



## **STC Test Report**

Date: 2015-03-03

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No.: MH191212

**Applicant:** Hip Shing Electronics Ltd.  
Units 1.2&3, 20/F., New Treasure Centre, 10 Ng Fong  
Street, San Po Kong, Kowloon, Hong Kong

**Manufacturer:** Dongguan Zhi Cheng Electronic Products Co., Ltd.  
No. 11 Shangbao Road, 188 Industrial Zone, Pingshan,  
Tangxia, Dongguan, Guangdong, China

**Description of Sample(s):** Product: Digital Radio Station  
Brand Name: REVO  
Model Number: SuperSignal  
FCC ID: BZADFB0315H1

**Date Sample(s) Received:** 2015-02-06

**Date Tested:** 2015-02-07 to 2015-02-14

**Investigation Requested:** Perform ElectroMagnetic Interference measurement in  
accordance with FCC 47CFR [Codes of Federal  
Regulations] Part 15: 2014 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):** Bluetooth FHSS (GFSK /  $\pi/4$ -DQPSK / 8DPSK)

---

Dr. LEE Kam Chuen  
Authorized Signatory  
ElectroMagnetic Compatibility Department  
For and on behalf of  
The Hong Kong Standards and Testing Centre Ltd.



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List of Measurement Equipment

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### **1.0 General Details**

#### **1.1 Test Laboratory**

The Hong Kong Standards and Testing Centre Ltd.  
EMC Laboratory  
10 Dai Wang Street, Taipo Industrial Estate  
New Territories, Hong Kong

Telephone: 852 2666 1888  
Fax: 852 2664 4353

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

Product:	Digital Radio Station
Manufacturer:	Dongguan Zhi Cheng Electronic Products Co., Ltd. No. 11 Shangbao Road, 188 Industrial Zone, Pingshan, Tangxia, Dongguan, Guangdong, China
Brand Name:	REVO
Model Number:	SuperSignal
Rating:	Input: 100-240V a.c. 50/60Hz 0.75A, Output: 18V d.c. 1330mA

The AC/DC adaptor was provided by the applicant with following details: -  
Brand name: REVO Model no.: GPE248-180133-Z

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

The Equipment Under Test (EUT) is a Digital Radio Station, modulation by IC; and type is frequency hopping speed spectrum Modulation.

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

2015-02-06

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

1 Sample

#### **1.5 Test Duration**

2015-02-07 to 2015-02-14

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

China

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### **1.7 RF Module Details**

Module Model Number:	JS-BTM8645
Module FCC ID:	N/A
Module Transmission Type:	Bluetooth V4.0+EDR
Modulation:	FHSS (GFSK / $\pi/4$ -DQPSK / 8DPSK)
Data Rates:	1 Mbps: 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:	Meander line antenna
Antenna Gain:	2.12dBi

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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: 2014 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 measurement (Radiated)	FCC 47CFR 15.247(c)	FCC Pubic Notice DA 00-705	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"/>
Pseudorandom Hopping Algorithm	FCC 47CFR 15.247(a)(1)	N/A	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 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 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:	2015-02-07
Mode of Operation:	Tx mode

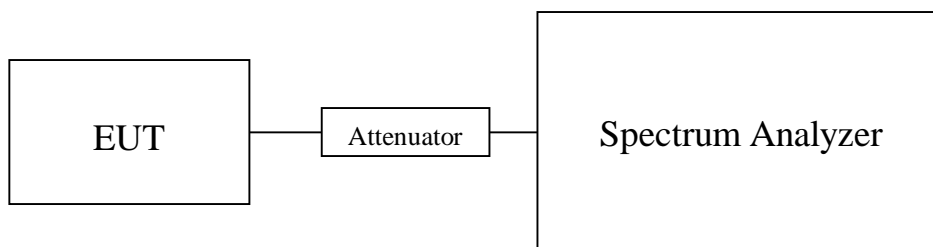
#### **Test Method:**

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	0.001361

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2441	0.001774

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.001702

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

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2402	0.000807

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2441	0.001159

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.001081

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

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2402	0.000931

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2441	0.001282

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.001219

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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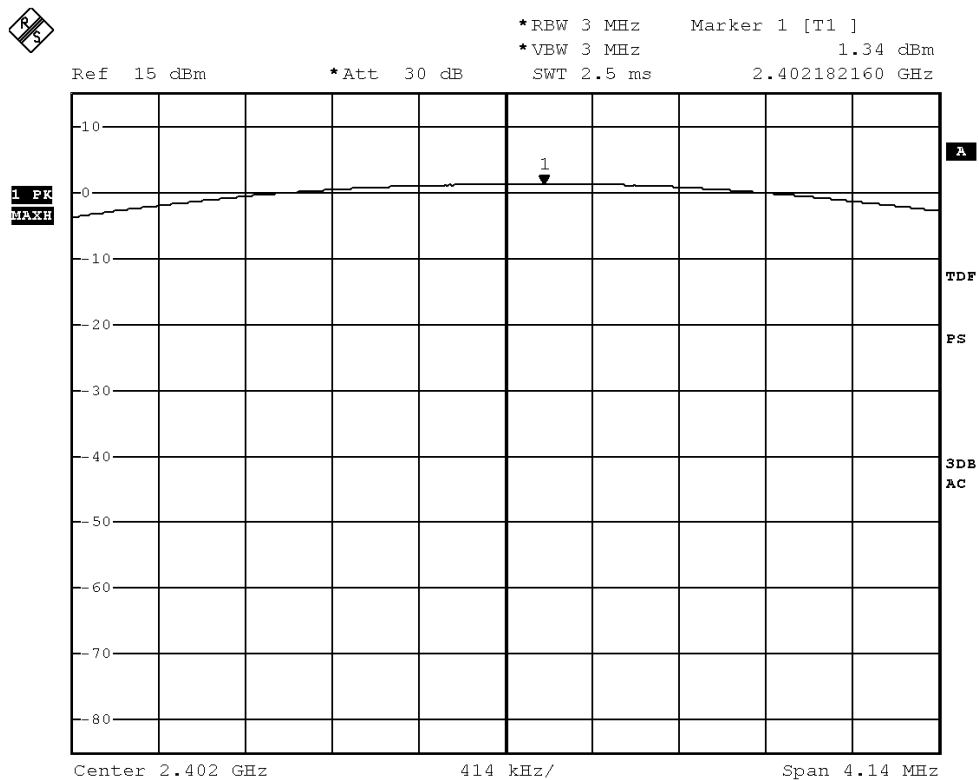
Date: 2015-03-03

