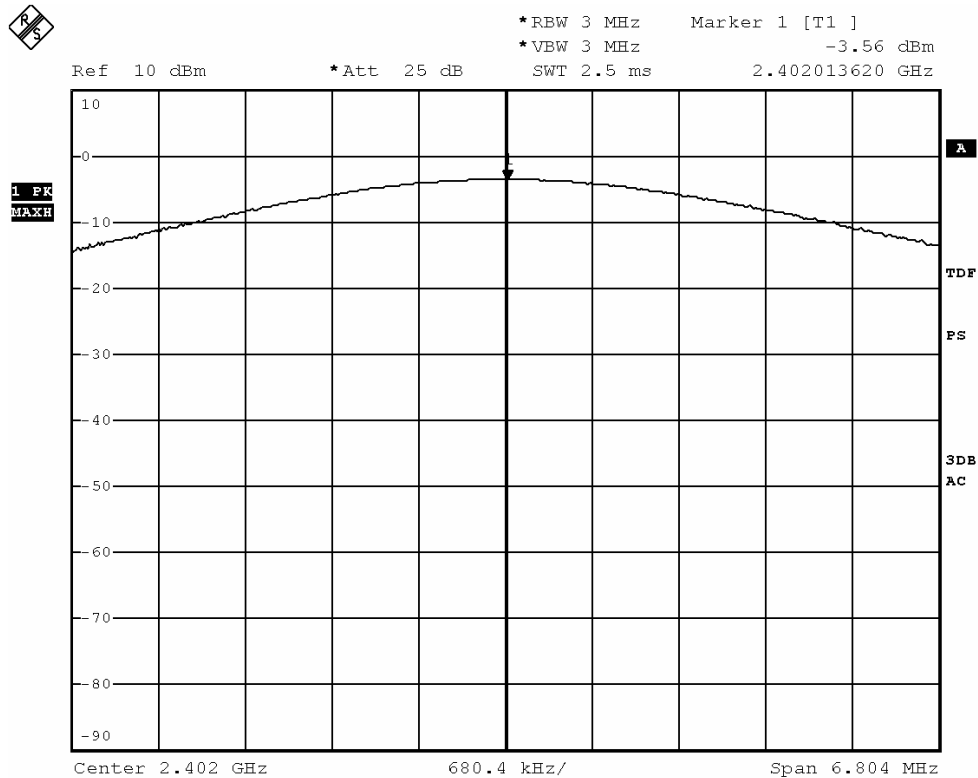
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### Bluetooth Communication mode (8DPSK, 2402MHz)



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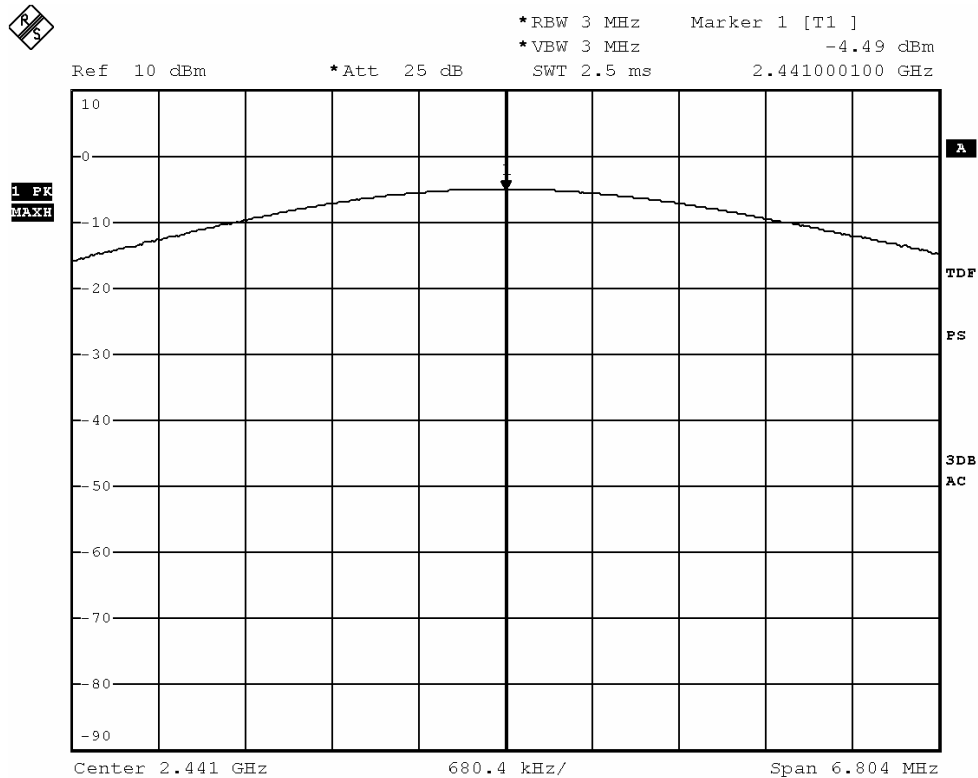
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### Bluetooth Communication mode (8DPSK, 2441MHz)



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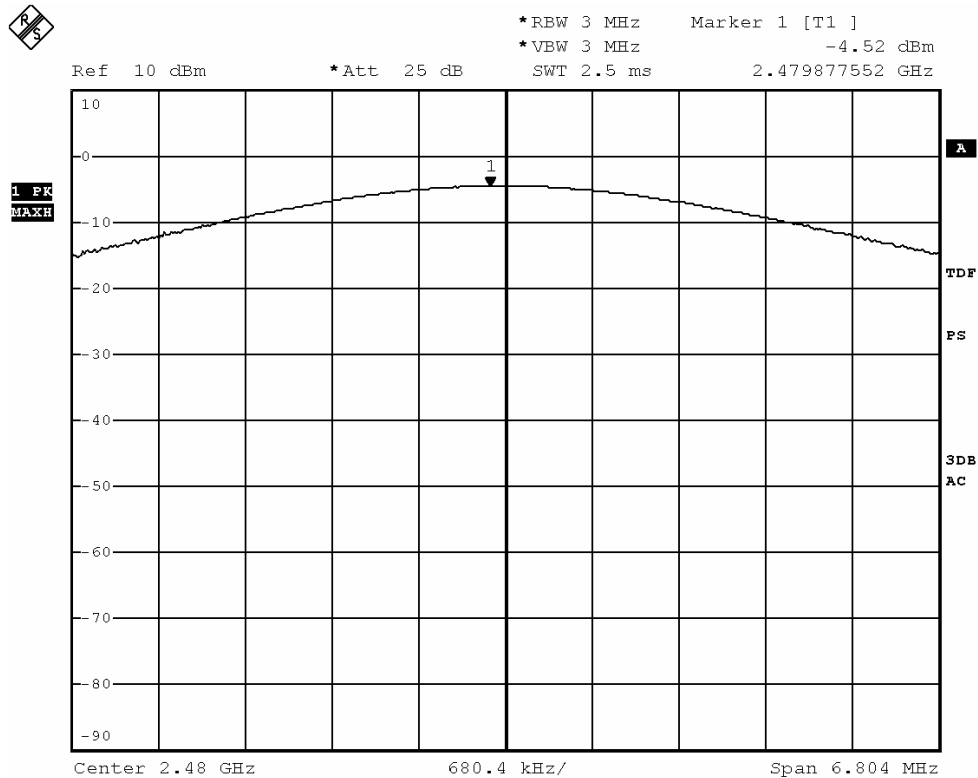
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### Bluetooth Communication mode (8DPSK, 2480MHz)



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### 3.1.2 Radiated Spurious Emissions

Test Requirement:	FCC 47CFR 15.209
Test Method:	ANSI C63.10:2013
Test Date:	2017-03-15
Mode of Operation:	Tx mode / Bluetooth Communication mode (GFSK)

#### Test Method:

For emission measurements at or below 1 GHz, the sample was placed 0.8m above the ground plane of semi-anechoic Chamber\*. For emission measurements above 1 GHz, the sample was placed 1.5m 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, rotated about all 3 axis (X, Y & Z) and 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

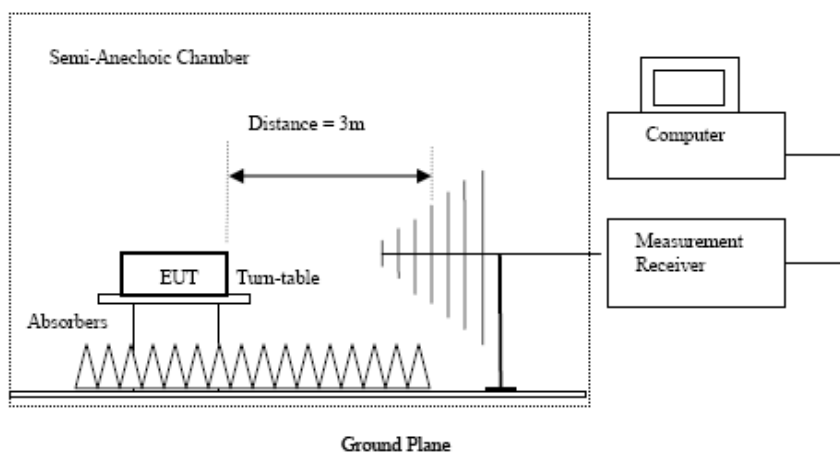
Above 1GHz (Pk)

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

Above 1GHz (Av)

RBW: 1MHz  
VBW: 10Hz  
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 15.247 Class B1:

Frequency Range	Quasi-Peak Limits
[MHz]	[μV/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) (9kHz – 30MHz): Pass

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

### Result of Tx mode (2402.0 MHz) (GFSK) (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	dBμV	dB/m	dBμV/m	dBμV/m	dBμV/m	
4804.0	16.1	41.5	57.6	74.0	16.4	Vertical
4804.0	14.3	42.4	56.7	74.0	17.3	Horizontal
7206.0	16.0	45.1	61.1	74.0	12.9	Vertical
7206.0	14.5	46.2	60.7	74.0	13.3	Horizontal
9608.0	7.5	48.0	55.5	74.0	18.5	Vertical
9608.0	6.1	48.8	54.9	74.0	19.1	Horizontal
12010.0	4.4	51.8	56.2	74.0	17.8	Vertical
12010.0	3.6	52.4	56.0	74.0	18.0	Horizontal

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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	0.7	41.5	42.2	54.0	11.8	Vertical
4804.0	-0.1	42.4	42.3	54.0	11.7	Horizontal
7206.0	0.6	45.1	45.7	54.0	8.3	Vertical
7206.0	-0.7	46.2	45.5	54.0	8.5	Horizontal
9608.0	-7.5	48.0	40.5	54.0	13.5	Vertical
9608.0	-8.4	48.8	40.4	54.0	13.6	Horizontal
12010.0	-6.3	51.8	45.5	54.0	8.5	Vertical
12010.0	-9.1	52.4	43.3	54.0	10.7	Horizontal

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

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

**Result of Tx mode (2441.0 MHz) (GFSK) (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	15.8	41.6	57.4	74.0	16.6	Vertical
4882.0	14.5	42.5	57.0	74.0	17.0	Horizontal
7323.0	8.5	53.2	61.7	74.0	12.3	Vertical
7323.0	13.9	46.3	60.2	74.0	13.8	Horizontal
9764.0	7.8	48.1	55.9	74.0	18.1	Vertical
9764.0	5.9	48.9	54.8	74.0	19.2	Horizontal
12205.0	4.2	51.6	55.8	74.0	18.2	Vertical
12205.0	3.8	52.5	56.3	74.0	17.7	Horizontal

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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	0.9	41.6	42.5	54.0	11.5	Vertical
4882.0	-0.6	42.5	41.9	54.0	12.1	Horizontal
7323.0	1.3	45.2	46.5	54.0	7.5	Vertical
7323.0	-1.4	46.3	44.9	54.0	9.1	Horizontal
9764.0	-7.5	48.1	40.6	54.0	13.4	Vertical
9764.0	-8.1	48.9	40.8	54.0	13.2	Horizontal
12205.0	-11.1	51.6	40.5	54.0	13.5	Vertical
12205.0	-10.5	52.5	42.0	54.0	12.0	Horizontal

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

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

**Result of Tx mode (2480.0 MHz) (GFSK) (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	15.8	41.4	57.2	74.0	16.8	Vertical
4960.0	14.1	42.7	56.8	74.0	17.2	Horizontal
7440.0	15.3	45.6	60.9	74.0	13.1	Vertical
7440.0	13.6	46.5	60.1	74.0	13.9	Horizontal
9920.0	6.9	48.6	55.5	74.0	18.5	Vertical
9920.0	5.2	49.7	54.9	74.0	19.1	Horizontal
12400.0	4.4	51.7	56.1	74.0	17.9	Vertical
12400.0	3.2	52.7	55.9	74.0	18.1	Horizontal

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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	42.9	54.0	11.1	Vertical
4960.0	-0.6	42.7	42.1	54.0	11.9	Horizontal
7440.0	-1.1	45.6	44.5	54.0	9.5	Vertical
7440.0	-1.2	46.5	45.3	54.0	8.7	Horizontal
9920.0	-8.0	48.6	40.6	54.0	13.4	Vertical
9920.0	-8.8	49.7	40.9	54.0	13.1	Horizontal
12400.0	-9.3	51.7	42.4	54.0	11.6	Vertical
12400.0	-11.7	52.7	41.0	54.0	13.0	Horizontal

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

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level dBuV	Correction Factor dB/m	Field Strength dBuV/m	Field Strength uV/m	Limit uV/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) (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
4804.0	15.7	41.5	57.2	74.0	16.8	Vertical
4804.0	14.5	42.4	56.9	74.0	17.1	Horizontal
7206.0	15.6	45.1	60.7	74.0	13.3	Vertical
7206.0	13.7	46.2	59.9	74.0	14.1	Horizontal
9608.0	8.7	48.0	56.7	74.0	17.3	Vertical
9608.0	6.7	48.8	55.5	74.0	18.5	Horizontal
12010.0	4.4	51.8	56.2	74.0	17.8	Vertical
12010.0	4.0	52.4	56.4	74.0	17.6	Horizontal

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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	0.9	41.5	42.4	54.0	11.6	Vertical
4804.0	-0.2	42.4	42.2	54.0	11.8	Horizontal
7206.0	0.2	45.1	45.3	54.0	8.7	Vertical
7206.0	-1.4	46.2	44.8	54.0	9.2	Horizontal
9608.0	-7.4	48.0	40.6	54.0	13.4	Vertical
9608.0	-7.6	48.8	41.2	54.0	12.8	Horizontal
12010.0	-9.9	51.8	41.9	54.0	12.1	Vertical
12010.0	-10.4	52.4	42.0	54.0	12.0	Horizontal

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

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level dBuV	Correction Factor dB/m	Field Strength dBuV/m	Field Strength uV/m	Limit uV/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) (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	15.3	41.6	56.9	74.0	17.1	Vertical
4882.0	13.4	42.5	55.9	74.0	18.1	Horizontal
7323.0	6.2	53.2	59.4	74.0	14.6	Vertical
7323.0	13.4	46.3	59.7	74.0	14.3	Horizontal
9764.0	7.6	48.1	55.7	74.0	18.3	Vertical
9764.0	6.6	48.9	55.5	74.0	18.5	Horizontal
12205.0	5.9	51.6	57.5	74.0	16.5	Vertical
12205.0	3.8	52.5	56.3	74.0	17.7	Horizontal

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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	0.9	41.6	42.5	54.0	11.5	Vertical
4882.0	-1.2	42.5	41.3	54.0	12.7	Horizontal
7323.0	-0.7	45.2	44.5	54.0	9.5	Vertical
7323.0	-2.1	46.3	44.2	54.0	9.8	Horizontal
9764.0	-7.6	48.1	40.5	54.0	13.5	Vertical
9764.0	-7.3	48.9	41.6	54.0	12.4	Horizontal
12205.0	-9.6	51.6	42.0	54.0	12.0	Vertical
12205.0	-10.4	52.5	42.1	54.0	11.9	Horizontal

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

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

**Result of Tx mode (2480.0 MHz) ( $\pi/4$ -DQPSK) (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	15.4	41.4	56.8	74.0	17.2	Vertical
4960.0	13.6	42.7	56.3	74.0	17.7	Horizontal
7440.0	13.5	45.6	59.1	74.0	14.9	Vertical
7440.0	12.0	46.5	58.5	74.0	15.5	Horizontal
9920.0	7.1	48.6	55.7	74.0	18.3	Vertical
9920.0	6.3	49.7	56.0	74.0	18.0	Horizontal
12400.0	4.6	51.7	56.3	74.0	17.7	Vertical
12400.0	2	52.7	54.7	74.0	19.3	Horizontal

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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	1.0	41.4	42.4	54.0	11.6	Vertical
4960.0	-0.6	42.7	42.1	54.0	11.9	Horizontal
7440.0	-1.4	45.6	44.2	54.0	9.8	Vertical
7440.0	-2.8	46.5	43.7	54.0	10.3	Horizontal
9920.0	-6.9	48.6	41.7	54.0	12.3	Vertical
9920.0	-7.5	49.7	42.2	54.0	11.8	Horizontal
12400.0	-9.2	51.7	42.5	54.0	11.5	Vertical
12400.0	-10.8	52.7	41.9	54.0	12.1	Horizontal

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

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level dBuV	Correction Factor dB/m	Field Strength dBuV/m	Field Strength uV/m	Limit uV/m	E-Field Polarity
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 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	15.3	41.5	56.8	74.0	17.2	Vertical
4804.0	14.0	42.4	56.4	74.0	17.6	Horizontal
7206.0	13.4	45.1	58.5	74.0	15.5	Vertical
7206.0	12.0	46.2	58.2	74.0	15.8	Horizontal
9608.0	7.9	48.0	55.9	74.0	18.1	Vertical
9608.0	6.9	48.8	55.7	74.0	18.3	Horizontal
12010.0	4.7	51.8	56.5	74.0	17.5	Vertical
12010.0	3.7	52.4	56.1	74.0	17.9	Horizontal

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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	1.0	41.5	42.5	54.0	11.5	Vertical
4804.0	0.0	42.4	42.4	54.0	11.6	Horizontal
7206.0	-0.8	45.1	44.3	54.0	9.7	Vertical
7206.0	-3.2	46.2	43.0	54.0	11.0	Horizontal
9608.0	-7.6	48.0	40.4	54.0	13.6	Vertical
9608.0	-7.5	48.8	41.3	54.0	12.7	Horizontal
12010.0	-10.0	51.8	41.8	54.0	12.2	Vertical
12010.0	-11.0	52.4	41.4	54.0	12.6	Horizontal

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

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

**Result of Tx mode (2441.0 MHz) (8DPSK) (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	15.1	41.6	56.7	74.0	17.3	Vertical
4882.0	14.0	42.5	56.5	74.0	17.5	Horizontal
7323.0	5.5	53.2	58.7	74.0	15.3	Vertical
7323.0	11.6	46.3	57.9	74.0	16.1	Horizontal
9764.0	7.4	48.1	55.5	74.0	18.5	Vertical
9764.0	7.0	48.9	55.9	74.0	18.1	Horizontal
12205.0	4.7	51.6	56.3	74.0	17.7	Vertical
12205.0	3.8	52.5	56.3	74.0	17.7	Horizontal

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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	0.6	41.6	42.2	54.0	11.8	Vertical
4882.0	-0.4	42.5	42.1	54.0	11.9	Horizontal
7323.0	-1.7	45.2	43.5	54.0	10.5	Vertical
7323.0	-3.5	46.3	42.8	54.0	11.2	Horizontal
9764.0	-7.1	48.1	41.0	54.0	13.0	Vertical
9764.0	-7.2	48.9	41.7	54.0	12.3	Horizontal
12205.0	-9.7	51.6	41.9	54.0	12.1	Vertical
12205.0	-10.4	52.5	42.1	54.0	11.9	Horizontal

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

Field Strength of Spurious Emissions						
Peak Value						
Frequency MHz	Measured Level dBuV	Correction Factor dB/m	Field Strength dBuV/m	Field Strength uV/m	Limit uV/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 dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4960.0	15.5	41.4	56.9	74.0	17.1	Vertical
4960.0	13.6	42.7	56.3	74.0	17.7	Horizontal
7440.0	12.0	45.6	57.6	74.0	16.4	Vertical
7440.0	10.9	46.5	57.4	74.0	16.6	Horizontal
9920.0	7.1	48.6	55.7	74.0	18.3	Vertical
9920.0	4.8	49.7	54.5	74.0	19.5	Horizontal
12400.0	4.8	51.7	56.5	74.0	17.5	Vertical
12400.0	3.6	52.7	56.3	74.0	17.7	Horizontal

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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	0.8	41.4	42.2	54.0	11.8	Vertical
4960.0	0.1	42.7	42.8	54.0	11.2	Horizontal
7440.0	-2.8	45.6	42.8	54.0	11.2	Vertical
7440.0	-3.7	46.5	42.8	54.0	11.2	Horizontal
9920.0	-6.8	48.6	41.8	54.0	12.2	Vertical
9920.0	-7.9	49.7	41.8	54.0	12.2	Horizontal
12400.0	-9.5	51.7	42.2	54.0	11.8	Vertical
12400.0	-10.5	52.7	42.2	54.0	11.8	Horizontal

Note: Above 13GHz Emissions detected are more than 20 dB below the FCC Limits .