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**Test plot of Maximum Peak Conducted Output Power :**

**Bluetooth Communication mode (GFSK, 2402MHz)**



Date: 7.FEB.2015 15:02:34

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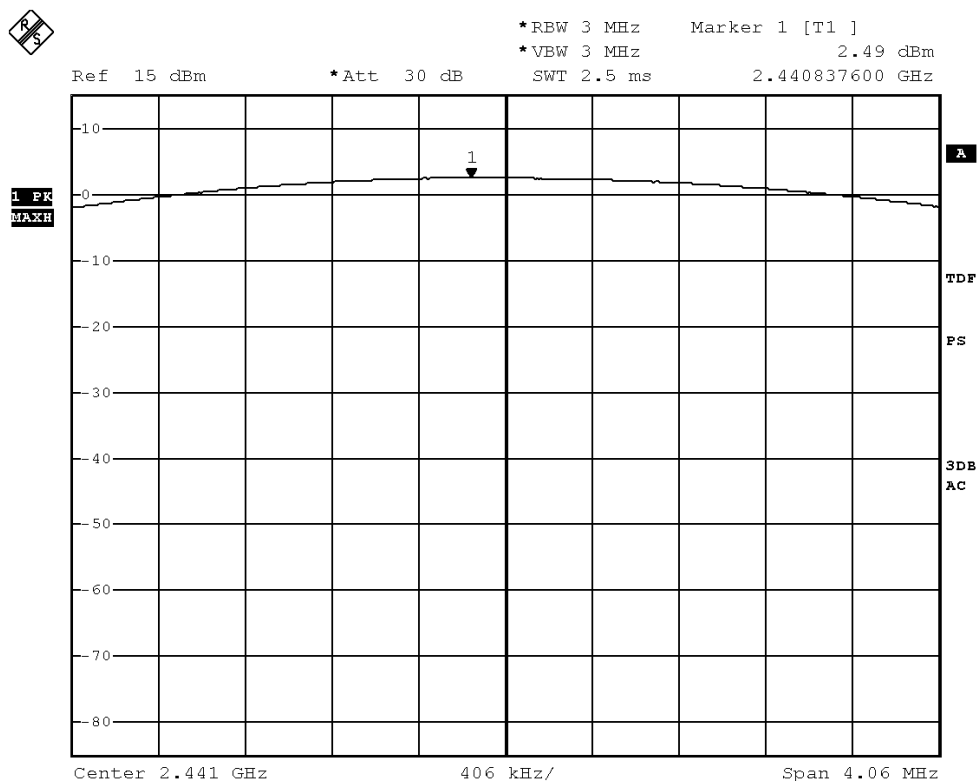
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### Bluetooth Communication mode (GFSK, 2441MHz)



Date: 7.FEB.2015 15:04:20



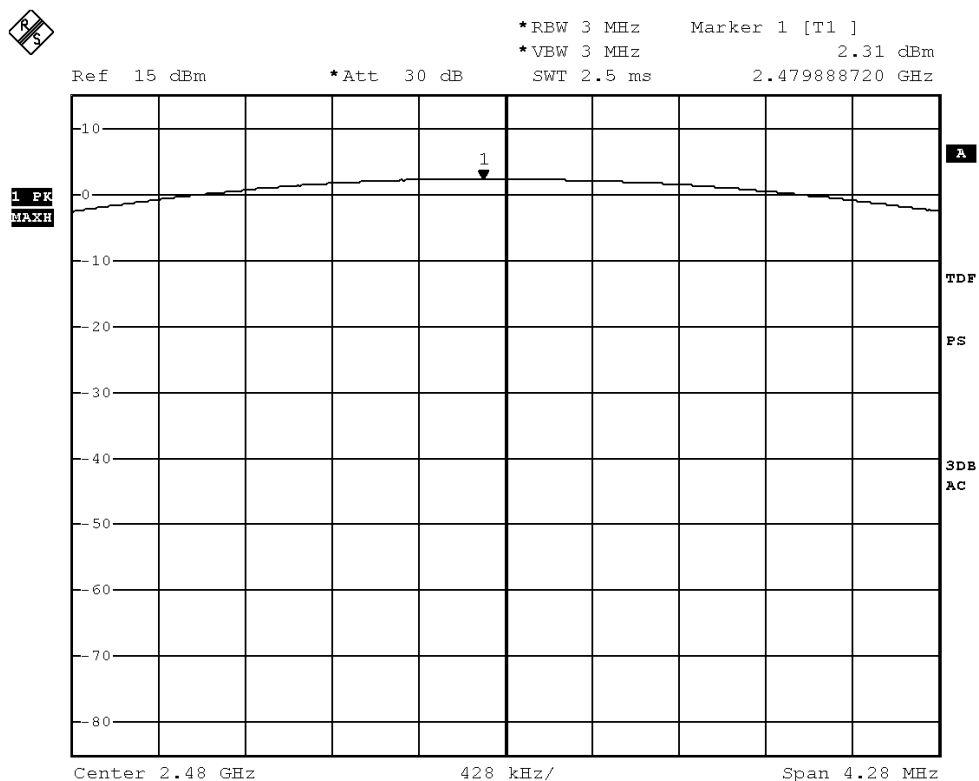
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### Bluetooth Communication mode (GFSK, 2480MHz)



Date: 7.FEB.2015 15:05:33

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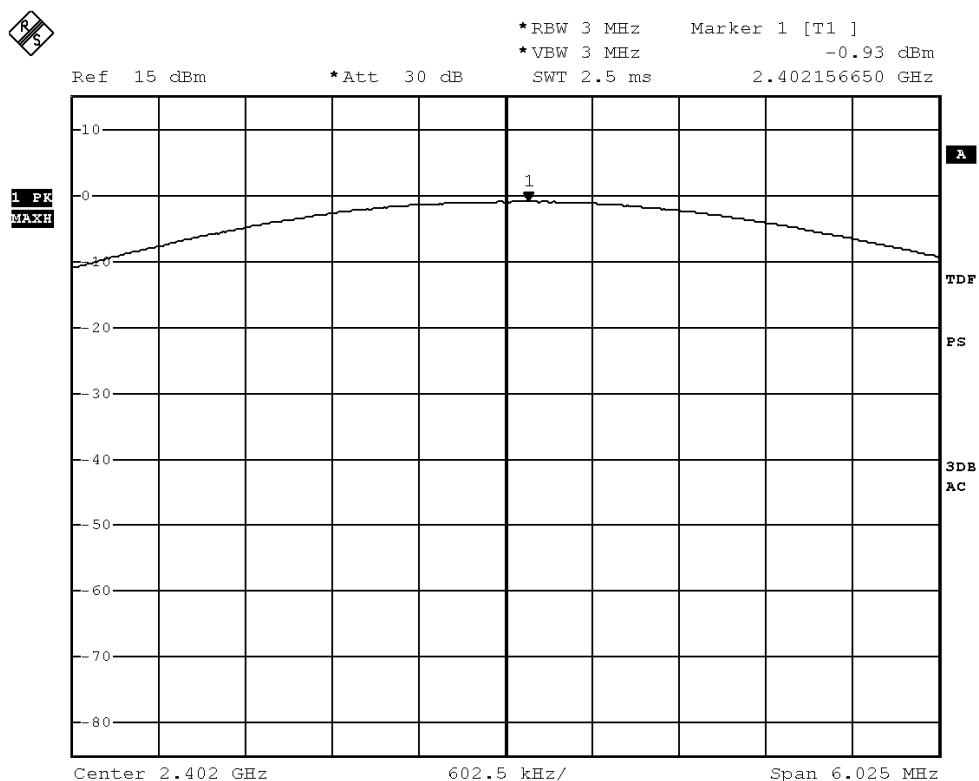
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### Bluetooth Communication mode ( $\pi/4$ -DQPSK, 2402MHz)



Date: 7.FEB.2015 15:08:41

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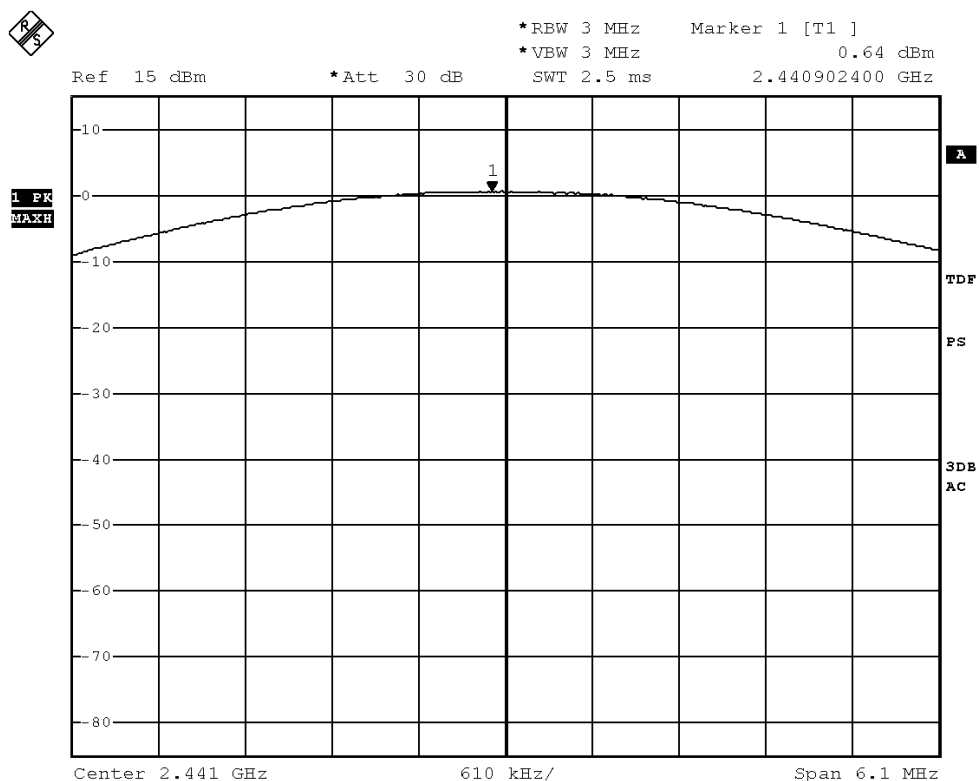
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### Bluetooth Communication mode ( $\pi/4$ -DQPSK, 2441MHz)



Date: 7.FEB.2015 15:07:44

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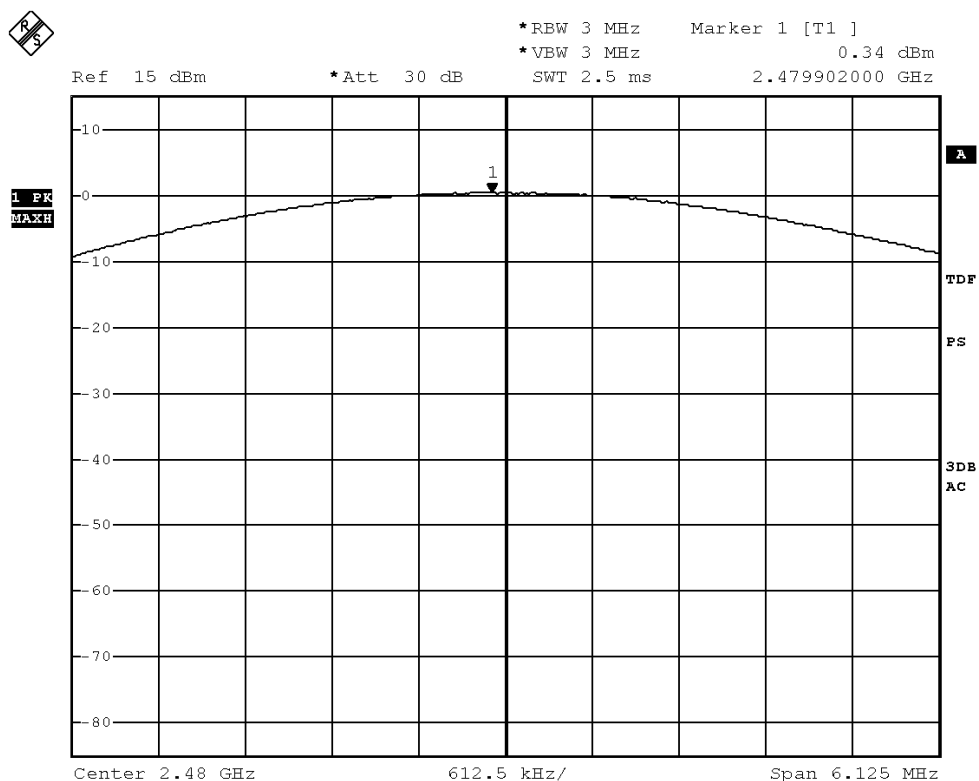
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### Bluetooth Communication mode ( $\pi/4$ -DQPSK, 2480MHz)