Remarks:

No additional spurious emissions found between lowest internal used/generated frequency and 30 MHz

\* 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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### 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: RF Radiated Emissions (Lowest)-GFSK

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	24.8	36.8	61.6	74.0	12.4	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	7.2	36.8	44.0	54.0	10.0	Vertical

#### Result: RF Radiated Emissions (Highest) -GFSK

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	30.3	36.8	67.1	74.0	6.9	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
2483.5	12.5	36.8	49.3	54.0	4.7	Vertical

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### 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: RF Radiated Emissions (Lowest)- $\pi/4$ -DQPSK

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
2390.0	24.1	36.8	60.9	74.0	13.1	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
2390.0	6.5	36.8	43.3	54.0	10.7	Vertical

#### Result: RF Radiated Emissions (Highest) - $\pi/4$ -DQPSK

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	31.3	36.8	68.1	74.0	5.9	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
2483.5	13.8	36.8	50.6	54.0	3.4	Vertical

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### 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: RF Radiated Emissions (Lowest)- 8DPSK

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
2390.0	24.2	36.8	61.0	74.0	13.0	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
2390.0	16.4	36.8	53.2	54.0	0.8	Vertical

#### Result: RF Radiated Emissions (Highest) -8DPSK

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	30.5	36.8	67.3	74.0	6.7	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
2483.5	12.7	36.8	49.5	54.0	4.5	Vertical

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### Limits for Radiated Emissions FCC 47 CFR 15.247 Class B]:

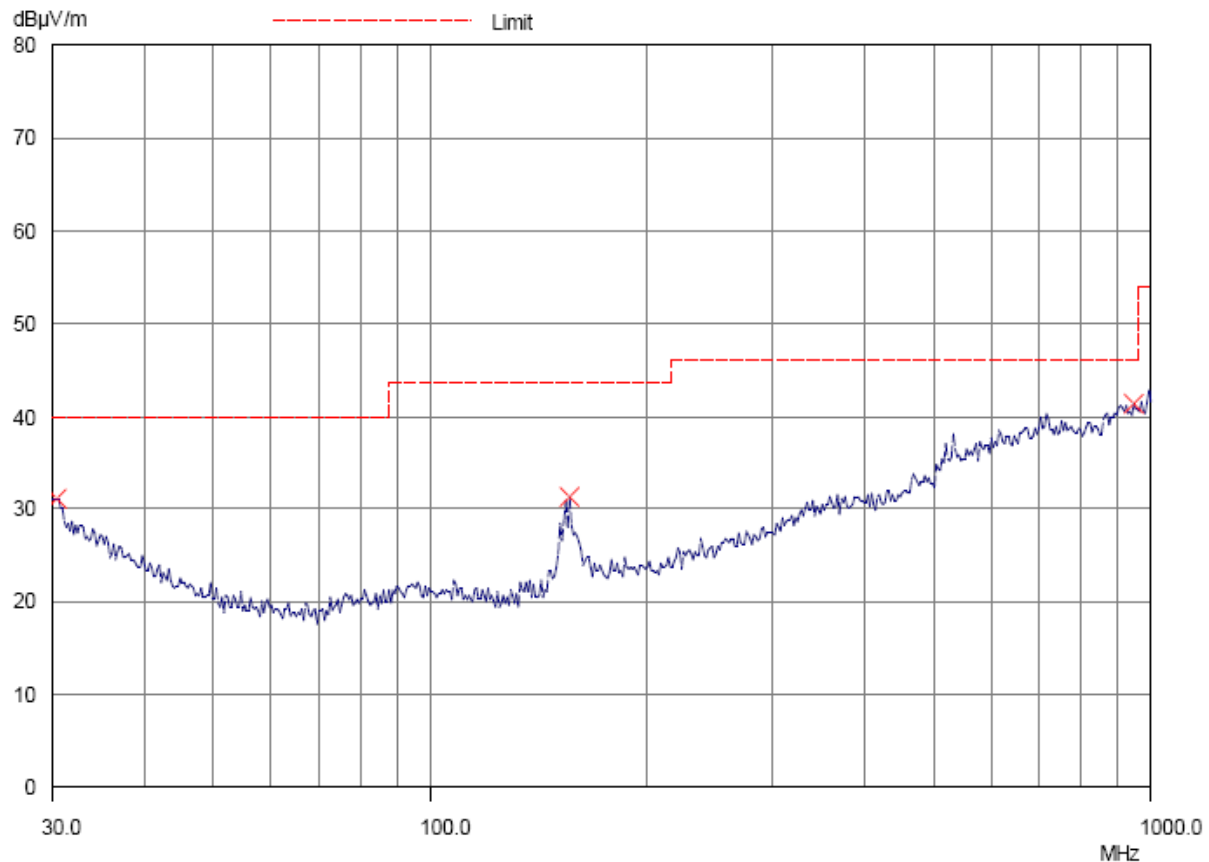
Frequency Range	Quasi-Peak Limits
[MHz]	[ $\mu$ V/m]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

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.

### Results of Bluetooth play+ light mode (GFSK 2402.0 MHz) (30MHz – 1GHz): Pass

Please refer to the following table for result details(The data is the worst cases)

Horizontal



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**Result of Bluetooth play+ light mode (GFSK 2402.0 MHz) (30MHz – 1GHz): Pass**

Radiated Emissions Quasi-Peak					
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
30.2	Horizontal	28.5	40.0	26.6	100
156.3	Horizontal	30.5	43.5	33.5	150
941.9	Horizontal	36.2	46.0	64.6	200

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### Limits for Radiated Emissions FCC 47 CFR 15.247 Class B1:

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

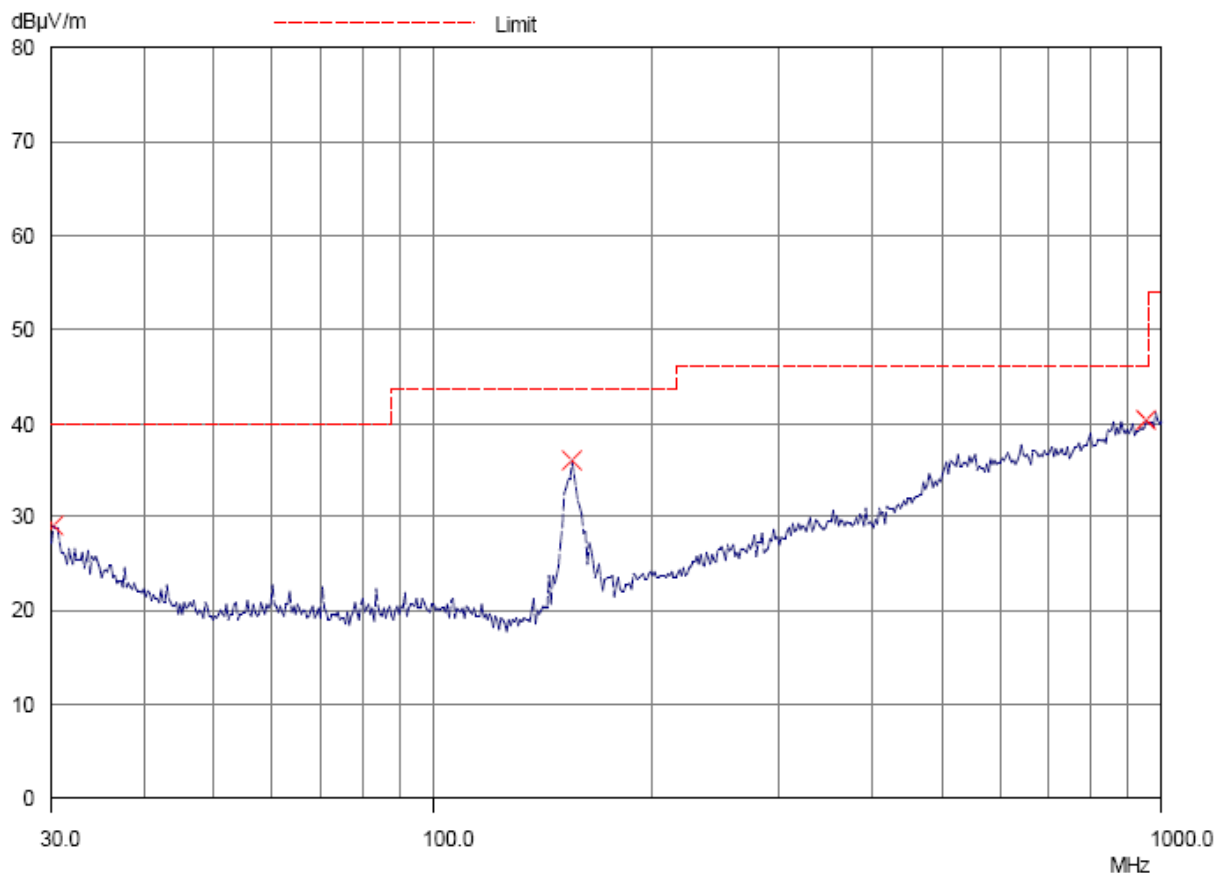
The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

### Results of Bluetooth play+ light mode (GFSK 2402.0 MHz) (30MHz – 1GHz): Pass

Please refer to the following table for result details(The data is the worst cases)

Vertical

dB $\mu$ V/m



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**Result of Bluetooth play+ light mode (GFSK 2402.0 MHz) (30MHz – 1GHz): Pass**

Radiated Emissions Quasi-Peak					
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	Vertical	26.0	40.0	20.0	100
155.2	Vertical	35.5	43.5	59.6	150
950.2	Vertical	35.3	46.0	58.2	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 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:

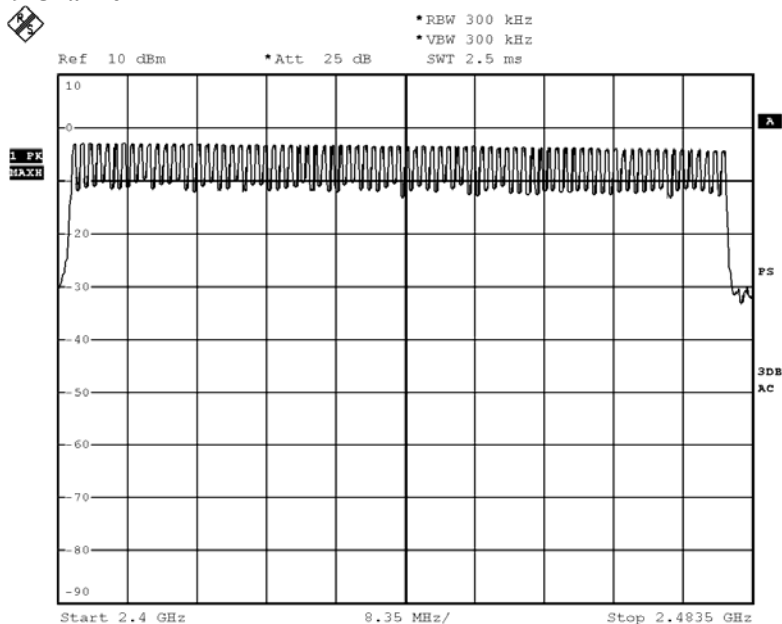
RBW = 300kHz, VBW  $\geq$  RBW, Sweep = Auto, Span = the frequency band of operation  
Detector = Peak, Trace = Max. hold

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



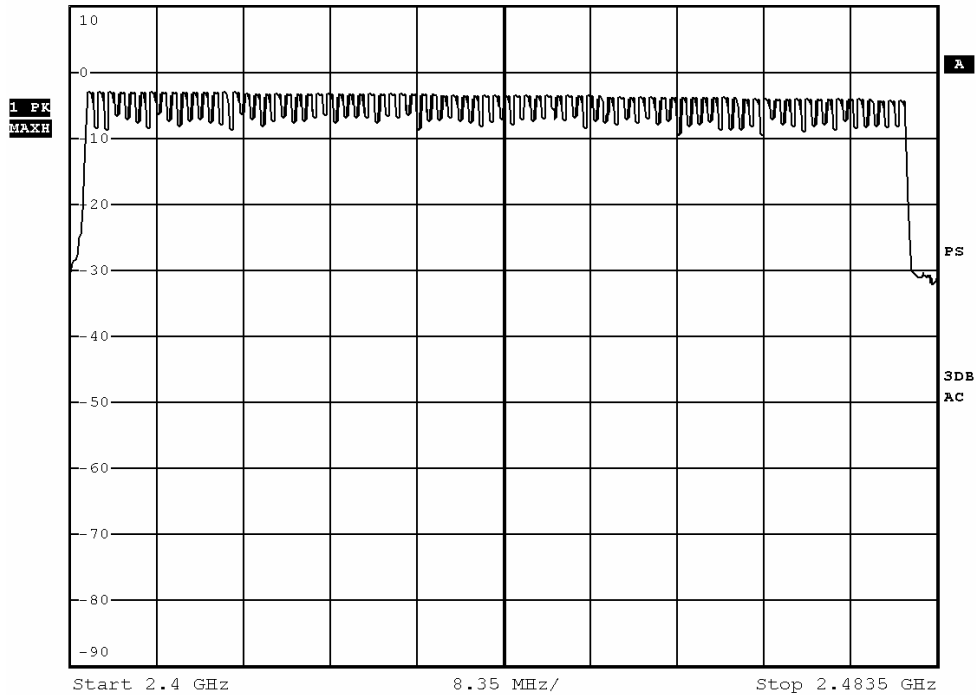
\*RBW 300 kHz

\*VBW 300 kHz

SWT 2.5 ms

Ref 10 dBm

\*Att 25 dB



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### 8DPSK: 79 of 79 Channel



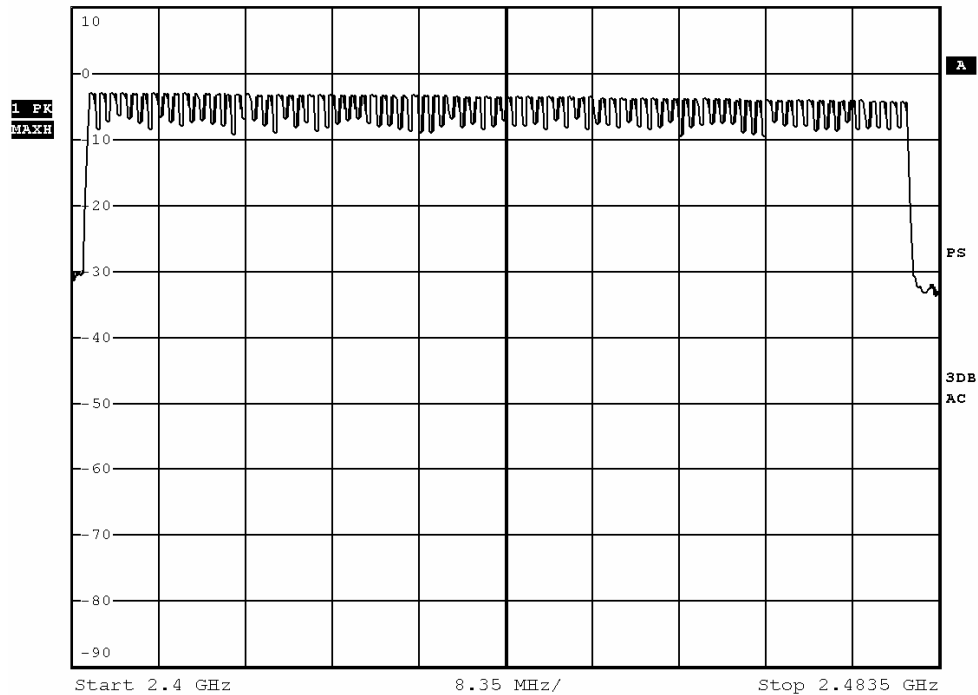
\*RBW 300 kHz

\*VBW 300 kHz

SWT 2.5 ms

Ref 10 dBm

\*Att 25 dB



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### 3.1.4 20dB Bandwidth

Test Requirement:	FCC 47CFR 15.247(a)(1)
Test Method:	ANSI C63.10:2013
Test Date:	2017-03-14
Mode of Operation:	Tx 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.

#### Spectrum Analyzer Setting:

RBW = 30kHz, VBW  $\geq$  RBW, Sweep = Auto, Span = two times and five times the OBW  
Detector = Peak, Trace = Max. hold

#### Test Setup:

As Test Setup of clause 3.1.1 in this test report.