Date: 7.FEB.2015 15:07:22

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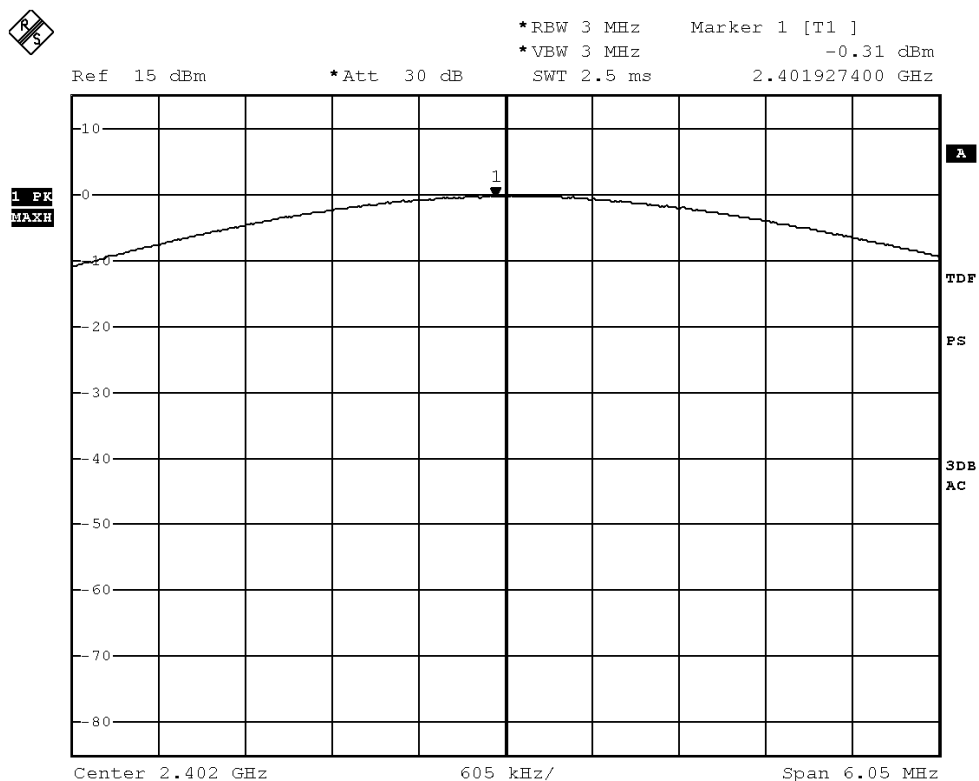
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### Bluetooth Communication mode (8DPSK, 2402MHz)



Date: 7.FEB.2015 15:09:45

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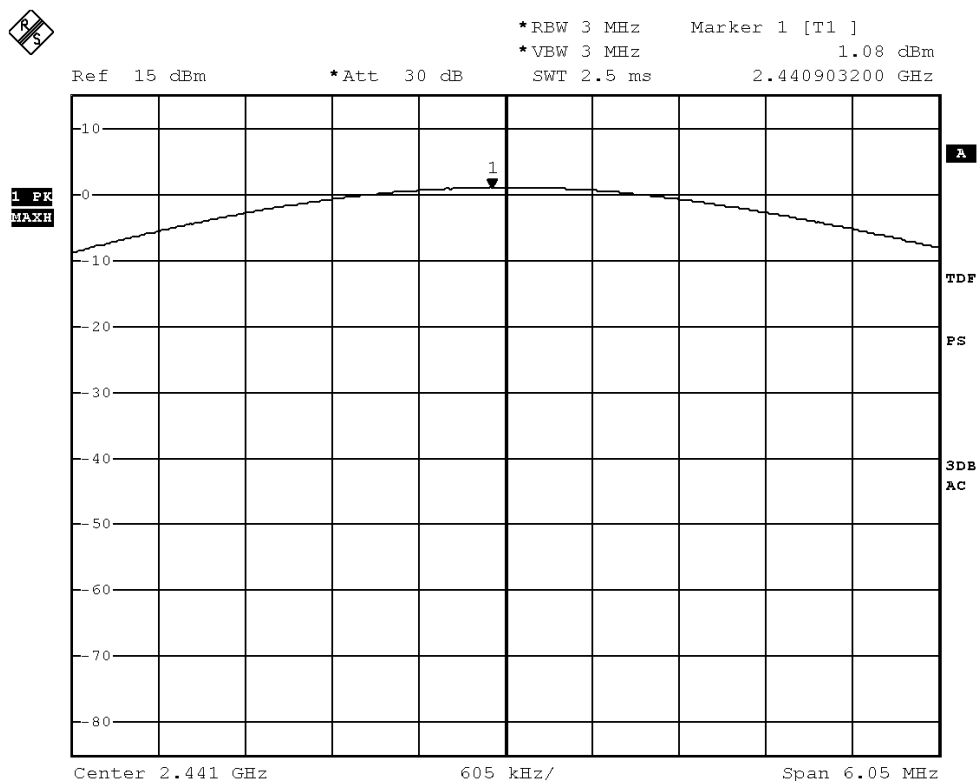
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### Bluetooth Communication mode (8DPSK, 2441MHz)



Date: 7.FEB.2015 15:11:04

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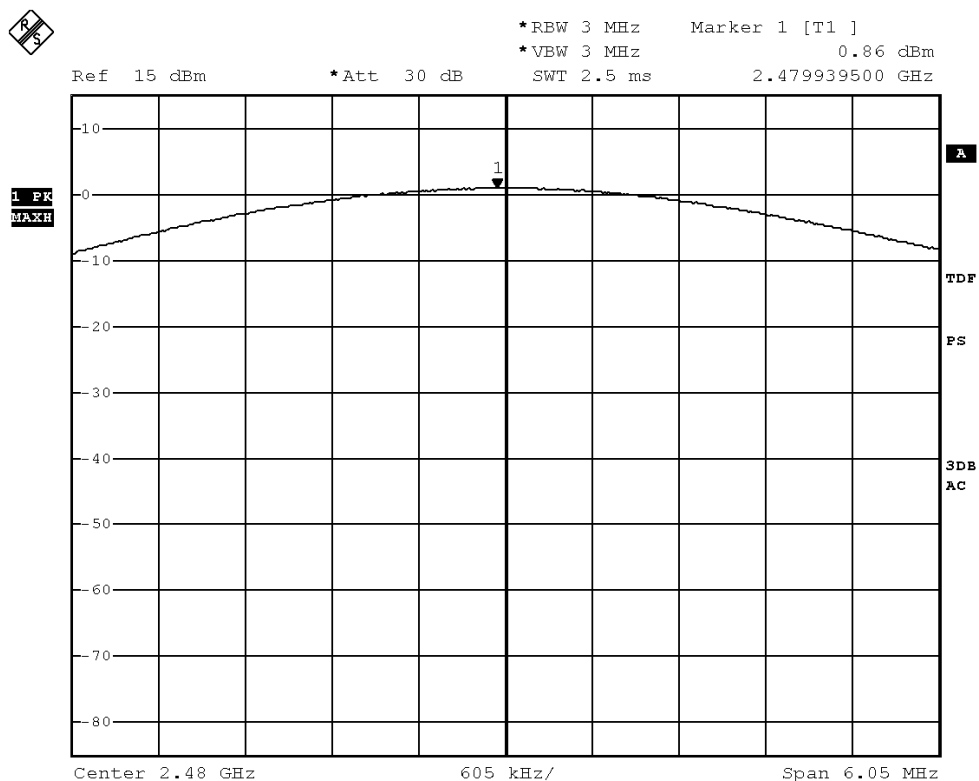
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### Bluetooth Communication mode (8DPSK, 2480MHz)