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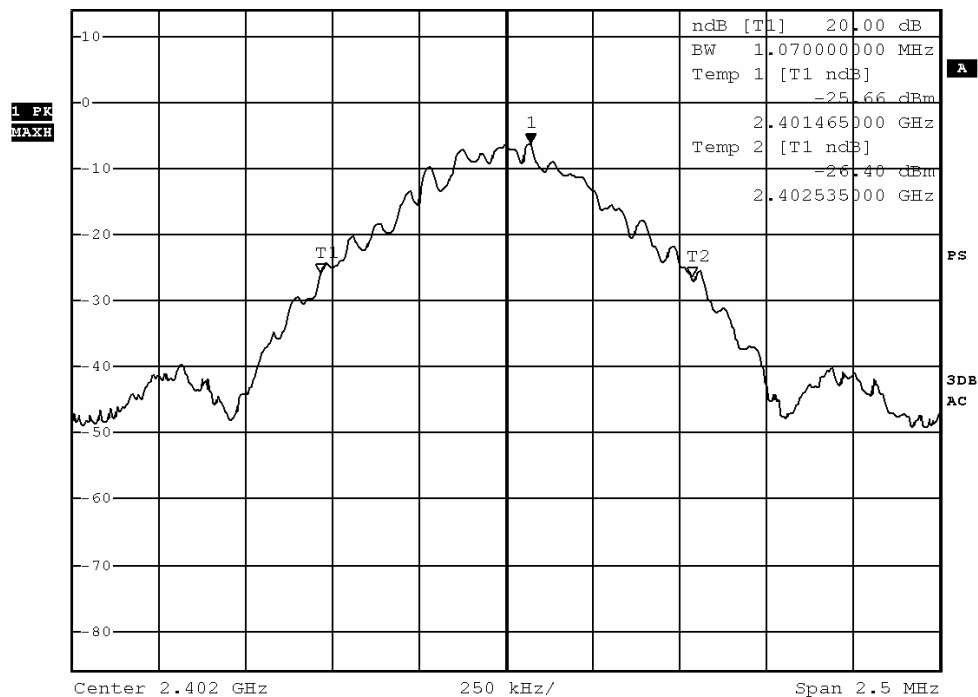
No. : DM126835

Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	1.07	Within 2400-2483.5

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



\*RBW 30 kHz Marker 1 [T1]  
\*VBW 100 kHz -6.18 dBm  
Ref 14 dBm \*Att 35 dB SWT 5 ms 2.402070000 GHz



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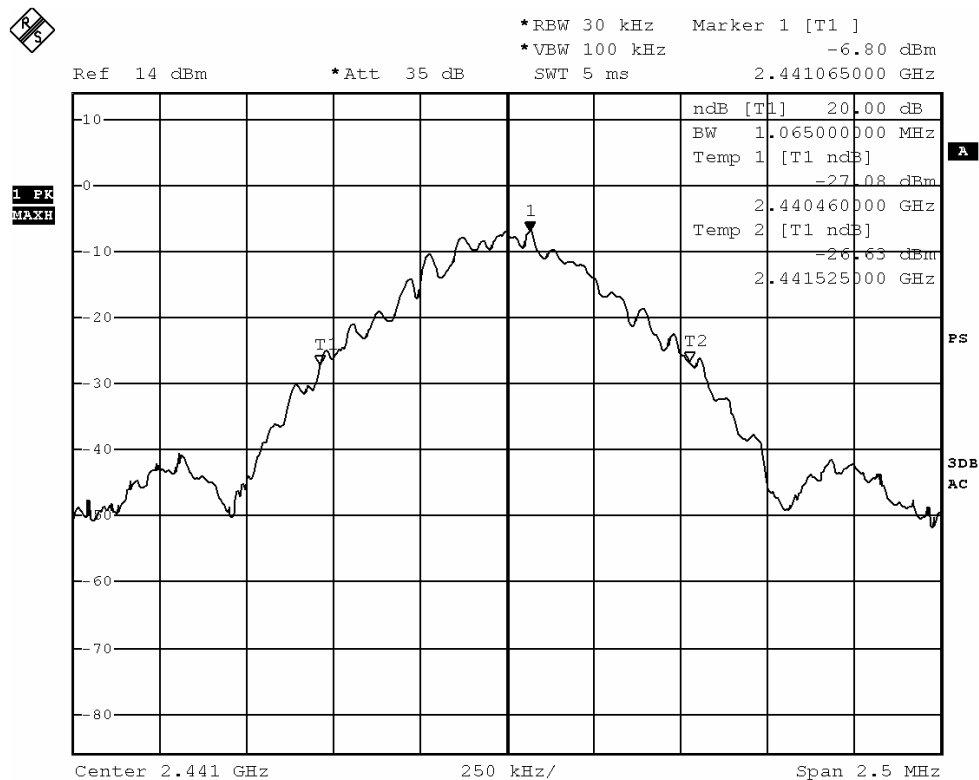
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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2441	1.065	Within 2400-2483.5

(Middle Operating Frequency) - (GFSK)



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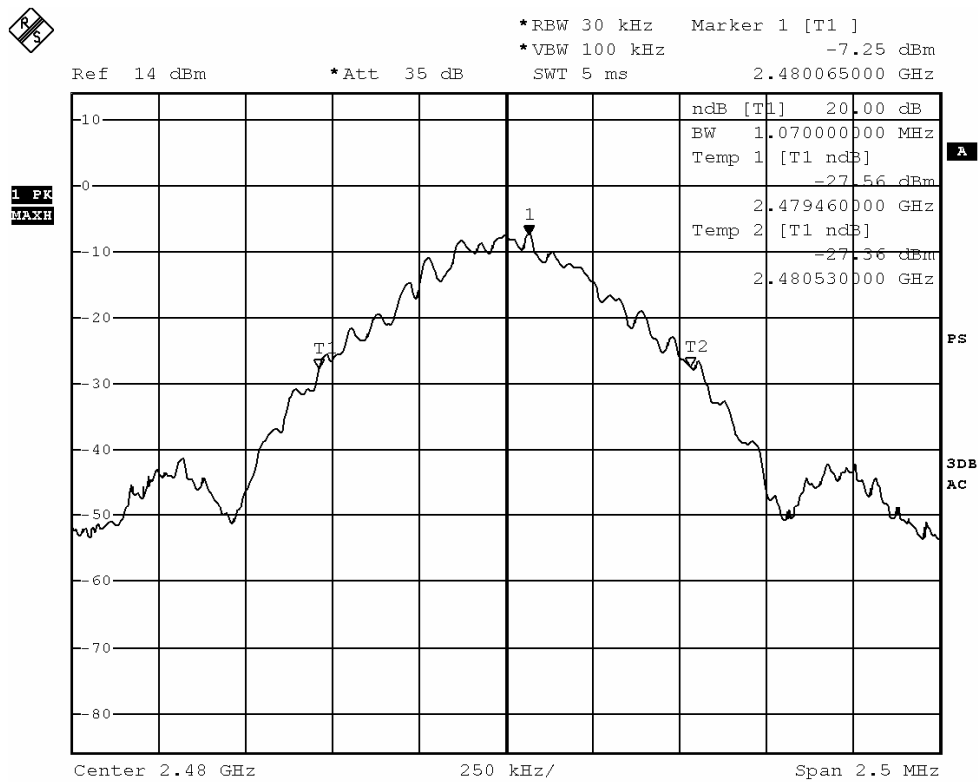
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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2480	1.07	Within 2400-2483.5

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



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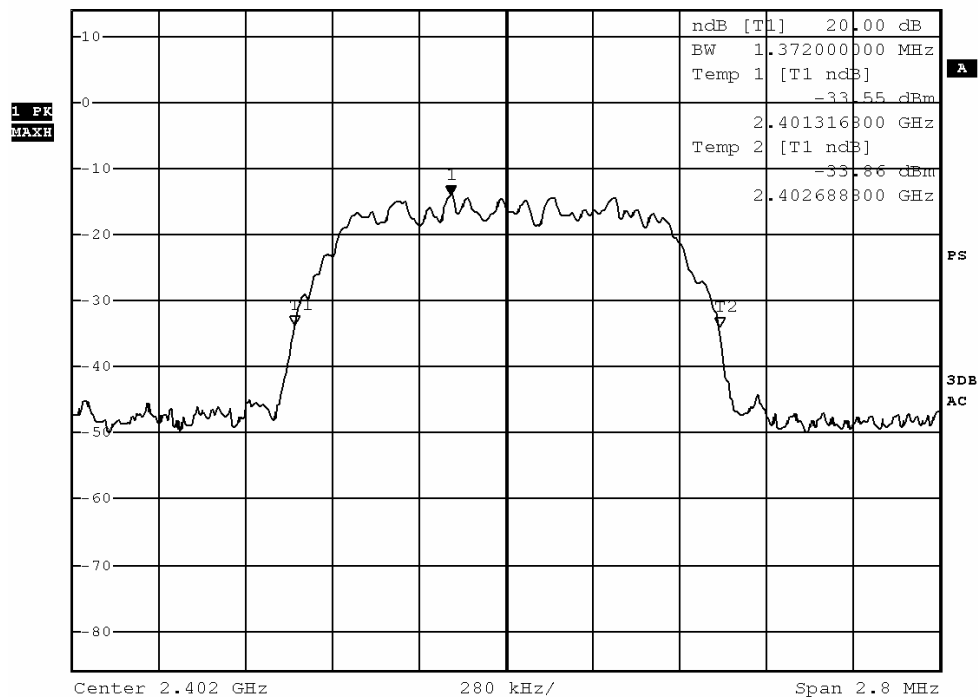
No. : DM126835

Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	1.372	Within 2400-2483.5

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



\*RBW 30 kHz Marker 1 [T1]  
\*VBW 100 kHz -13.58 dBm  
Ref 14 dBm \*Att 35 dB SWT 5 ms 2.401820800 GHz



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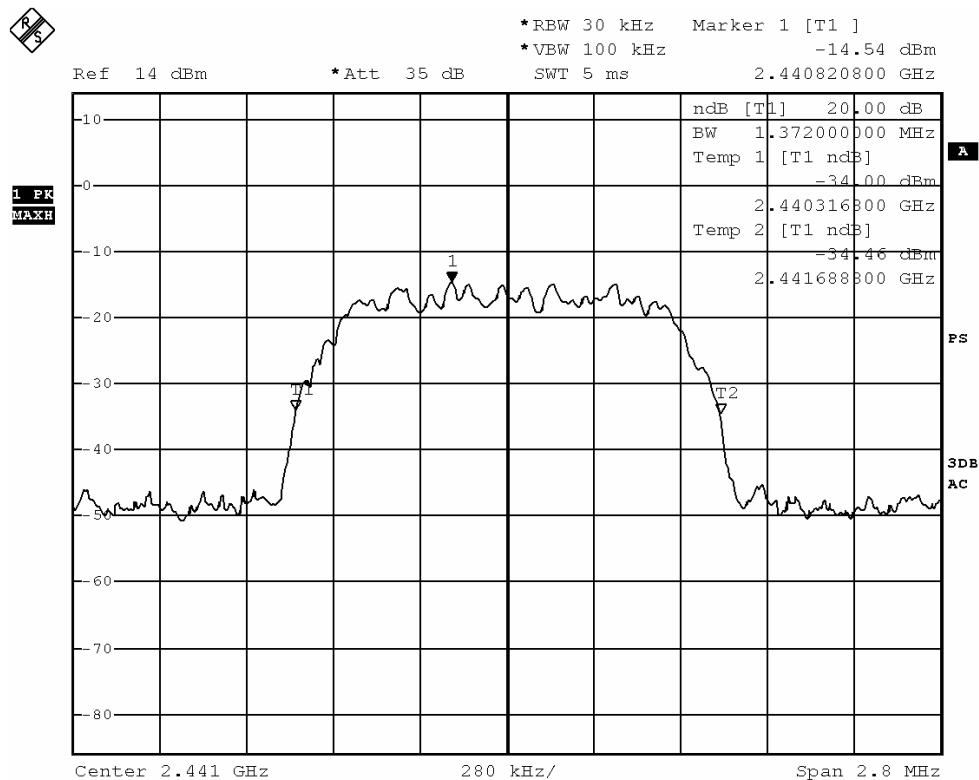
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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2441	1.372	Within 2400-2483.5

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



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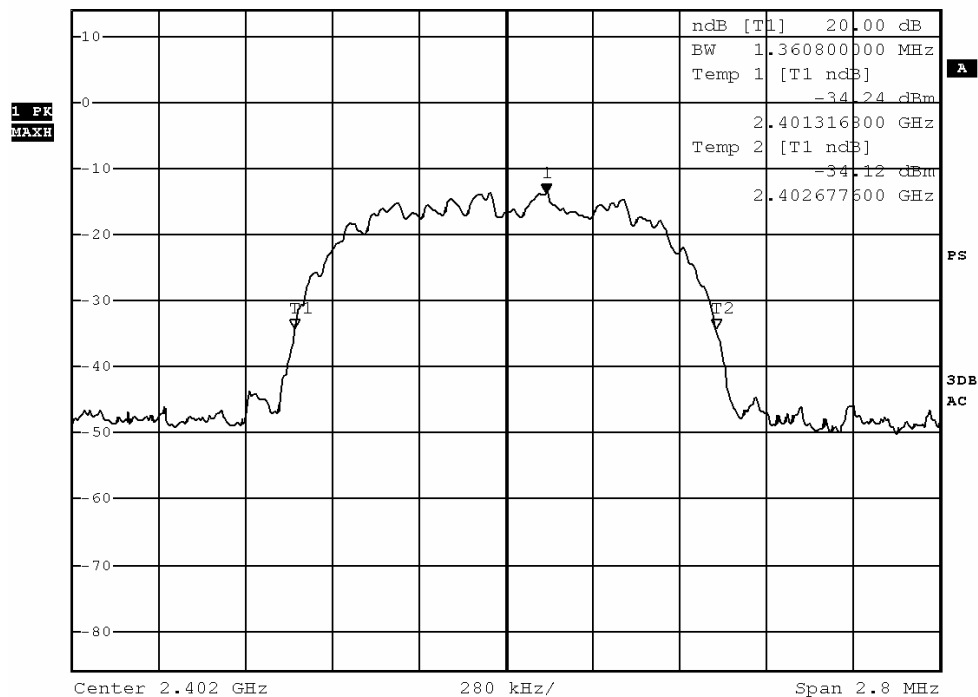
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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	1.3608	Within 2400-2483.5

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



\*RBW 30 kHz Marker 1 [T1 ]  
\*VBW 100 kHz -13.74 dBm  
Ref 14 dBm \*Att 35 dB SWT 5 ms 2.402128800 GHz



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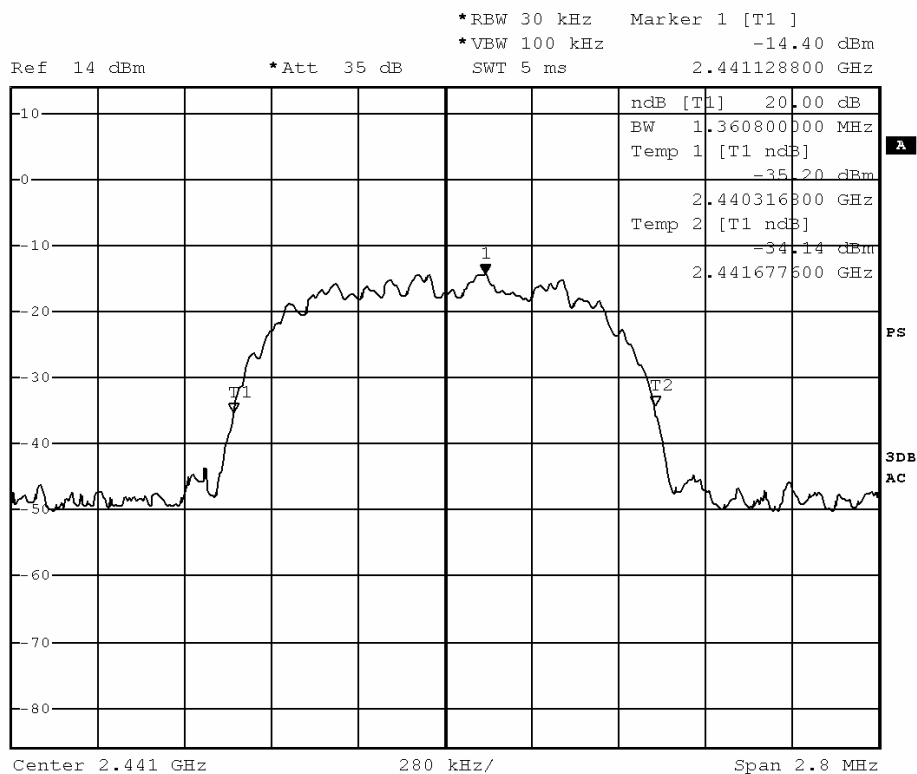
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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2441	1.3608	Within 2400-2483.5

(Middle Operating Frequency) - (8DPSK)



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## Test Report

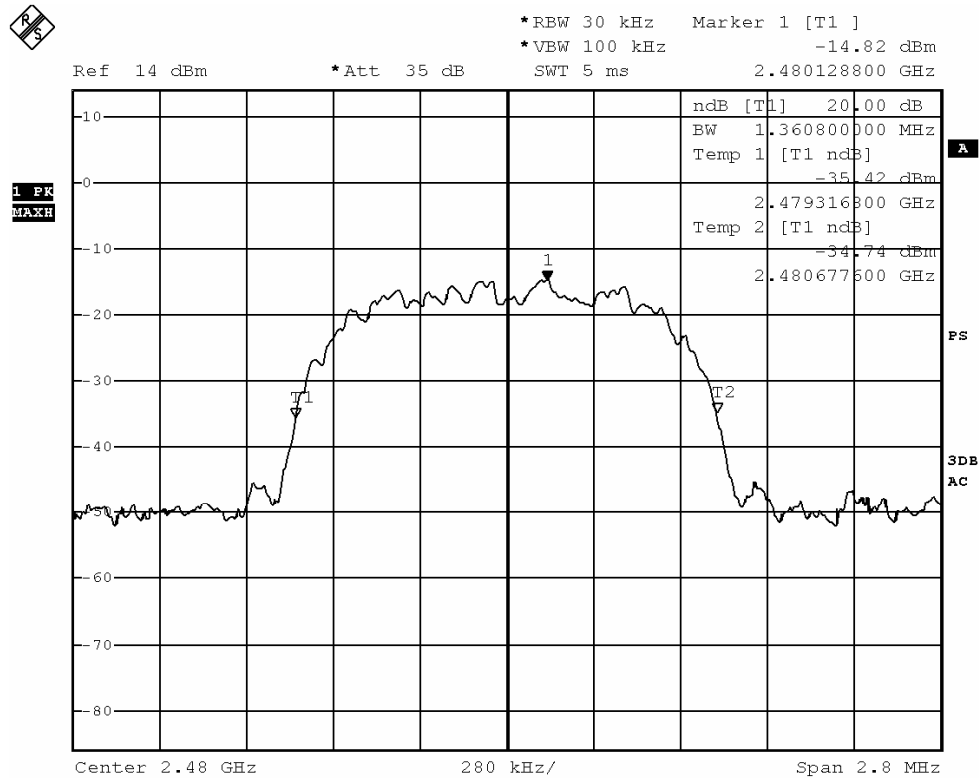
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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2480	1.3608	Within 2400-2483.5

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



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### 3.1.5 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.

#### Spectrum Analyzer Setting:

RBW = 300kHz, VBW  $\geq$  RBW, Sweep = Auto,  
Span = Wide enough to capture the peaks of two adjacent channels  
Detector = Peak, Trace = Max. hold

#### Limit:

The measured maximum bandwidth \*  $\frac{2}{3}$  = 1.07MHz \*  $\frac{2}{3}$  = 713.3 kHz(GFSK)

The measured maximum bandwidth \*  $\frac{2}{3}$  = 1.372MHz \*  $\frac{2}{3}$  = 914.7kHz( $\pi/4$  DQPSK, 8DPSK)

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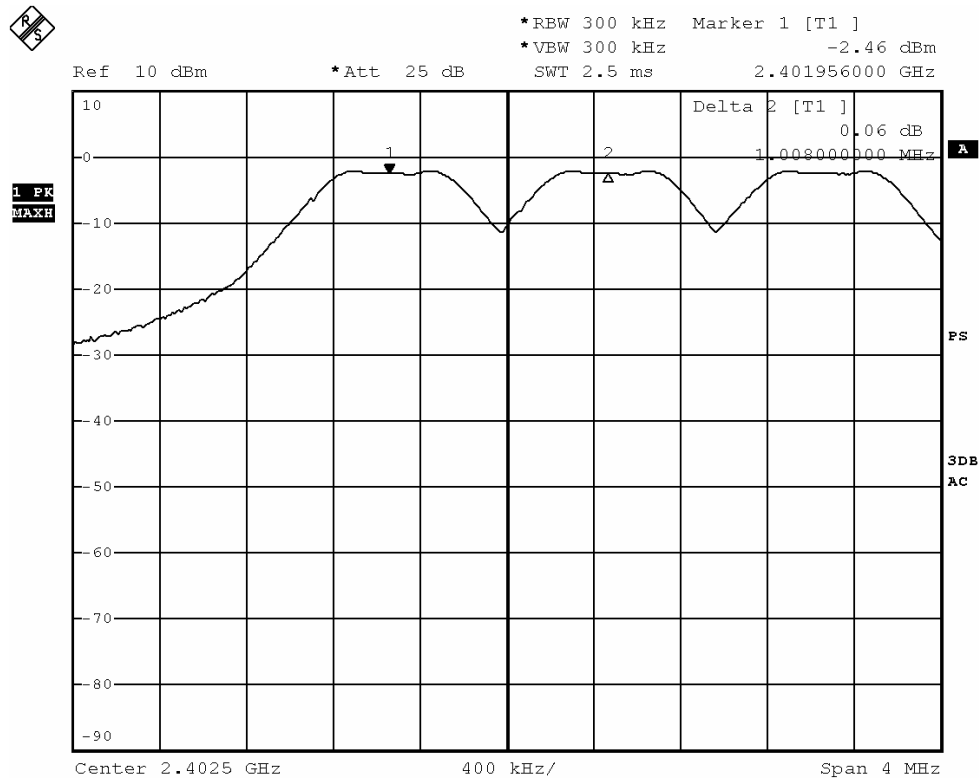
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Channel separation = 1MHz (>713.3kHz) (Lowest) (GFSK)