Date: 7.FEB.2015 15:13:18

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### **3.1.2 Radiated Spurious Emissions**

Test Requirement:	FCC 47CFR 15.209
Test Method:	ANSI C63.4:2009
Test Date:	2015-02-10
Mode of Operation:	Tx mode / Bluetooth Communication 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 G/F of The Hong Kong Standards and Testing Centre Ltd. with a metal ground plane filed with the FCC pursuant to section 2.948 of the FCC rules, with Registration Number: 607756.

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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

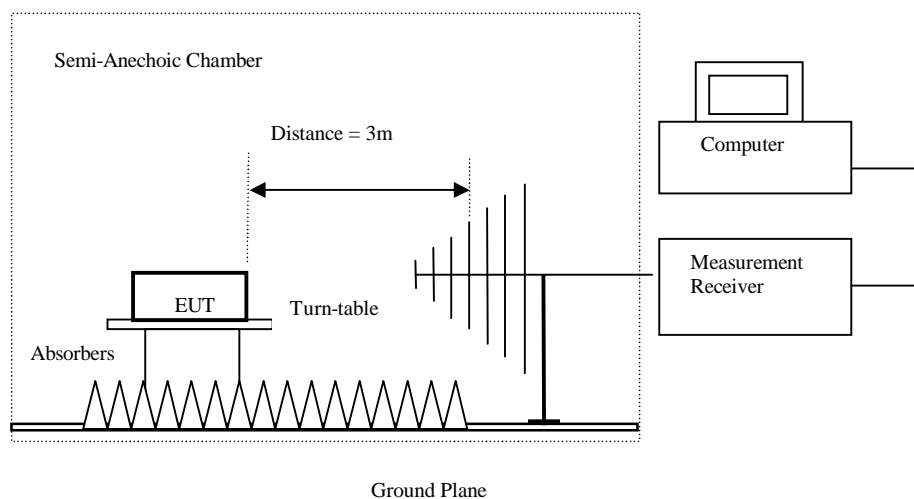
30MHz – 1GHz (QP)

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]	[ $\mu$ 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 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) (GFSK mode) (30MHz – 1GHz): Pass

Field Strength of Spurious Emissions Quasi-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) (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
4804.0	15.7	41.5	57.2	74.0	16.8	Vertical
4804.0	12.7	42.4	55.1	74.0	18.9	Horizontal
7206.0	8.0	45.1	53.1	74.0	20.9	Vertical
7206.0	7.8	46.2	54.0	74.0	20.0	Horizontal
9608.0	6.9	48.0	54.9	74.0	19.1	Vertical
9608.0	5.2	48.8	54.0	74.0	20.0	Horizontal
12010.0	3.0	51.5	54.5	74.0	19.5	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) (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	0.2	41.5	41.7	54.0	12.3	Vertical
4804.0	-3.0	42.4	39.4	54.0	14.6	Horizontal
7206.0	-4.4	45.1	40.7	54.0	13.3	Vertical
7206.0	-6.8	46.2	39.4	54.0	14.6	Horizontal
9608.0	-8.6	48.0	39.4	54.0	14.6	Vertical
9608.0	-8.1	48.8	40.7	54.0	13.3	Horizontal
12010.0	-12.7	51.5	38.8	54.0	15.2	Vertical
12010.0	-10.7	52.4	41.7	54.0	12.3	Horizontal

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

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Field Strength uV/m	Limit uV/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 Quasi-Peak Value						
Frequency MHz	Measured Level dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Field Strength uV/m	Limit uV/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**

<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	15.3	41.6	56.9	74.0	17.1	Vertical
4882.0	11.2	42.5	53.7	74.0	20.3	Horizontal
7323.0	0.8	45.2	46.0	74.0	28.0	Vertical
7323.0	7.8	46.3	54.1	74.0	19.9	Horizontal
9764.0	6.0	48.1	54.1	74.0	19.9	Vertical
9764.0	5.0	48.9	53.9	74.0	20.1	Horizontal
12205.0	4.4	51.6	56.0	74.0	18.0	Vertical
12205.0	3.2	52.5	55.7	74.0	18.3	Horizontal

### **Result of Tx mode (2441.0 MHz) (GFSK mode) (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	-0.1	41.6	41.5	54.0	12.5	Vertical
4882.0	-4.2	42.5	38.3	54.0	15.7	Horizontal
7323.0	-6.7	45.2	38.5	54.0	15.5	Vertical
7323.0	-5.9	46.3	40.4	54.0	13.6	Horizontal
9764.0	-9.3	48.1	38.8	54.0	15.2	Vertical
9764.0	-11.6	48.9	37.3	54.0	16.7	Horizontal
12205.0	-11.0	51.6	40.6	54.0	13.4	Vertical
12205.0	-12.2	52.5	40.3	54.0	13.7	Horizontal

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**Result of Tx mode (2480.0 MHz) (GFSK mode) (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						