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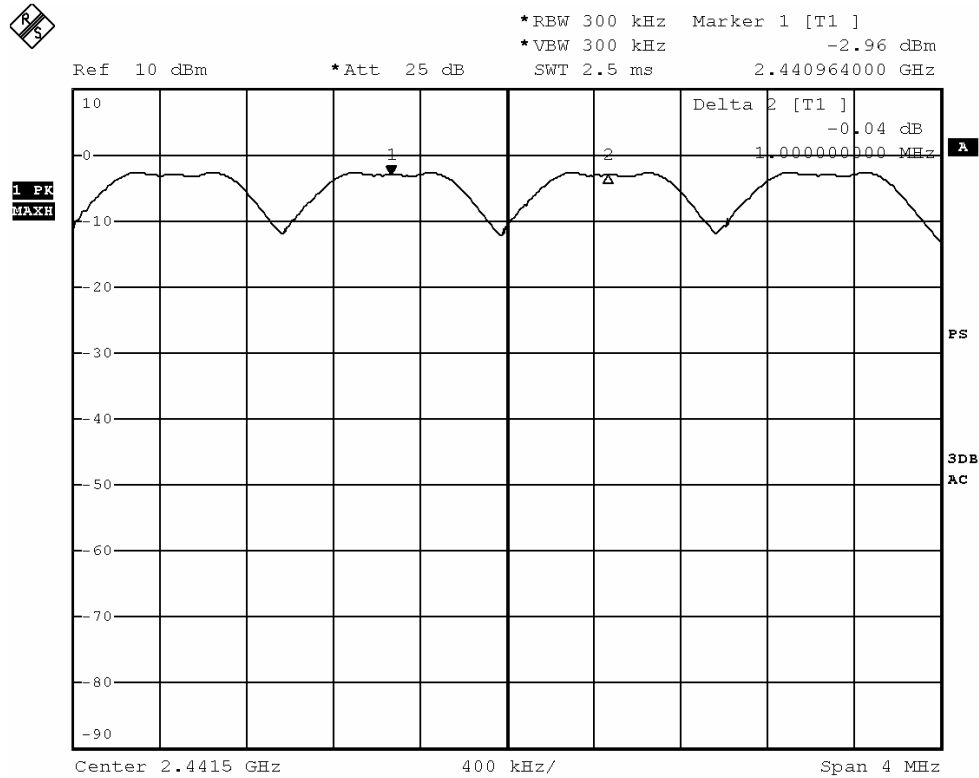
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### Channel separation = 1MHz (>713.3kHz) (Mid) (GFSK)



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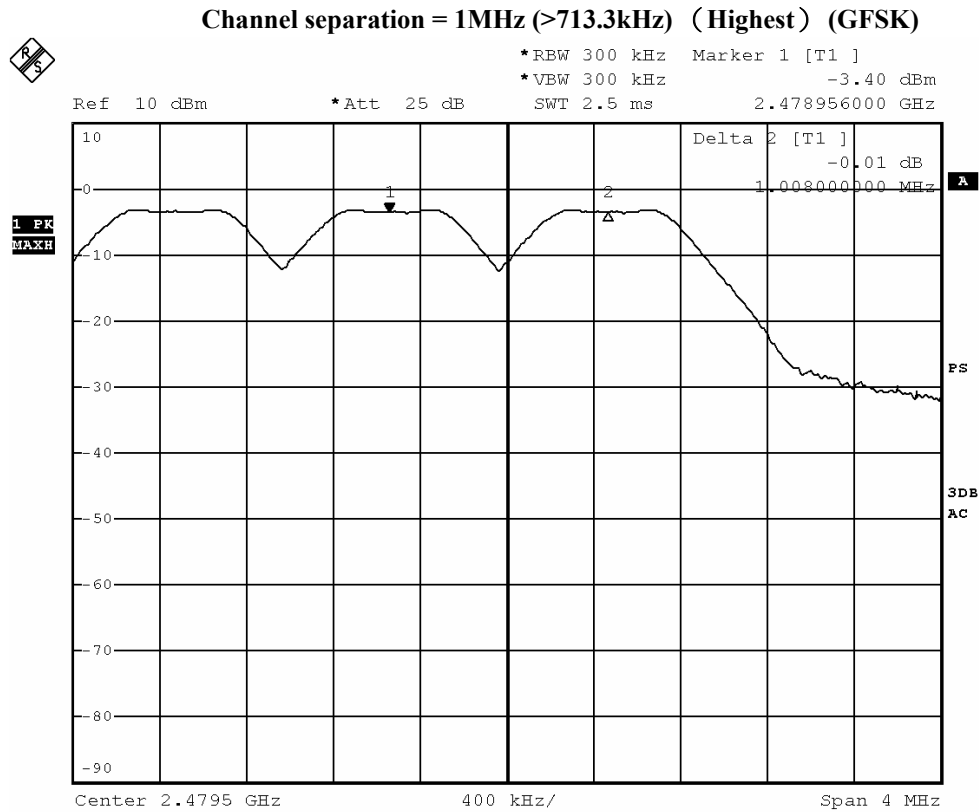


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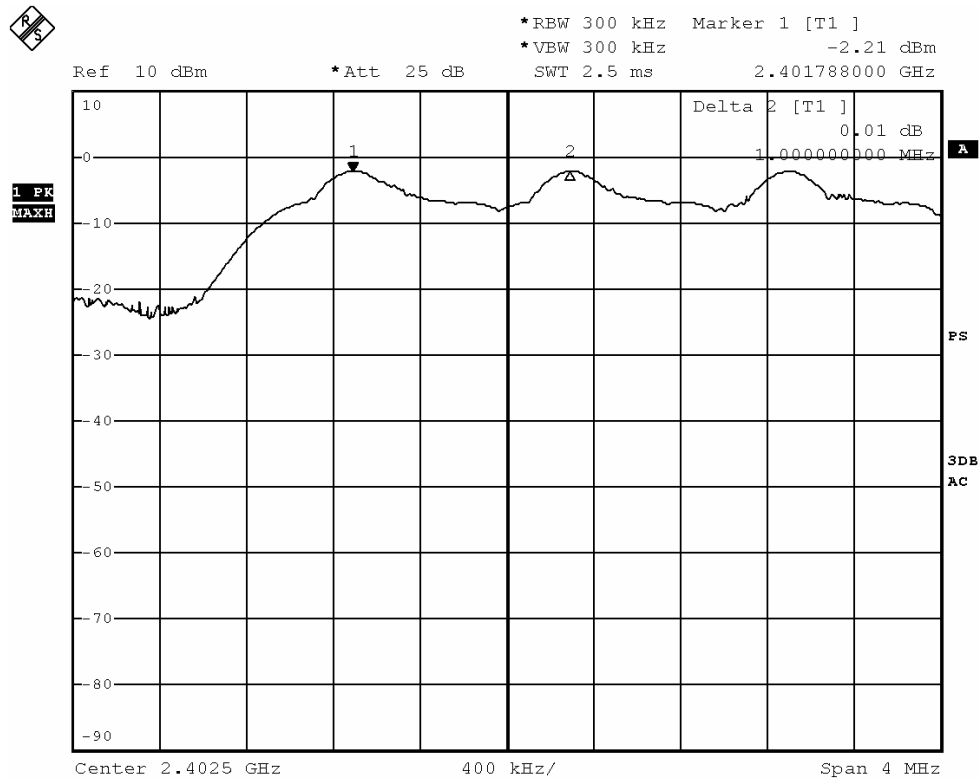
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Channel separation = 1MHz (>914.7kHz) (Lowest) ( $\pi/4$  DQPSK)



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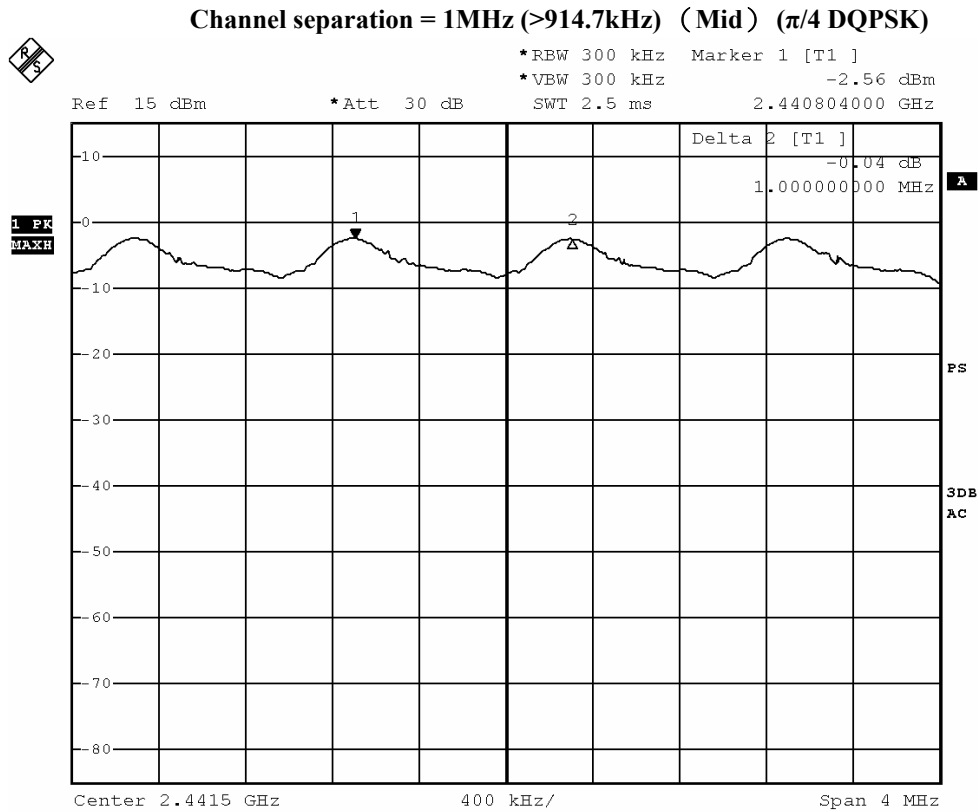


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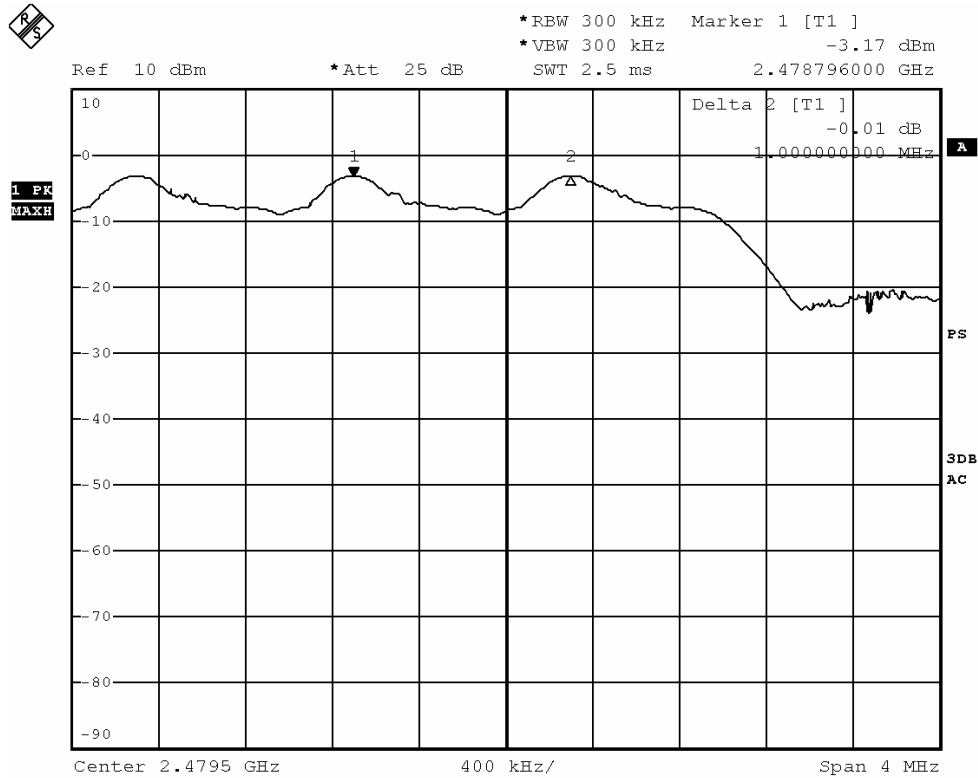
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Channel separation = 1MHz (>914.9kHz) (Highest) ( $\pi/4$  DQPSK)



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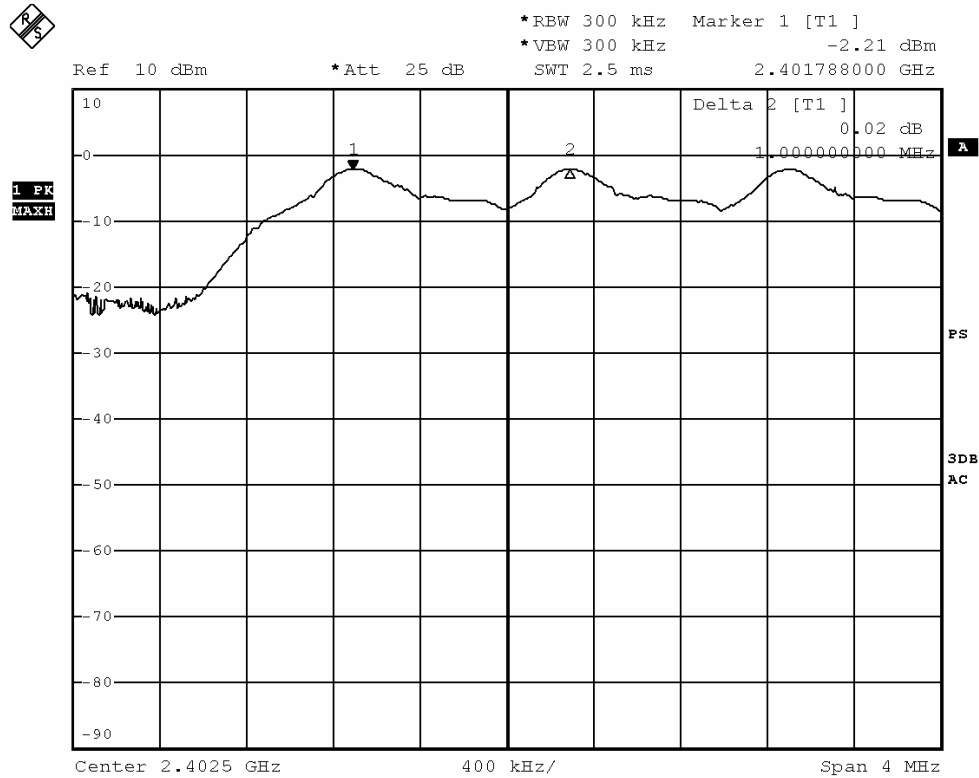
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Channel separation = 1MHz (>914.7kHz) (Lowest) (8DPSK)



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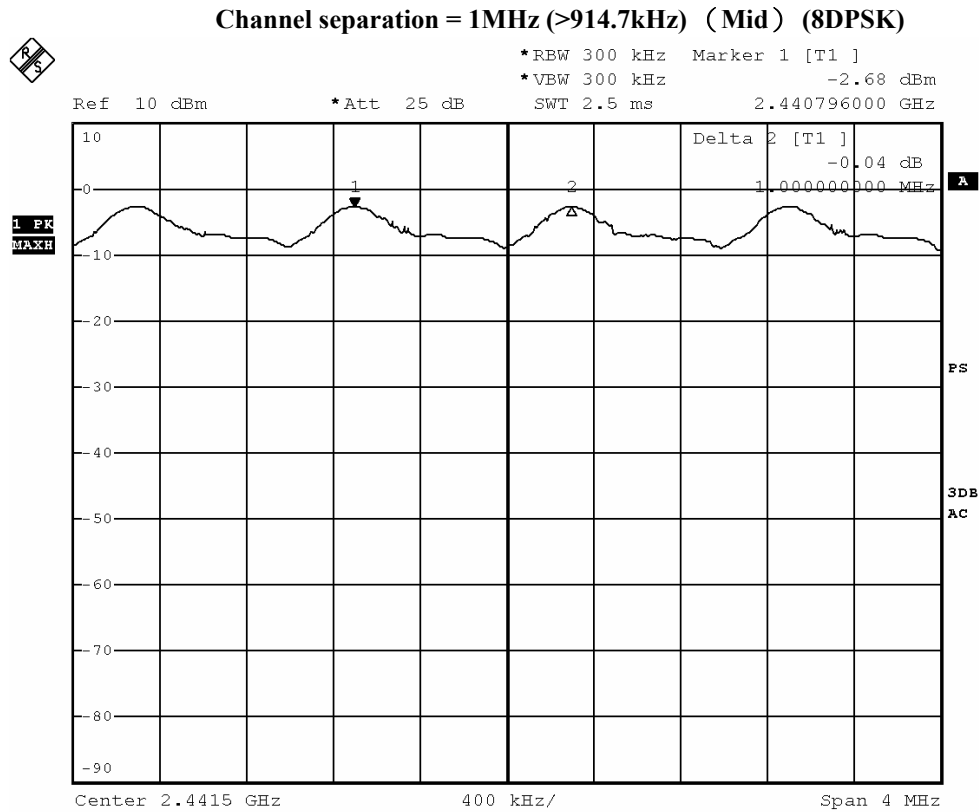
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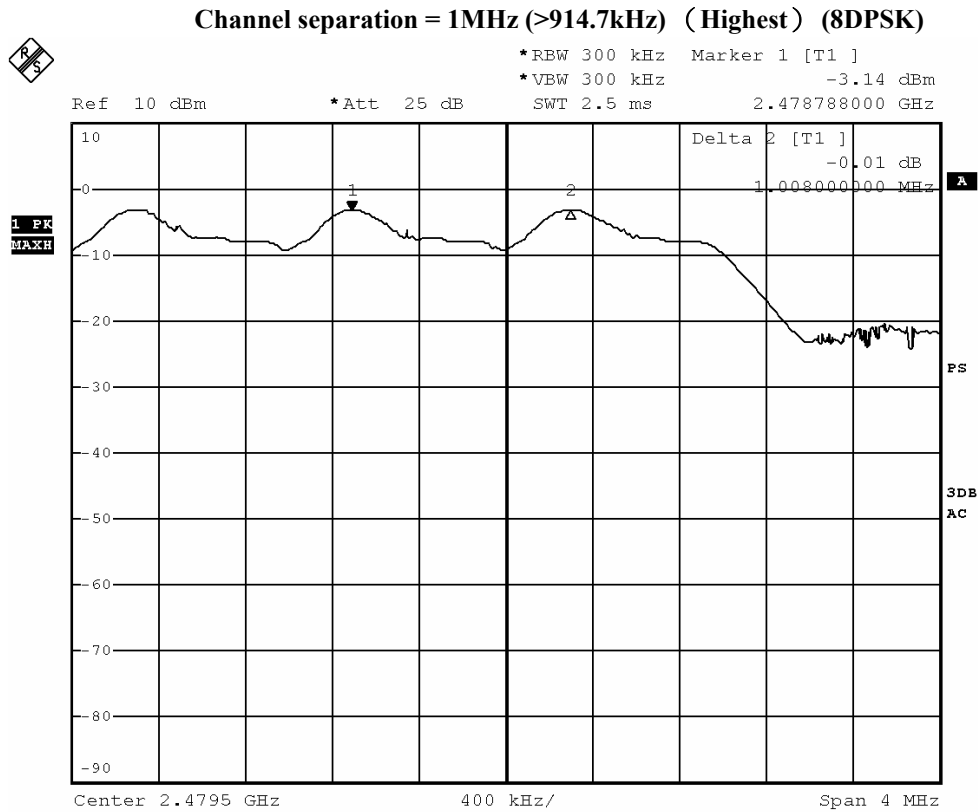


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### **3.1.6 Band-edge Compliance of RF Conducted Emissions Measurement:**

#### **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.

According to the test method DA 00-705.

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

RBW = 100kHz, VBW= 300kHz, Sweep = Coupled,

Span = Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products that fall outside of the authorized band of operation.

Detector = Peak, Trace = Max. hold

Remark: Emissions under the fixed frequency mode and hopping mode have been investigated, the worst-case measurement results were recorded in the test report

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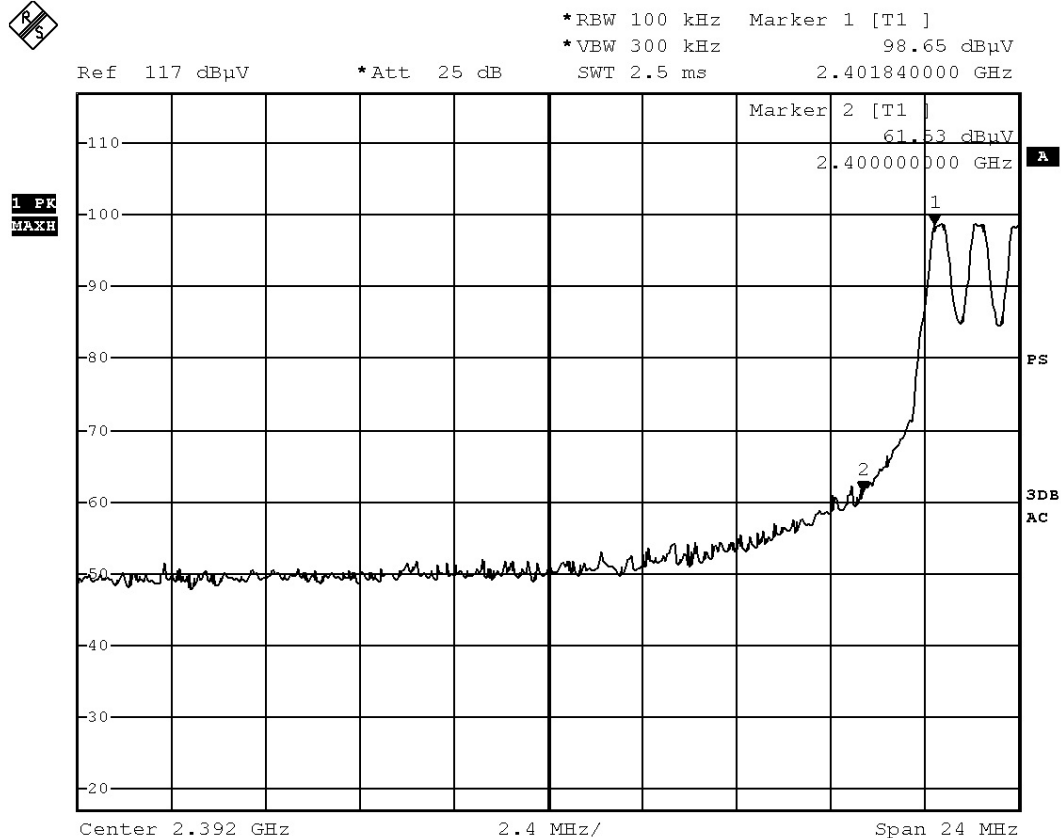
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### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	37.12

### Band-edge Compliance of RF Emissions – Lowest (GFSK) (Hopping on)



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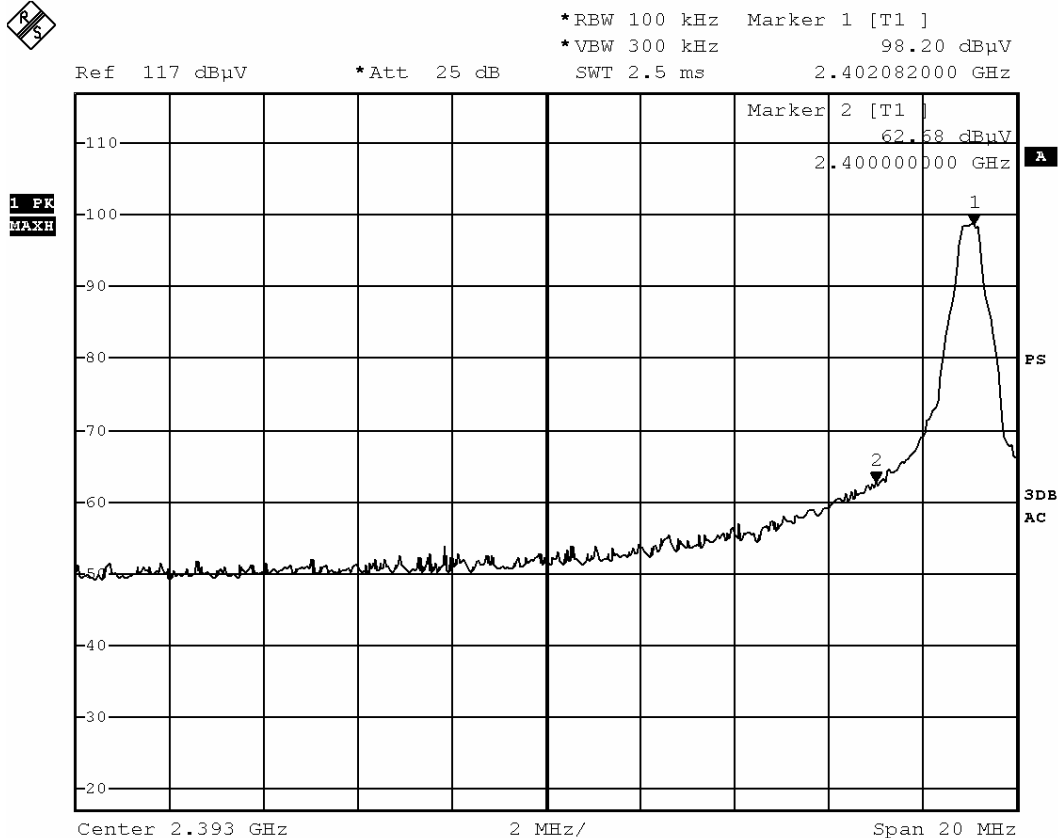
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### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	35.52

### Band-edge Compliance of RF Emissions – Lowest (GFSK) (Hopping off)



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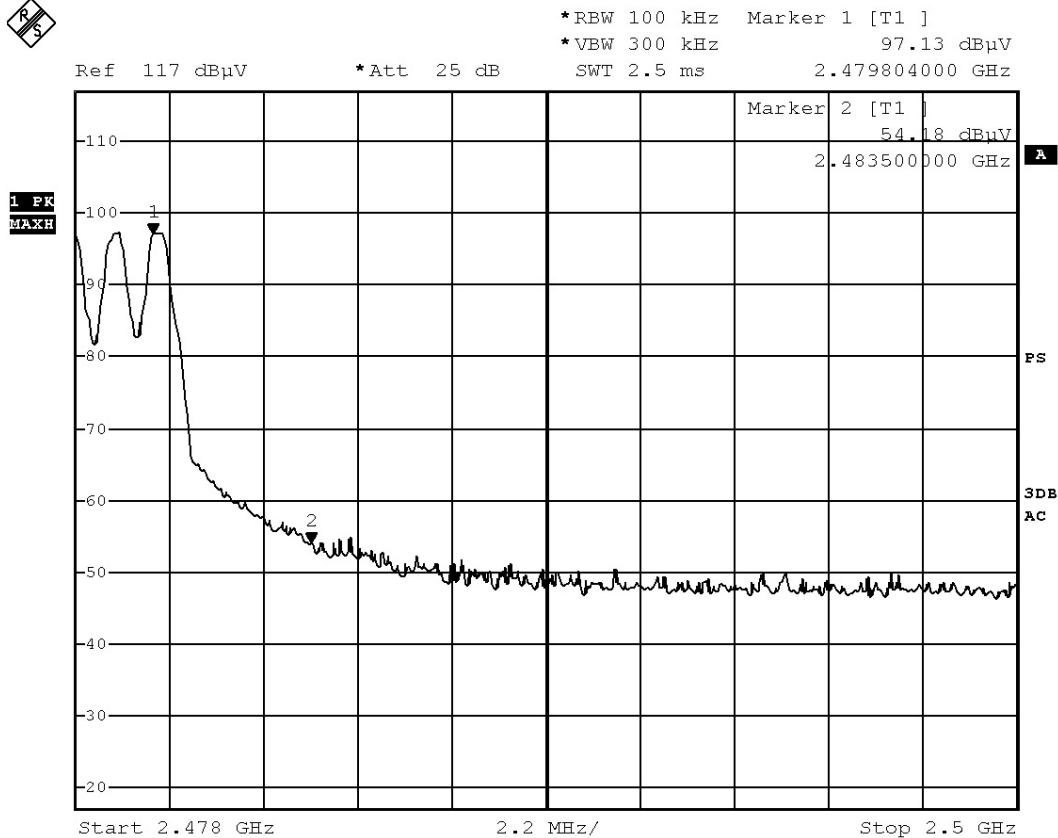
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### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2483.5 - Highest Fundamental (2480)	42.95

### Band-edge Compliance of RF Emissions – Highest (GFSK) (Hopping on)



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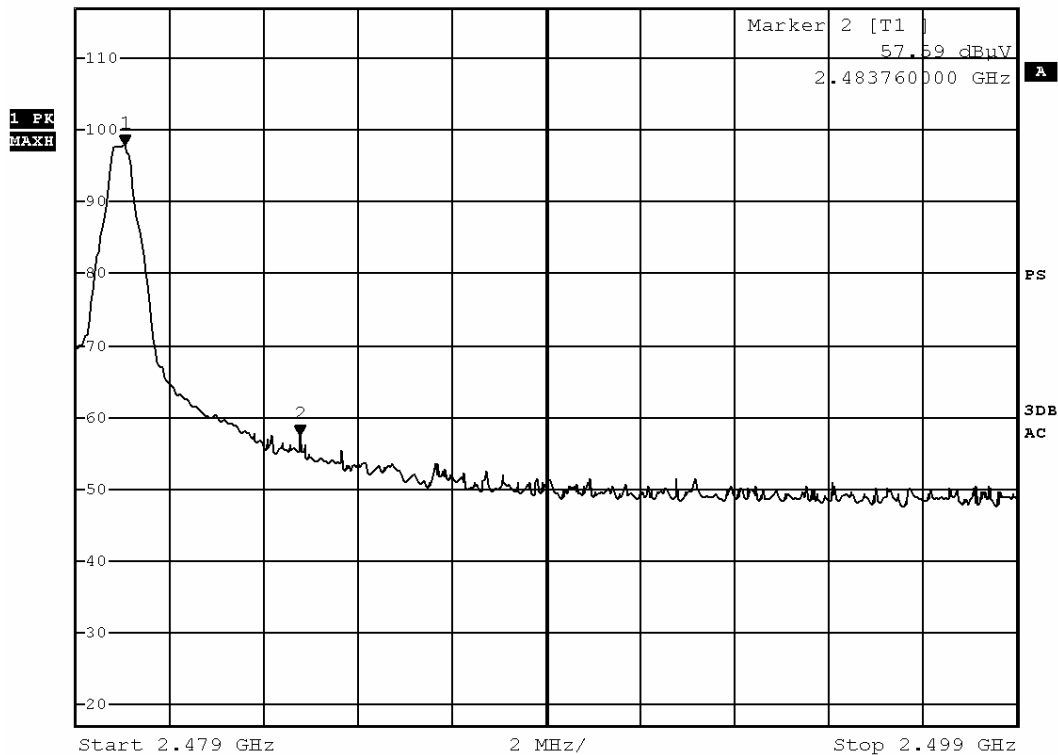
### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2483.5 - Highest Fundamental (2480)	39.71

### Band-edge Compliance of RF Emissions – Highest (GFSK) (Hopping off)



Ref 117 dBμV      \*Att 25 dB      \*RBW 100 kHz      Marker 1 [T1]      \*VBW 300 kHz      97.40 dBμV  
SWT 2.5 ms      2.480040040 GHz



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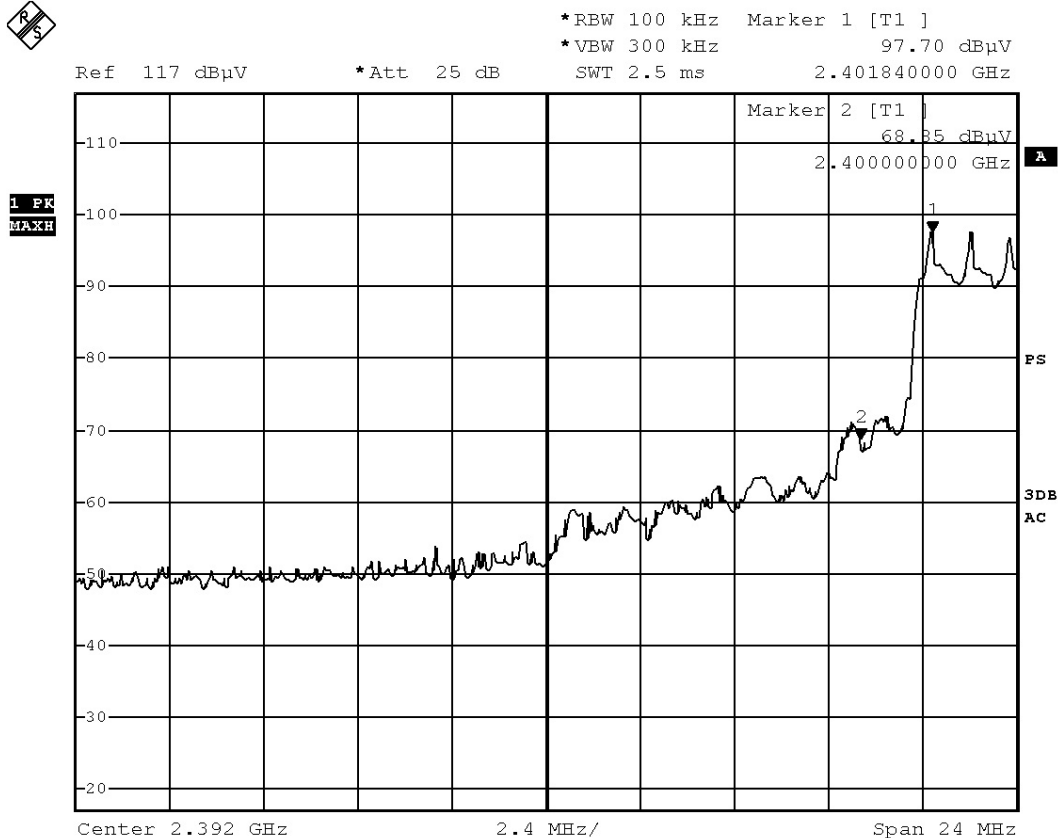
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### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	28.85

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



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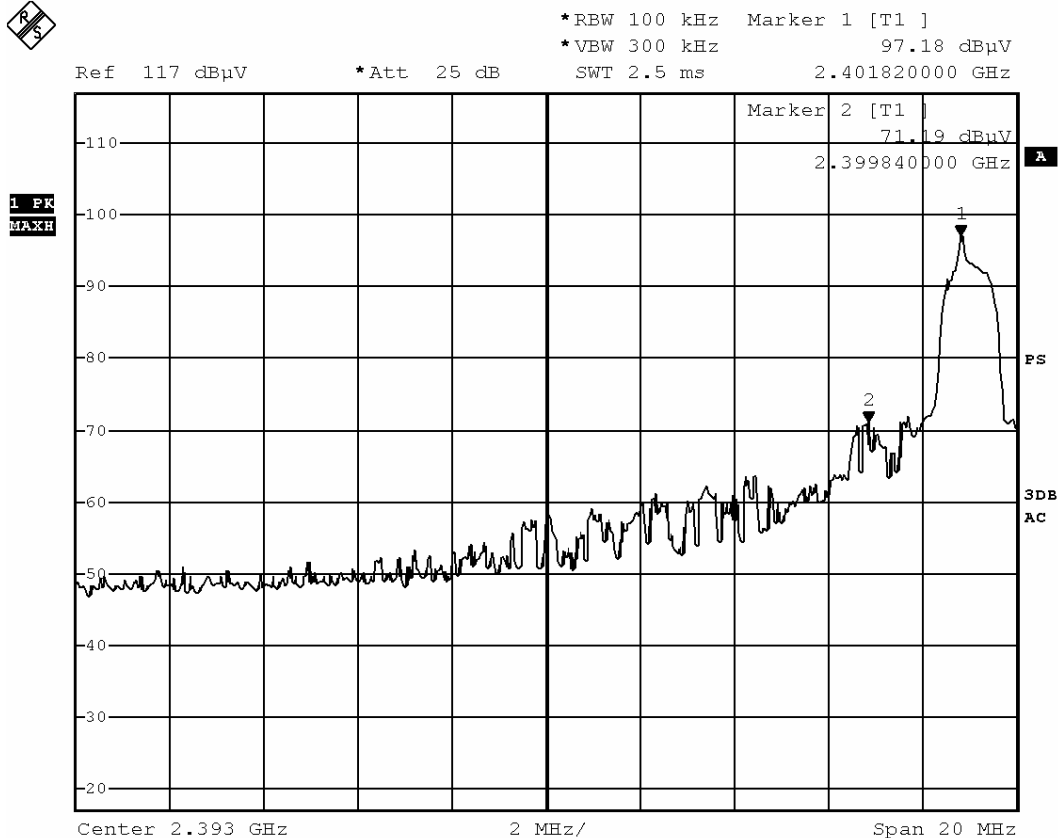
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### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	25.99

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



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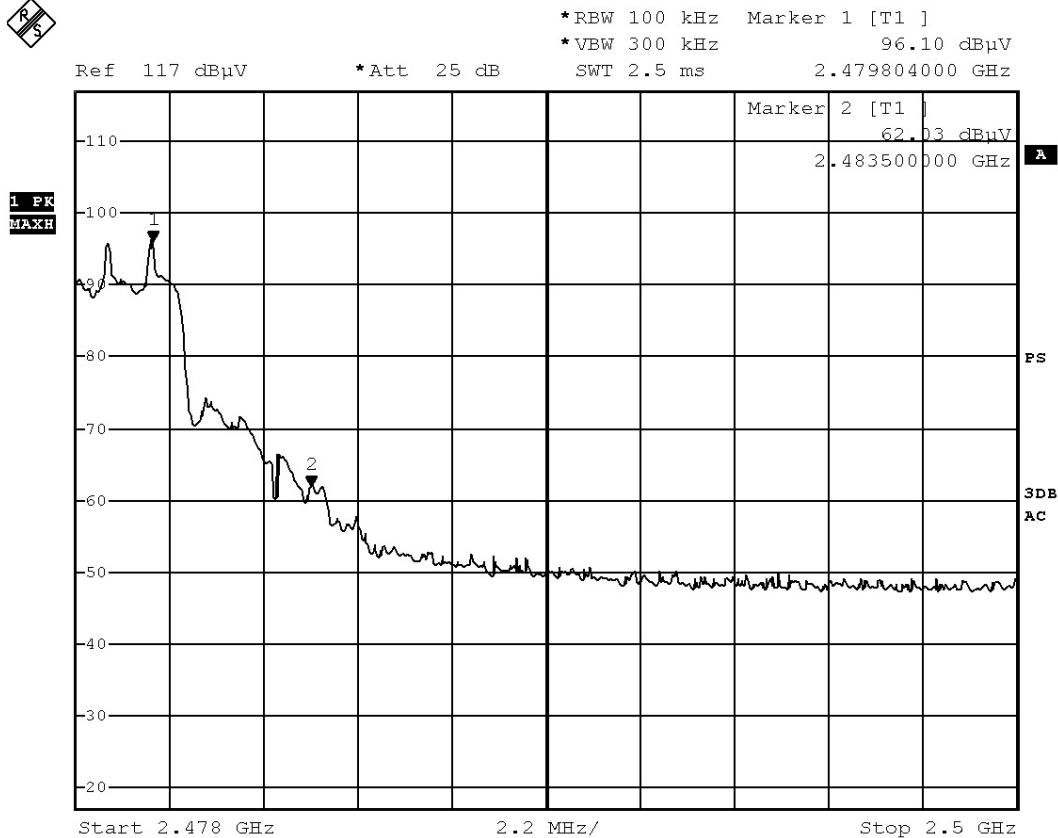
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### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2483.5 - Highest Fundamental (2480)	33.77