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

Field Strength of Spurious Emissions Quasi-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 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	15.8	41.4	57.2	74.0	16.8	Vertical
4960.0	11.7	42.7	54.4	74.0	19.6	Horizontal
7440.0	7.7	45.6	53.3	74.0	20.7	Vertical
7440.0	8.7	46.5	55.2	74.0	18.8	Horizontal
9920.0	6.0	48.6	54.6	74.0	19.4	Vertical
9920.0	6.0	49.7	55.7	74.0	18.3	Horizontal
12400.0	3.5	51.7	55.2	74.0	18.8	Vertical
12400.0	3.4	52.7	56.1	74.0	17.9	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	0.5	41.4	41.9	54.0	12.1	Vertical
4960.0	-3.7	42.7	39.0	54.0	15.0	Horizontal
7440.0	-7.8	45.6	37.8	54.0	16.2	Vertical
7440.0	-5.7	46.5	40.8	54.0	13.2	Horizontal
9920.0	-9.7	48.6	38.9	54.0	15.1	Vertical
9920.0	-9.7	49.7	40.0	54.0	14.0	Horizontal
12400.0	-12.1	51.7	39.6	54.0	14.4	Vertical
12400.0	-11.3	52.7	41.4	54.0	12.6	Horizontal

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

Field Strength of Spurious Emissions Quasi-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						

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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	15.5	41.5	57.0	74.0	17.0	Vertical
4804.0	12.7	42.4	55.1	74.0	18.9	Horizontal
7206.0	9.4	45.1	54.5	74.0	19.5	Vertical
7206.0	7.1	46.2	53.3	74.0	20.7	Horizontal
9608.0	5.2	48.0	53.2	74.0	20.8	Vertical
9608.0	5.4	48.8	54.2	74.0	19.8	Horizontal
12010.0	2.9	51.5	54.4	74.0	19.6	Vertical
12010.0	4.2	52.4	56.6	74.0	17.4	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	0.0	41.5	41.5	54.0	12.5	Vertical
4804.0	-3.0	42.4	39.4	54.0	14.6	Horizontal
7206.0	-5.1	45.1	40.0	54.0	14.0	Vertical
7206.0	-5.5	46.2	40.7	54.0	13.3	Horizontal
9608.0	-10.2	48.0	37.8	54.0	16.2	Vertical
9608.0	-8	48.8	40.8	54.0	13.2	Horizontal
12010.0	-11.9	51.5	39.6	54.0	14.4	Vertical
12010.0	-11.2	52.4	41.2	54.0	12.8	Horizontal

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**Result of Tx mode (2441.0 MHz) ( $\pi/4$ -DQPSK mode) (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						

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

Field Strength of Spurious Emissions Quasi-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 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	15.5	41.6	57.1	74.0	16.9	Vertical
4882.0	12.9	42.5	55.4	74.0	18.6	Horizontal
7323.0	0.4	45.2	45.6	74.0	28.4	Vertical
7323.0	8.2	46.3	54.5	74.0	19.5	Horizontal
9764.0	6.2	48.1	54.3	74.0	19.7	Vertical
9764.0	6.1	48.9	55.0	74.0	19.0	Horizontal
12205.0	4.3	51.6	55.9	74.0	18.1	Vertical
12205.0	3.4	52.5	55.9	74.0	18.1	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	0.1	41.6	41.7	54.0	12.3	Vertical
4882.0	-2.4	42.5	40.1	54.0	13.9	Horizontal
7323.0	-7.1	45.2	38.1	54.0	15.9	Vertical
7323.0	-5.5	46.3	40.8	54.0	13.2	Horizontal
9764.0	-9.1	48.1	39.0	54.0	15.0	Vertical
9764.0	-9.5	48.9	39.4	54.0	14.6	Horizontal
12205.0	-11.1	51.6	40.5	54.0	13.5	Vertical
12205.0	-12.0	52.5	40.5	54.0	13.5	Horizontal

### **Result of Tx mode (2480.0 MHz) ( $\pi/4$ -DQPSK mode) (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						

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

Field Strength of Spurious Emissions Quasi-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						

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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	15.5	41.4	56.9	74.0	17.1	Vertical
4960.0	11.9	42.7	54.6	74.0	19.4	Horizontal
7440.0	7.8	45.6	53.4	74.0	20.6	Vertical
7440.0	6.7	46.5	53.2	74.0	20.8	Horizontal
9920.0	6.1	48.6	54.7	74.0	19.3	Vertical
9920.0	5.6	49.7	55.3	74.0	18.7	Horizontal
12400.0	3.6	51.7	55.3	74.0	18.7	Vertical
12400.0	3.4	52.7	56.1	74.0	17.9	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	0.2	41.4	41.6	54.0	12.4	Vertical
4960.0	-3.4	42.7	39.3	54.0	14.7	Horizontal
7440.0	-7.7	45.6	37.9	54.0	16.1	Vertical
7440.0	-5.7	46.5	40.8	54.0	13.2	Horizontal
9920.0	-9.7	48.6	38.9	54.0	15.1	Vertical
9920.0	-9.1	49.7	40.6	54.0	13.4	Horizontal
12400.0	-12.0	51.7	39.7	54.0	14.3	Vertical
12400.0	-12.3	52.7	40.4	54.0	13.6	Horizontal

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

Field Strength of Spurious Emissions						
Peak 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						
Quasi-Peak Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBuV	dB/m	dBuV/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	dBuV	dB/m	dBuV/m	dBuV/m	dBuV/m	
4804.0	14.8	41.5	56.3	74.0	17.7	Vertical
4804.0	12.7	42.4	55.1	74.0	18.9	Horizontal
7206.0	9.8	45.1	54.9	74.0	19.1	Vertical
7206.0	8.0	46.2	54.2	74.0	19.8	Horizontal
9608.0	6.3	48.0	54.3	74.0	19.7	Vertical
9608.0	6.3	48.8	55.1	74.0	18.9	Horizontal
12010.0	3.6	51.8	55.4	74.0	18.6	Vertical
12010.0	3.4	52.4	55.8	74.0	18.2	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	-0.6	41.5	40.9	54.0	13.1	Vertical
4804.0	-3.0	42.4	39.4	54.0	14.6	Horizontal
7206.0	-5.7	45.1	39.4	54.0	14.6	Vertical
7206.0	-6.6	46.2	39.6	54.0	14.4	Horizontal
9608.0	-9.2	48.0	38.8	54.0	15.2	Vertical
9608.0	-8.1	48.8	40.7	54.0	13.3	Horizontal
12010.0	-12.2	51.8	39.6	54.0	14.4	Vertical
12010.0	-11.9	52.4	40.5	54.0	13.5	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						

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

Field Strength of Spurious Emissions Quasi-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						

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### **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	15.2	41.6	56.8	74.0	17.2	Vertical
4882.0	12.8	42.5	55.3	74.0	18.7	Horizontal
7323.0	1.2	45.2	46.4	74.0	27.6	Vertical
7323.0	7.2	46.3	53.5	74.0	20.5	Horizontal
9764.0	7.2	48.1	55.3	74.0	18.7	Vertical
9764.0	5.4	48.9	54.3	74.0	19.7	Horizontal
12205.0	4.4	51.6	56.0	74.0	18.0	Vertical
12205.0	2.9	52.5	55.4	74.0	18.6	Horizontal