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



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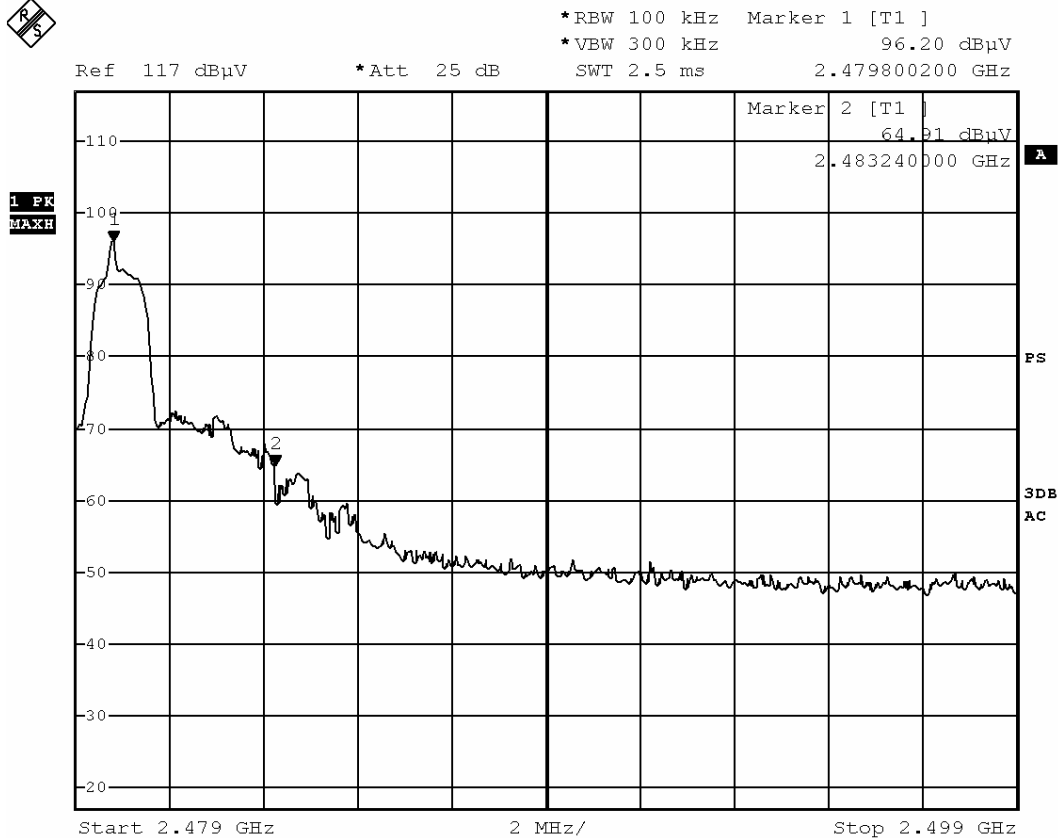
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### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2483.5 - Highest Fundamental (2480)	31.29

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



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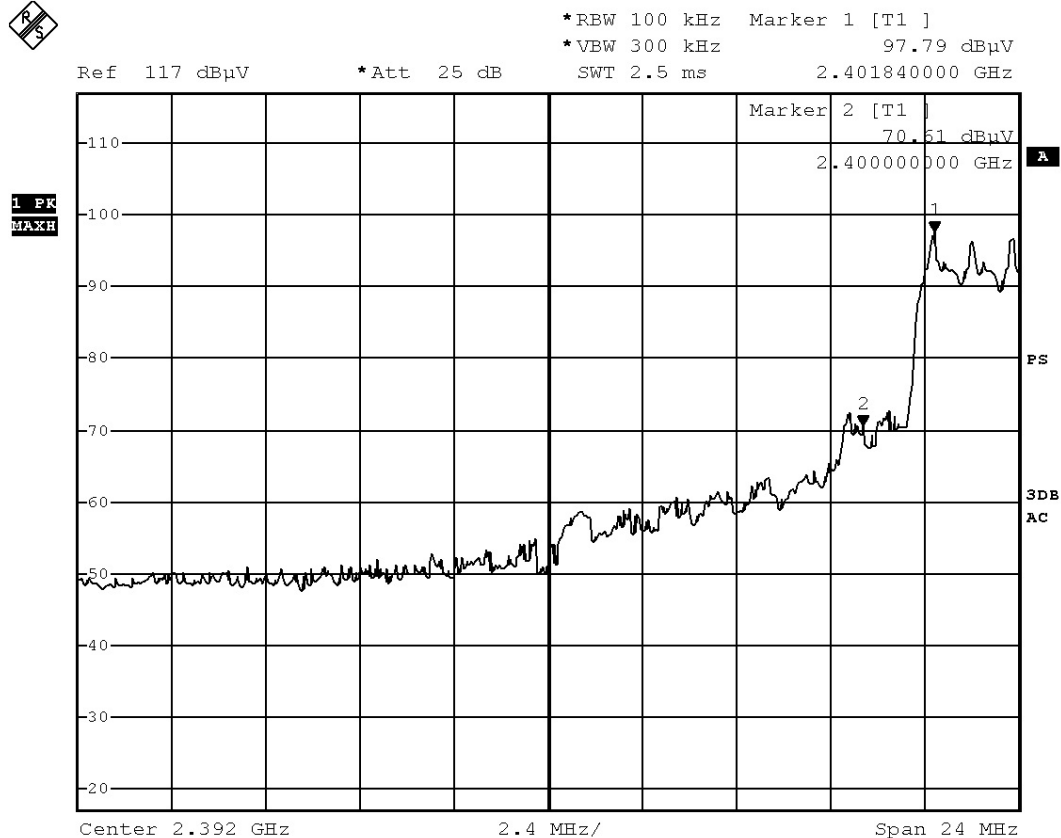
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### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	27.28

### Band-edge Compliance of RF Emissions – Lowest (8DPSK) (Hopping on)



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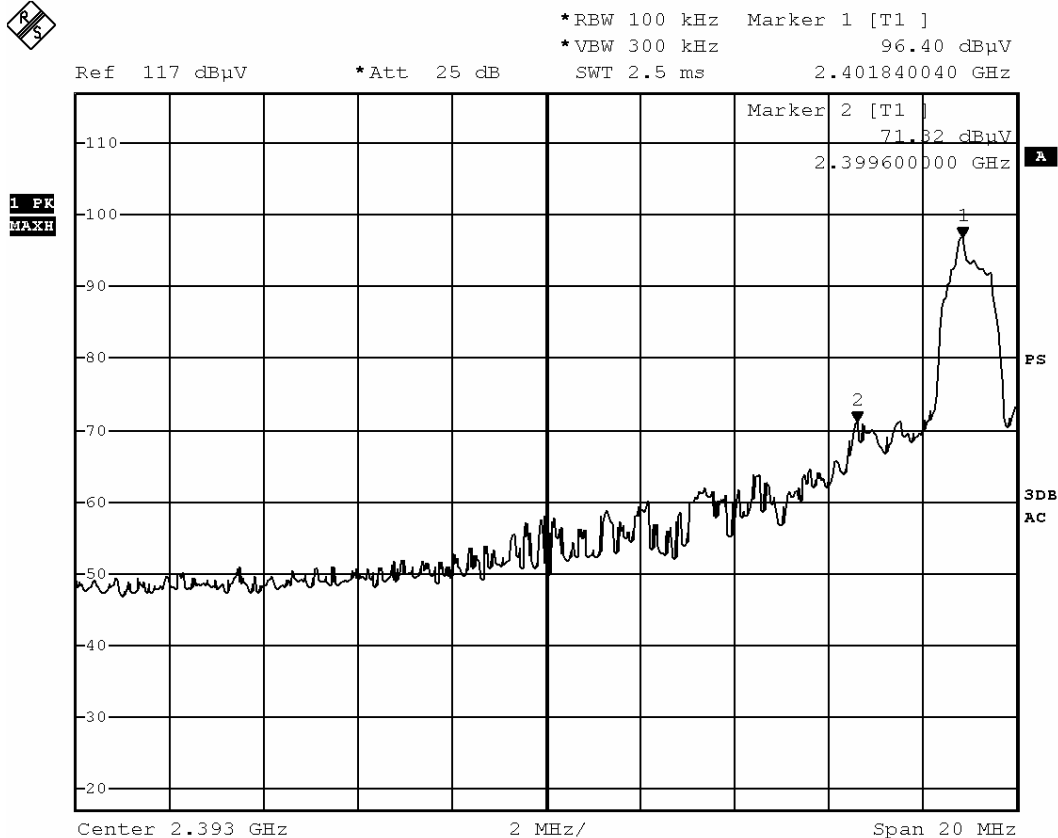
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### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	25.08

### Band-edge Compliance of RF Emissions – Lowest (8DPSK) (Hopping off)



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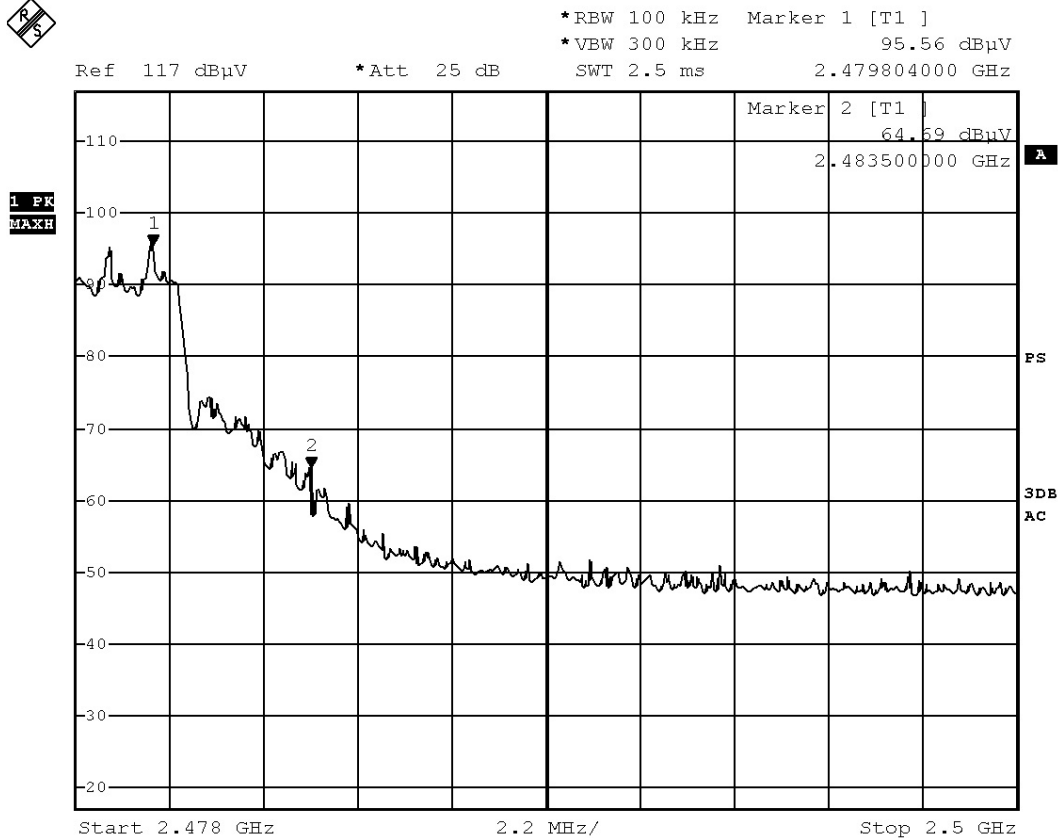
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### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2483.5 - Highest Fundamental (2480)	30.97

### Band-edge Compliance of RF Emissions – Highest (8DPSK) (Hopping on)



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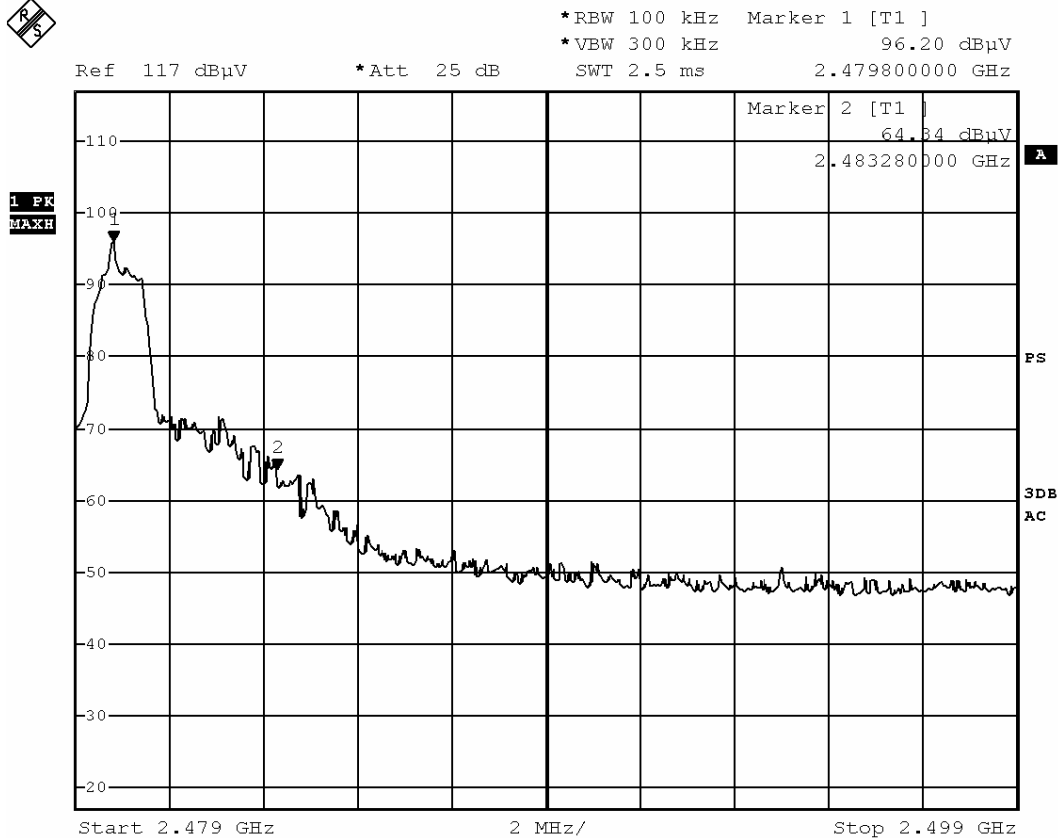
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### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2483.5 - Highest Fundamental (2480)	31.86

### Band-edge Compliance of RF Emissions – Highest (8DPSK) (Hopping off)



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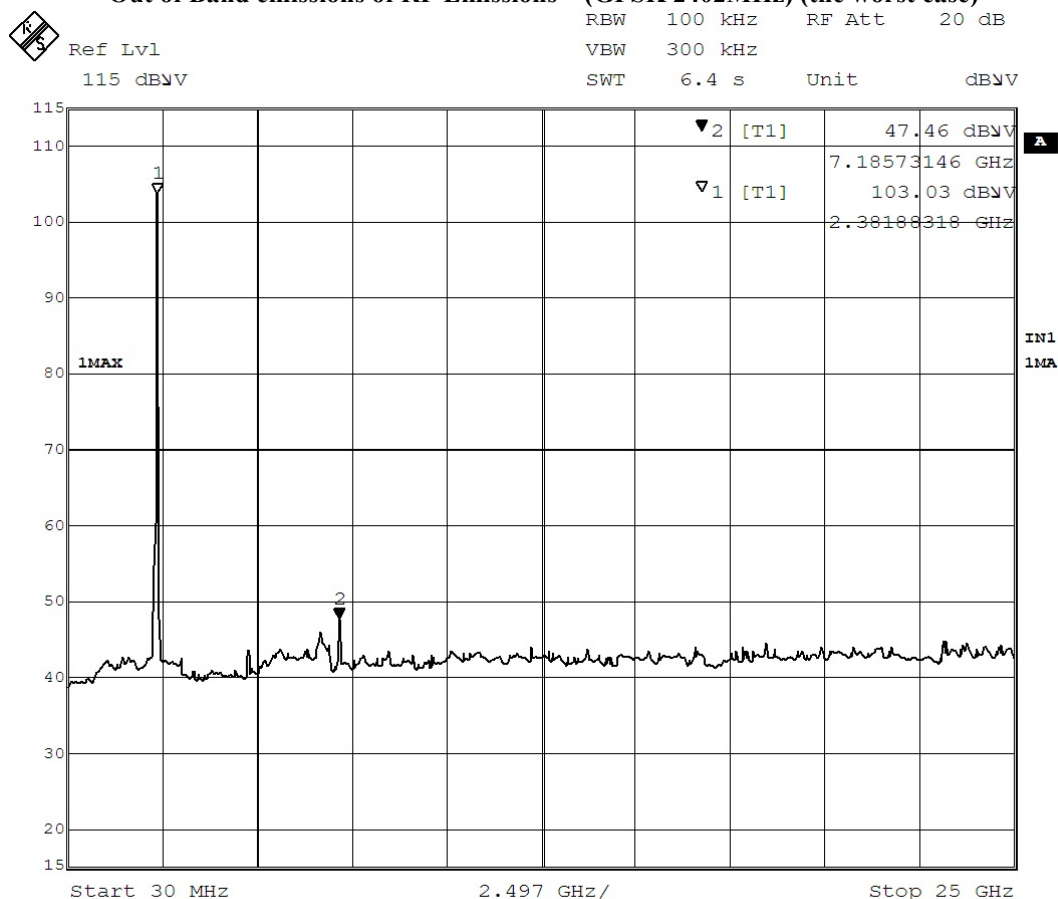
### Out of Band emissions of RF Conducted Emissions Measurement:

#### 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.

Remark: Emissions under the fixed frequency mode and hopping mode have been investigated, the worst-case measurement results were recorded in the test report

### Out of Band emissions of RF Emissions – (GFSK 2402MHz) (the worst case)



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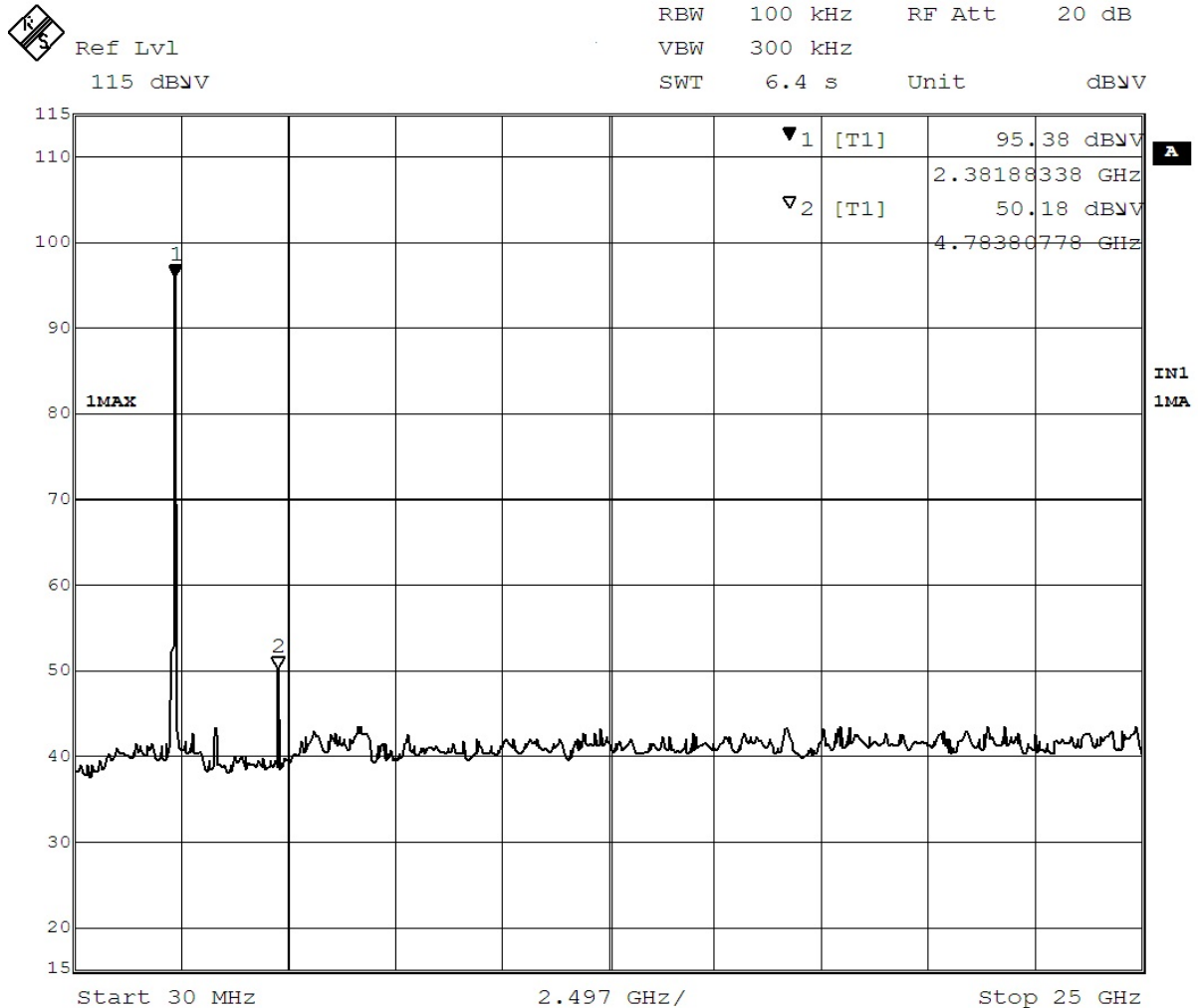


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### Out of Band emissions of RF Emissions – ( $\pi/4$ -DQPSK 2402MHz) (the worst case)



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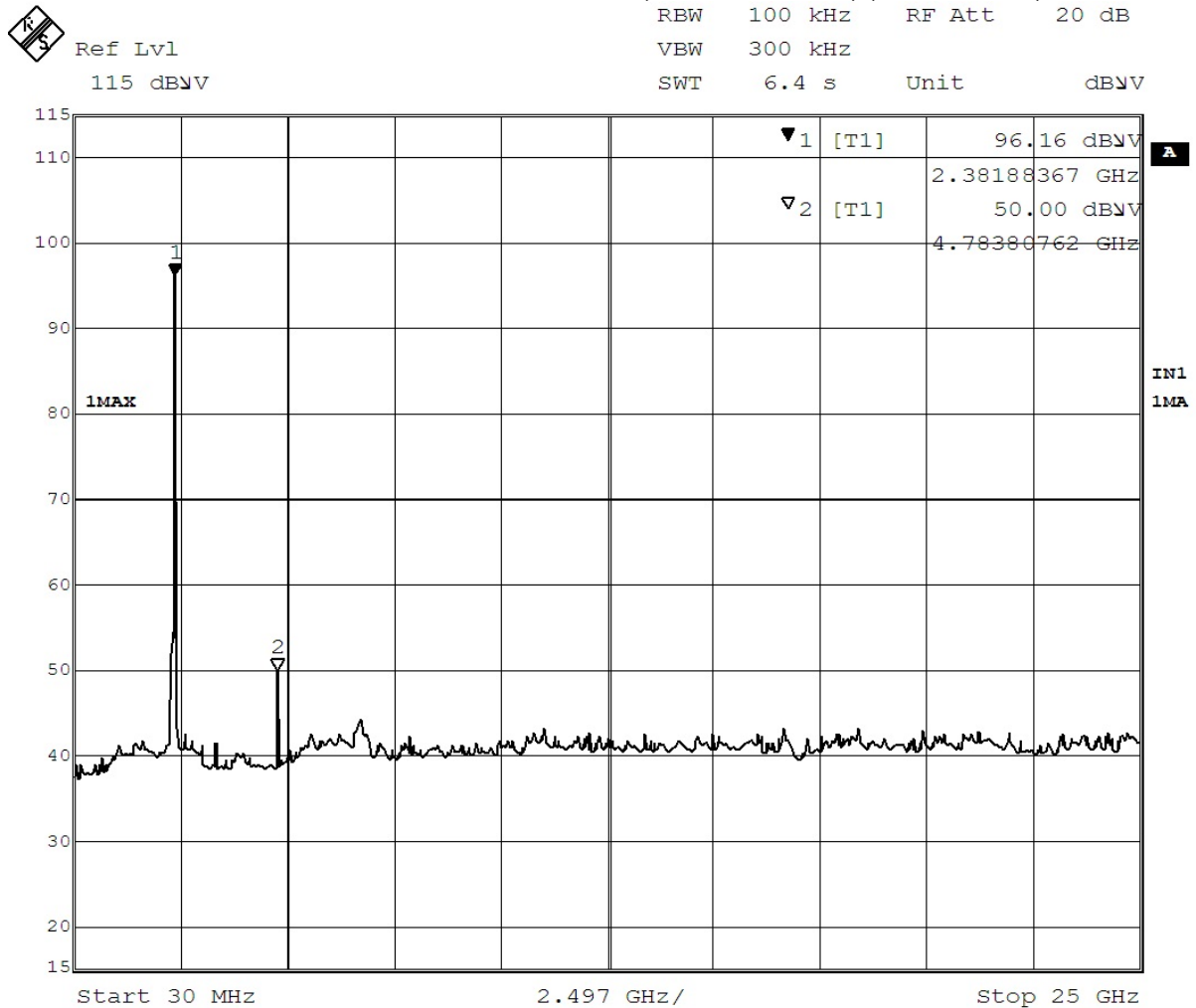


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### Out of Band emissions of RF Emissions – (8DPSK 2402MHz) (the worst case)



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### 3.1.7 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.

#### Spectrum Analyzer Setting:

RBW = 300kHz, VBW  $\geq$  RBW,

Sweep = A longer sweep time to show two successive hops on a channel,

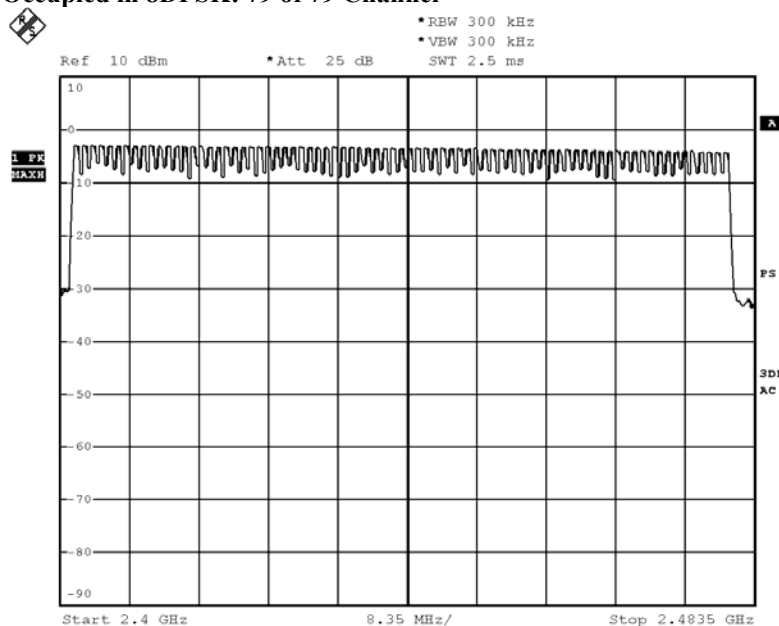
Span = Zero, Detector = Peak, Trace = Max. hold

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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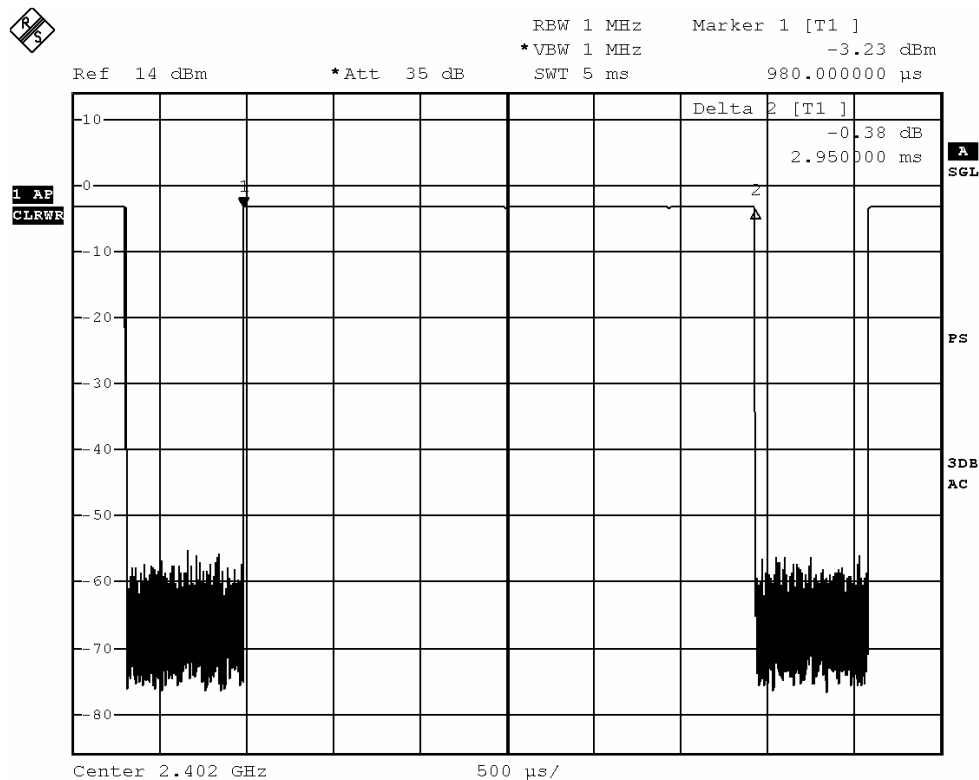
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### 8DPSK DH5 Packet:

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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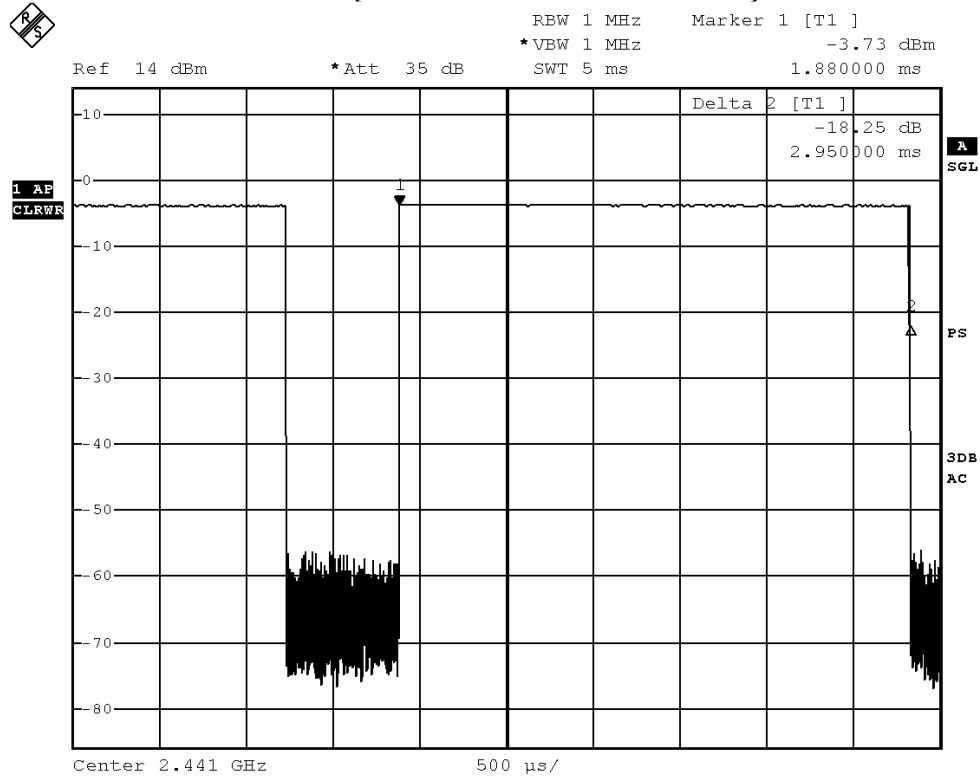


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**Fig. B**  
**[Pulse duration of Middle Channel]**



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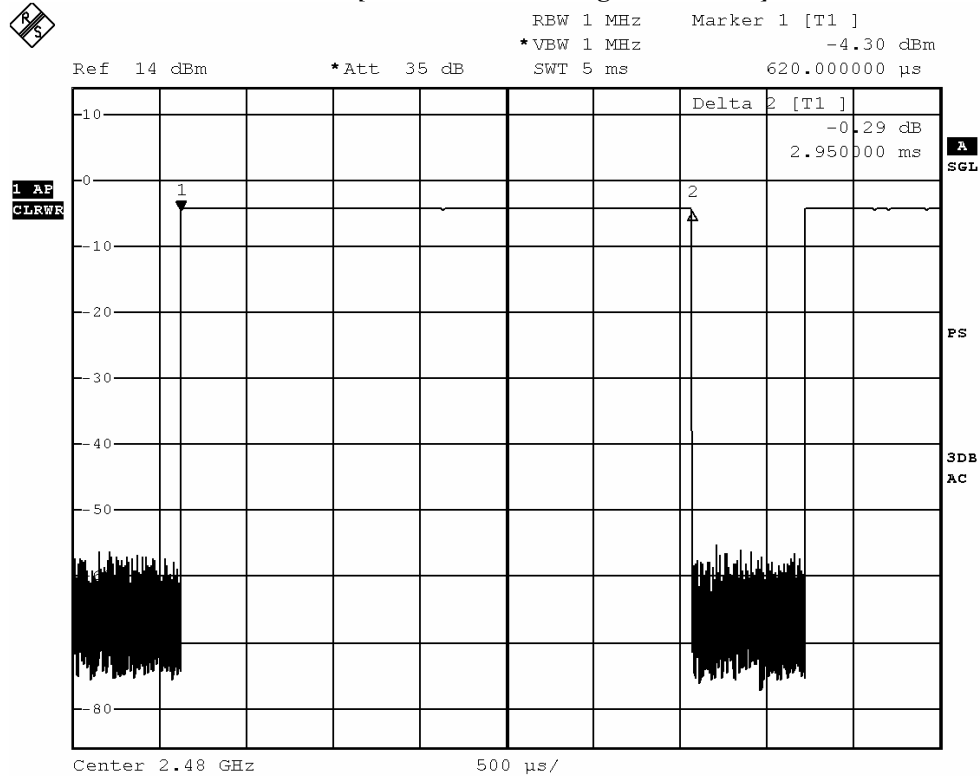


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**Fig. C**  
**[Pulse duration of Highest Channel]**



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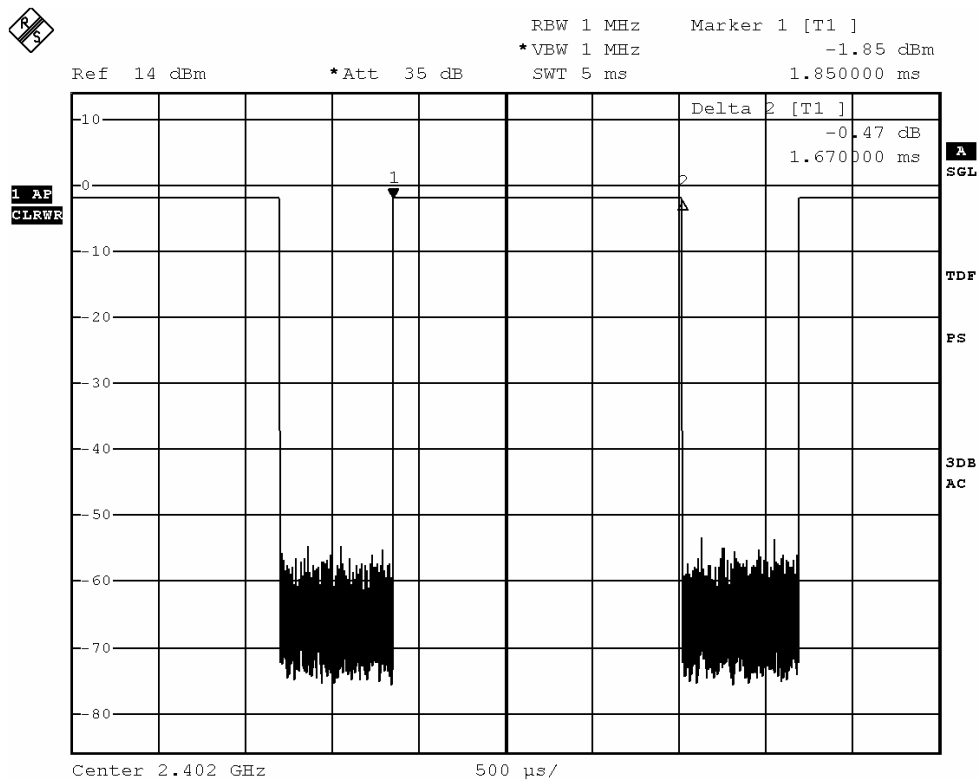
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### 8DPSK DH3 Packet:

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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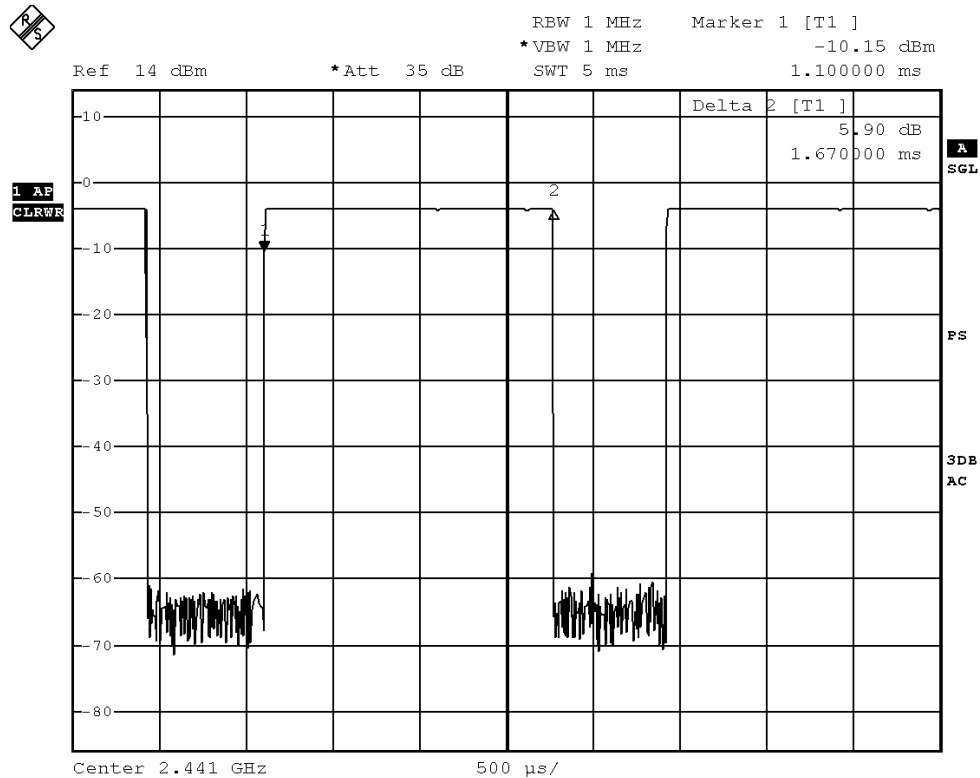


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**Fig. E**  
**[Pulse duration of Middle Channel]**