### **Result of Tx mode (2441.0 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
4882.0	-0.3	41.6	41.3	54.0	12.7	Vertical
4882.0	-2.6	42.5	39.9	54.0	14.1	Horizontal
7323.0	-6.3	45.2	38.9	54.0	15.1	Vertical
7323.0	-7.5	46.3	38.8	54.0	15.2	Horizontal
9764.0	-8.2	48.1	39.9	54.0	14.1	Vertical
9764.0	-10.2	48.9	38.7	54.0	15.3	Horizontal
12205.0	-11.0	51.6	40.6	54.0	13.4	Vertical
12205.0	-12.5	52.5	40	54.0	14.0	Horizontal

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

Field Strength of Spurious Emissions						
Peak 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						
Quasi-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	12.2	42.7	54.9	74.0	19.1	Horizontal
7440.0	8.3	45.6	53.9	74.0	20.1	Vertical
7440.0	7.4	46.5	53.9	74.0	20.1	Horizontal
9920.0	6.3	48.6	54.9	74.0	19.1	Vertical
9920.0	4.0	49.7	53.7	74.0	20.3	Horizontal
12400.0	4.1	51.7	55.8	74.0	18.2	Vertical
12400.0	2.0	52.7	54.7	74.0	19.3	Horizontal

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### **Result of Tx mode (2480.0 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
4960.0	0.2	41.4	41.6	54.0	12.4	Vertical
4960.0	-3.2	42.7	39.5	54.0	14.5	Horizontal
7440.0	-7.2	45.6	38.4	54.0	15.6	Vertical
7440.0	-6.0	46.5	40.5	54.0	13.5	Horizontal
9920.0	-9.5	48.6	39.1	54.0	14.9	Vertical
9920.0	-11.7	49.7	38.0	54.0	16.0	Horizontal
12400.0	-11.6	51.7	40.1	54.0	13.9	Vertical
12400.0	-13.7	52.7	39.0	54.0	15.0	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): 2.0dB

(30MHz -1GHz): 4.9dB

(1GHz -6GHz): 4.02dB

(6GHz -26.5GHz): 4.03dB

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]:

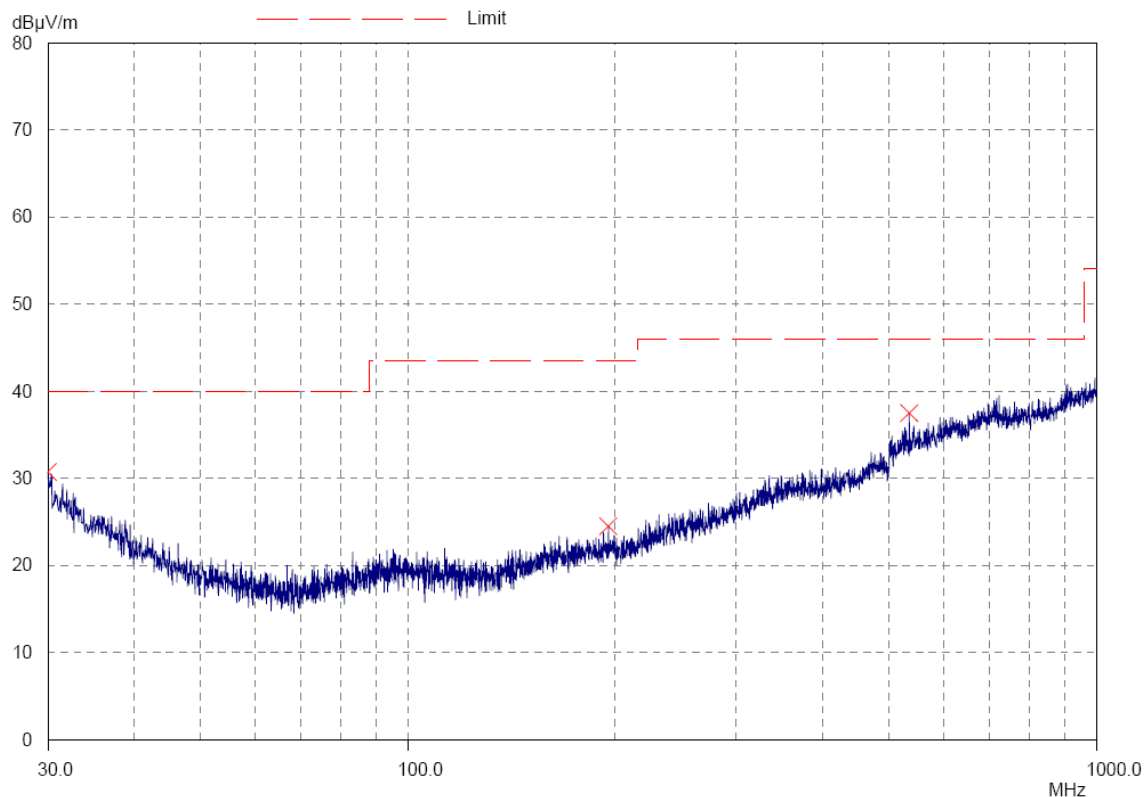
Frequency Range	Quasi-Peak Limits
[MHz]	[ $\mu\text{V/m}$ ]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

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 (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 (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
30.0	Horizontal	30.7	40.0	34.3	100
195.5	Horizontal	24.4	43.5	16.6	150
534.9	Horizontal	37.5	46.0	75.0	200