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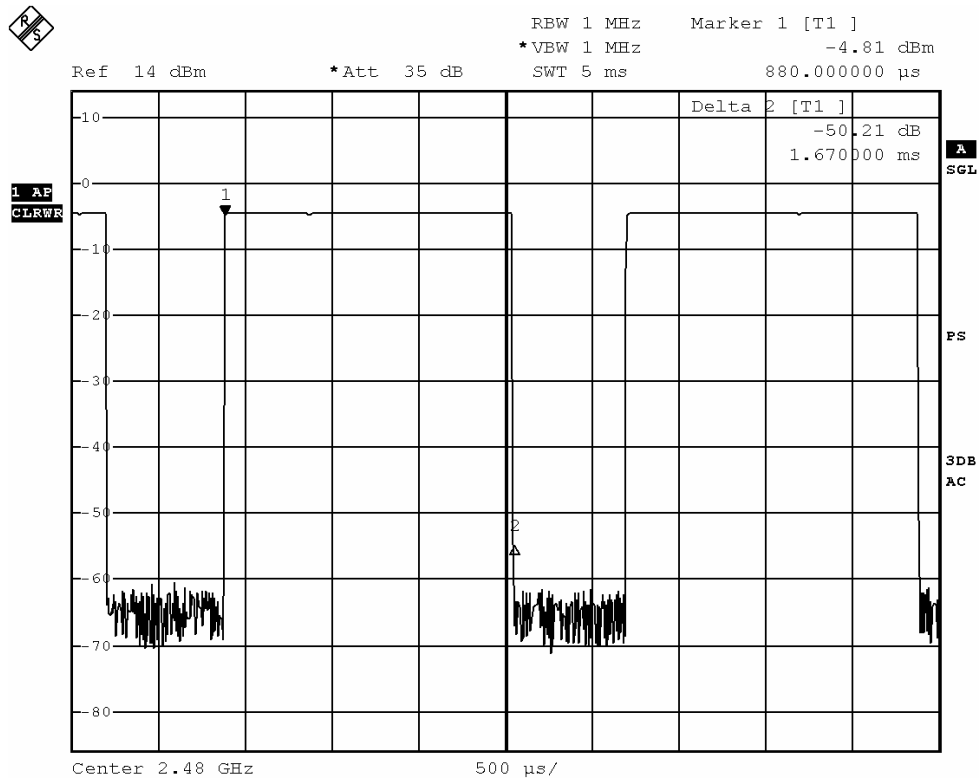


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**Fig. F**  
**[Pulse duration of Highest Channel]**



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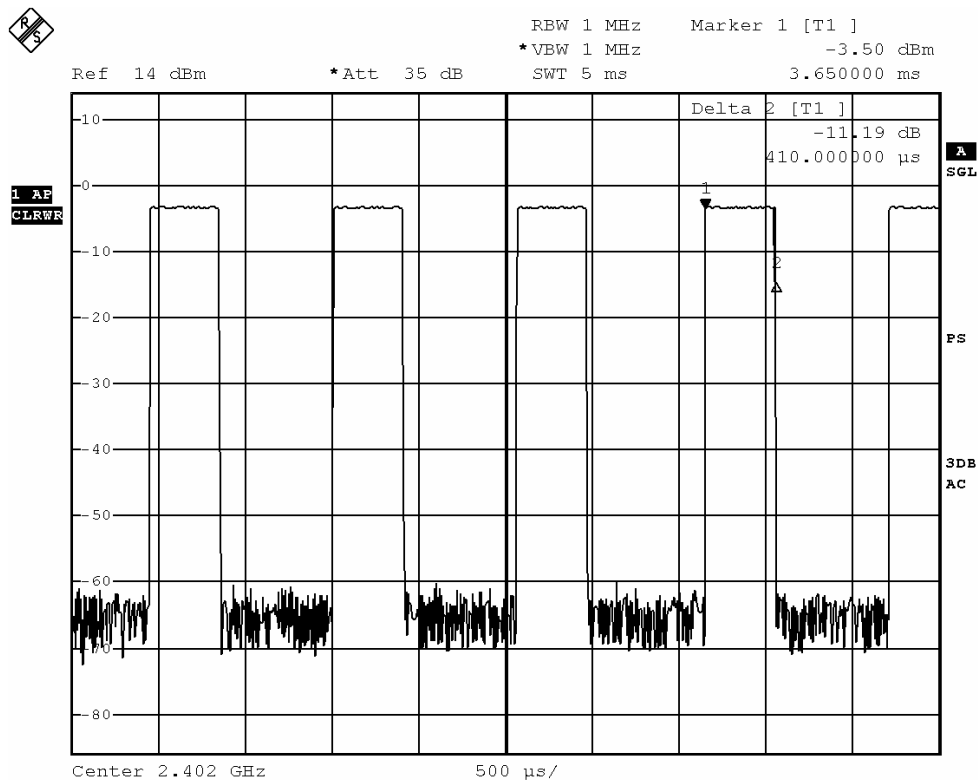
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### 8DPSK DH1 Packet:

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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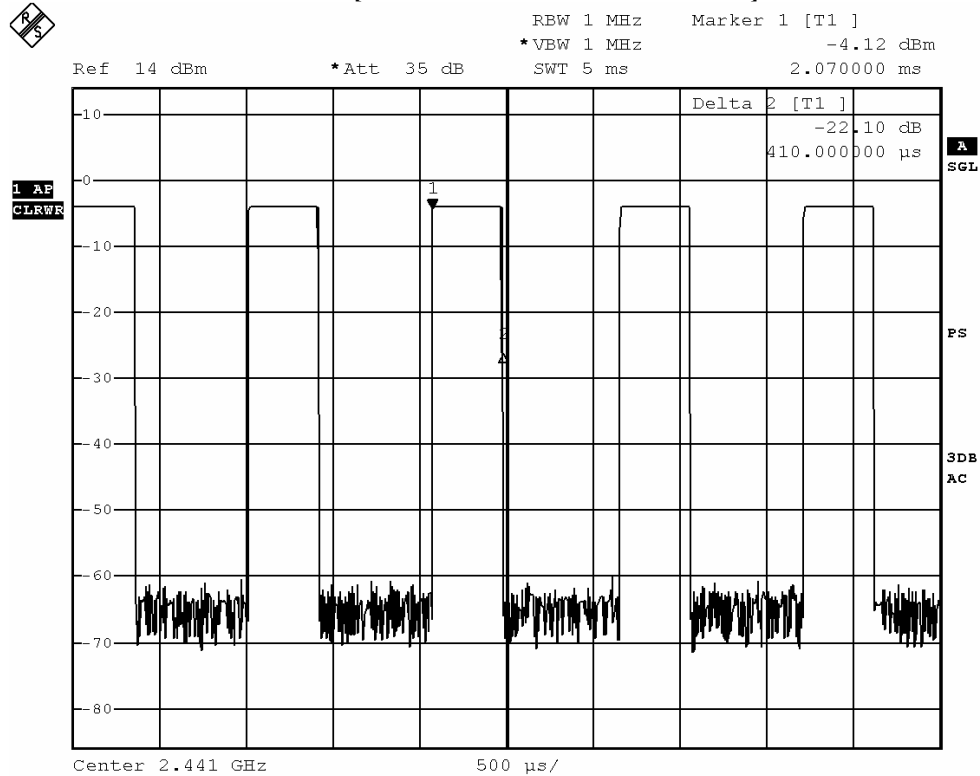


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**Fig. H**  
**[Pulse duration of Middle Channel]**



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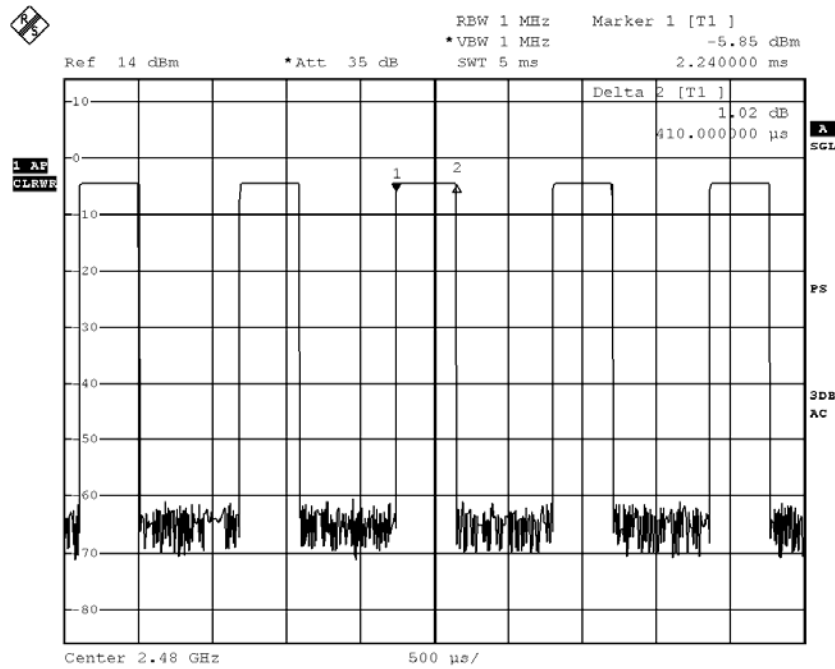


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**Fig. I**  
**[Pulse duration of Highest Channel]**



Time of occupancy (Dwell Time):

Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (s)	Limits (s)	Test Results
DH5	2402	2.950	0.314	0.400	Complies
DH5	2441	2.950	0.314	0.400	Complies
DH5	2480	2.950	0.314	0.400	Complies
DH3	2402	1.670	0.267	0.400	Complies
DH3	2441	1.670	0.267	0.400	Complies
DH3	2480	1.670	0.267	0.400	Complies
DH1	2402	0.410	0.131	0.400	Complies
DH1	2441	0.410	0.131	0.400	Complies
DH1	2480	0.410	0.131	0.400	Complies

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### 3.1.8 Channel Centre Frequency

#### **Requirements:**

Frequency hopping system in the 2400-2483.5MHz band shall use at least 79 (Channel 1 to 79) 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 = 1,...,79 (Channel separation = 1MHz)

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### **3.1.9 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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### **3.1.10 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 PCB antenna. There is no external antenna, the antenna gain = 0dBi. User is unable to remove or changed the Antenna.

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### Appendix A

#### List of Measurement Equipment

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EMD004	LISN	ROHDE & SCHWARZ	ESH3-Z5	100102	2016.3.29	2017.3.29
EMD022	EMI Test Receiver	ROHDE & SCHWARZ	ESCS30	100314	2016.3.29	2017.3.29
EMD035	EMI Test Receiver	ROHDE & SCHWARZ	ESCI	100441	2016.3.29	2017.3.29
EMD036	EMI Test Receiver	ROHDE & SCHWARZ	ESIB 26	100388	2016.3.29	2017.3.29
EMD041	TWO-LINE V-NETWORK	ROHDE & SCHWARZ	ENV216	100261	2016.3.29	2017.3.29
EMD061	Biconilog Antenna	ETS.LINDGREN	3142C	00060439	2016.12.30	2018.12.30
EMD062	Double-Ridged Waveguide (1GHz – 18GHz)	ETS.LINDGREN	3117	00075933	2014.11.15	2017.11.15
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	2016.3.29	2017.3.29
	100V Insertion Unit	ROHDE & SCHWARZ	URV5-Z4	100464	2016.3.29	2017.3.29
EMD113	Pre-Amplifier	ROHDE & SCHWARZ	N/A	1129588	2016.3.29	2017.3.29
EMD124	Loop Antenna	ETS-Lindgren	6502	00104905	2016.05.23	2017.05.23
EMD131	Standard Gain Horn Antenna (18GHz – 26.5GHz)	Chengdu AINFO Inc.	JXTXLB-42-15-C-KF	J2021100721001	2015.04.09	2017.04.09
RE01	RF cable	N/A	N/A	N/A	2016-9-28	2018-9-27
RE02	RF cable	N/A	N/A	N/A	2016-9-28	2018-9-27

Remarks:-

N/A Not Applicable or Not Available

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### Appendix B

#### Photographs of EUT

**Front View of the product**



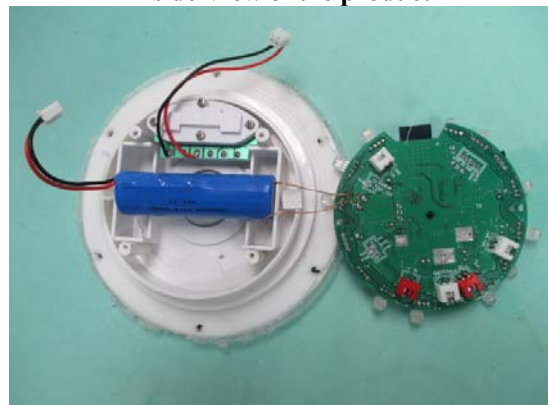
**Rear View of the product**



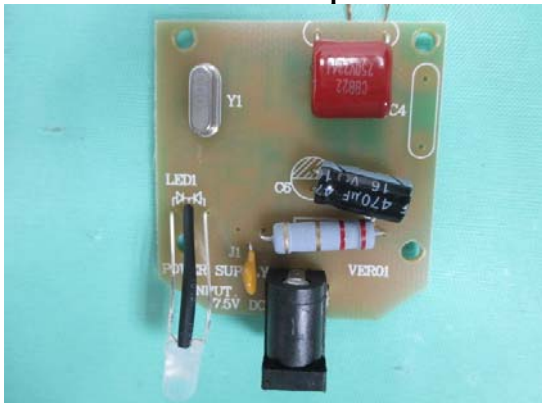
**Inside View of the product**



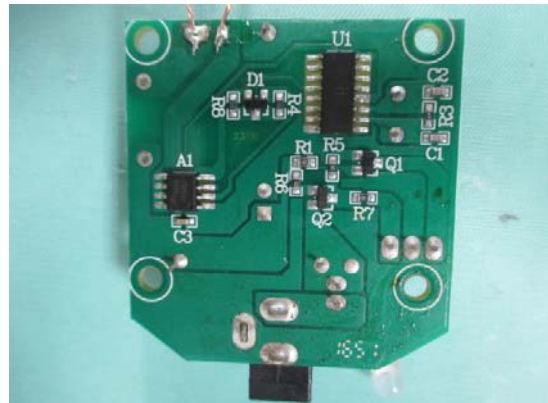
**Inside View of the product**



**Inner Circuit Top View**



**Inner Circuit Bottom View**



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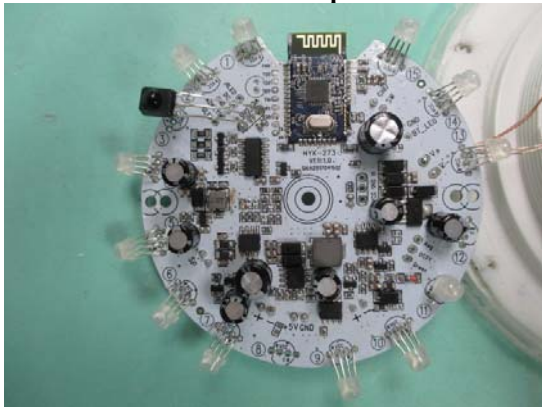
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### Photographs of EUT

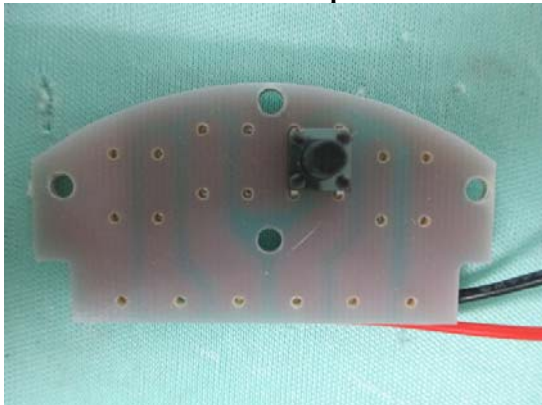
Inner Circuit Top View



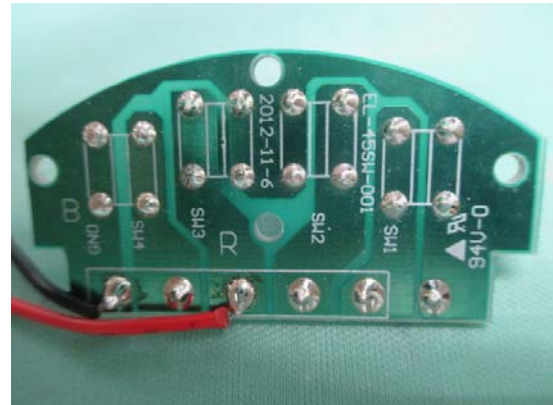
Inner Circuit Bottom View



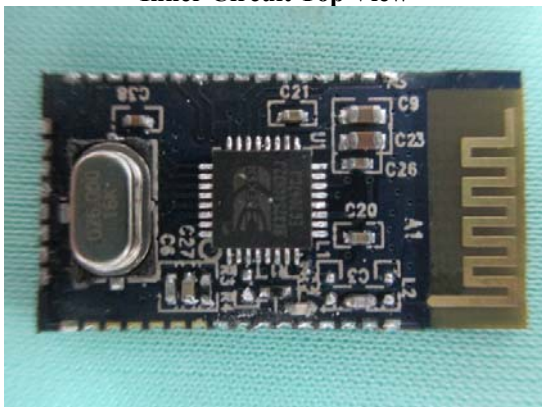
Inner Circuit Top View



Inner Circuit Bottom View



Inner Circuit Top View



Inner Circuit Bottom View



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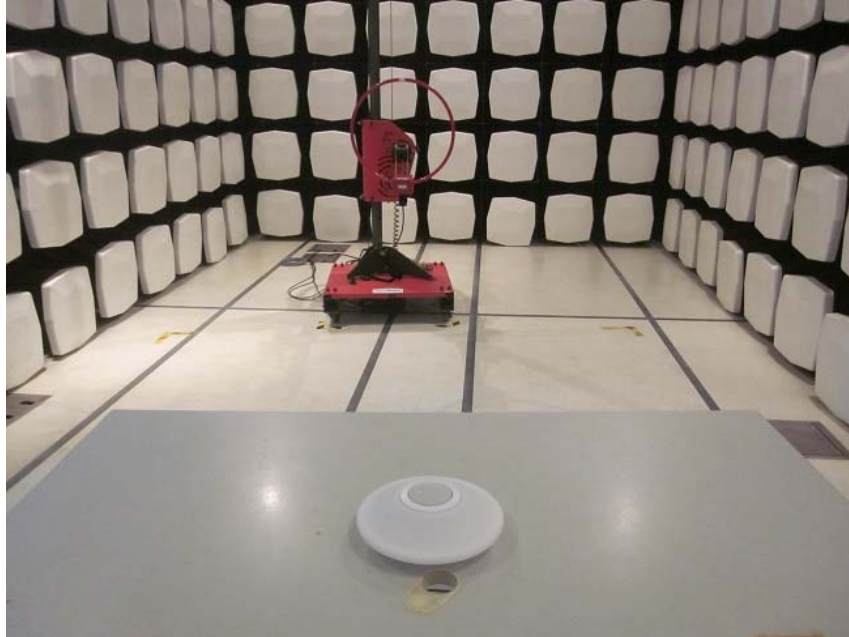
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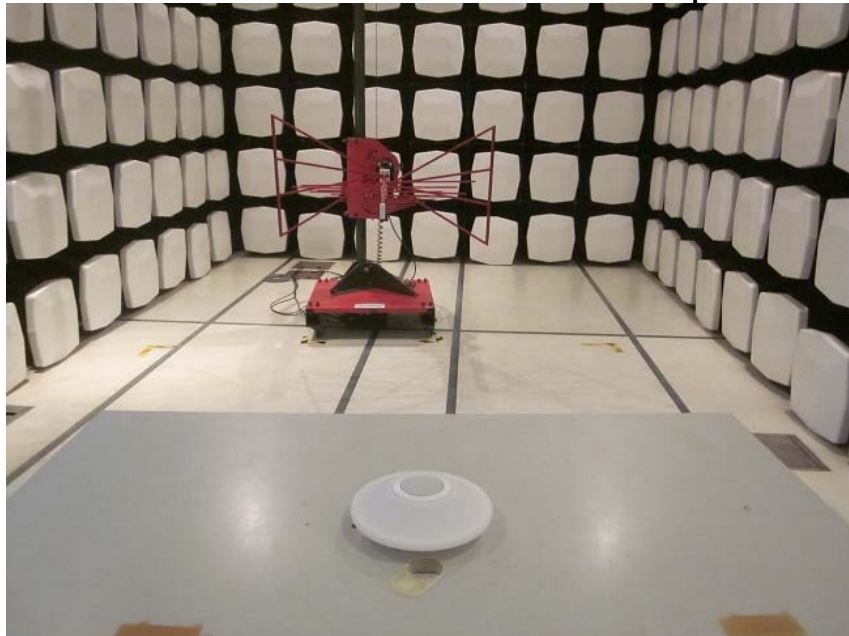
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### Photographs of EUT

**Measurement of Radiated Emission Test Set Up**



**Measurement of Radiated Emission Test Set Up**



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**Measurement of Radiated Emission Test Set Up**



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

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