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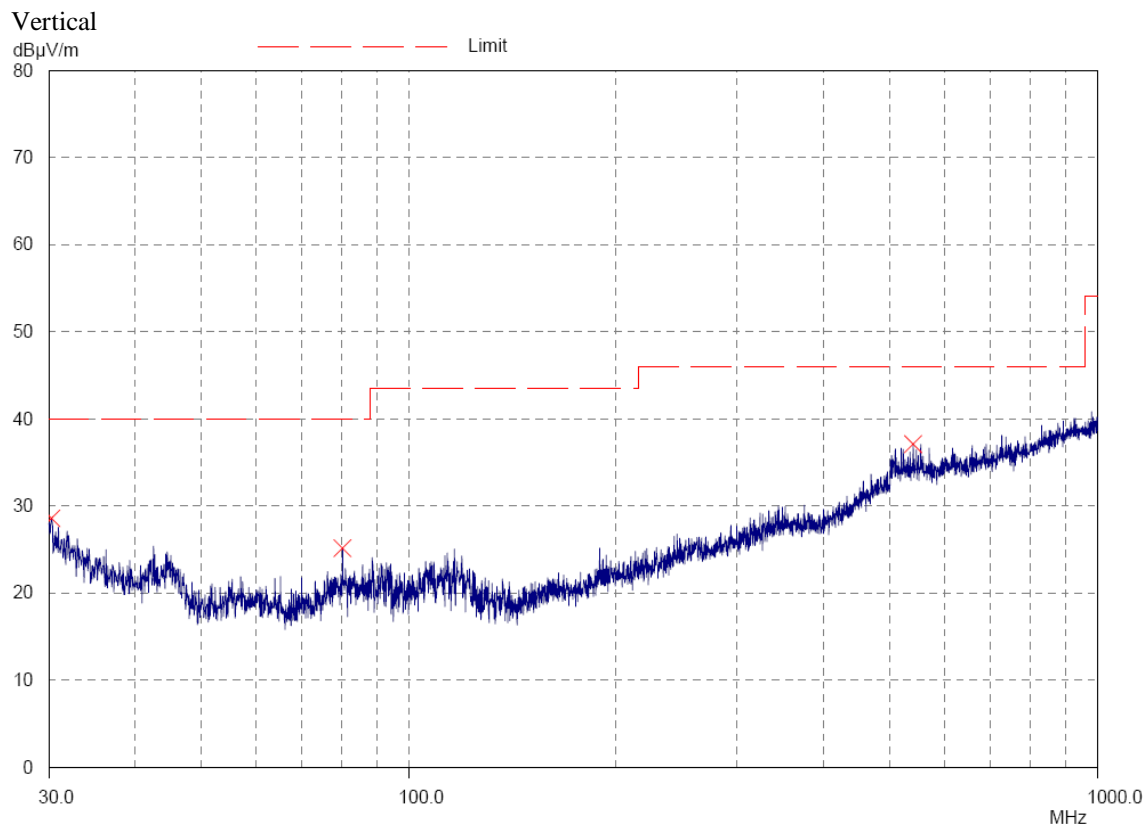
### **Limits for Radiated Emissions [FCC 47 CFR 15.209 Class B]:**

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 (GFSK / $\pi/4$ -DQPSK/ 8DPSK) (30MHz – 1GHz): Pass**

Please refer to the following table for result details



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**Result of Bluetooth Communication mode (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
30.3	Vertical	28.5	40.0	26.6	100
80.1	Vertical	25.1	40.0	18.0	100
540.4	Vertical	37.1	46.0	71.6	200

Remarks:

Calculated measurement uncertainty (30MHz – 1GHz): 4.9dB

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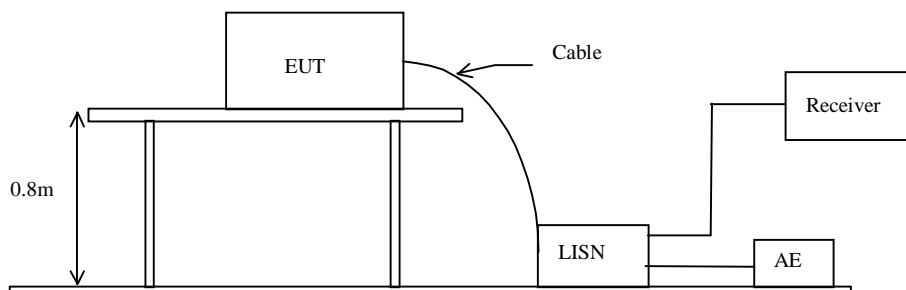
### **3.1.3 AC Mains Conducted Emissions (0.15MHz to 30MHz)**

Test Requirement:	FCC 47CFR 15.207
Test Method:	ANSI C63.4:2009
Test Date:	2015-02-09
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):

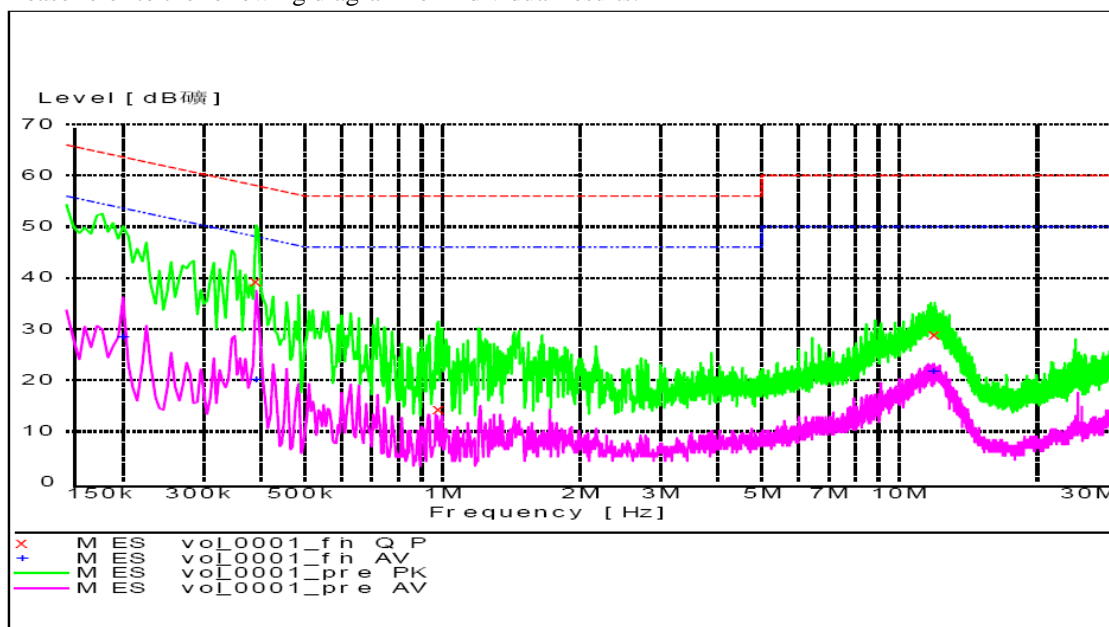
Frequency Range [MHz]	Quasi-Peak Limits [dBμV]	Average [dBμV]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

\* 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 (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	0.390	39.2	58.0	-*-	-*-
Live	0.980	14.2	56.0	-*-	-*-
Live	11.945	28.7	60.0	-*-	-*-
Live	0.200	-*-	-*-	28.4	54.0
Live	0.390	-*-	-*-	20.0	48.0
Live	11.875	-*-	-*-	21.5	50.0

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

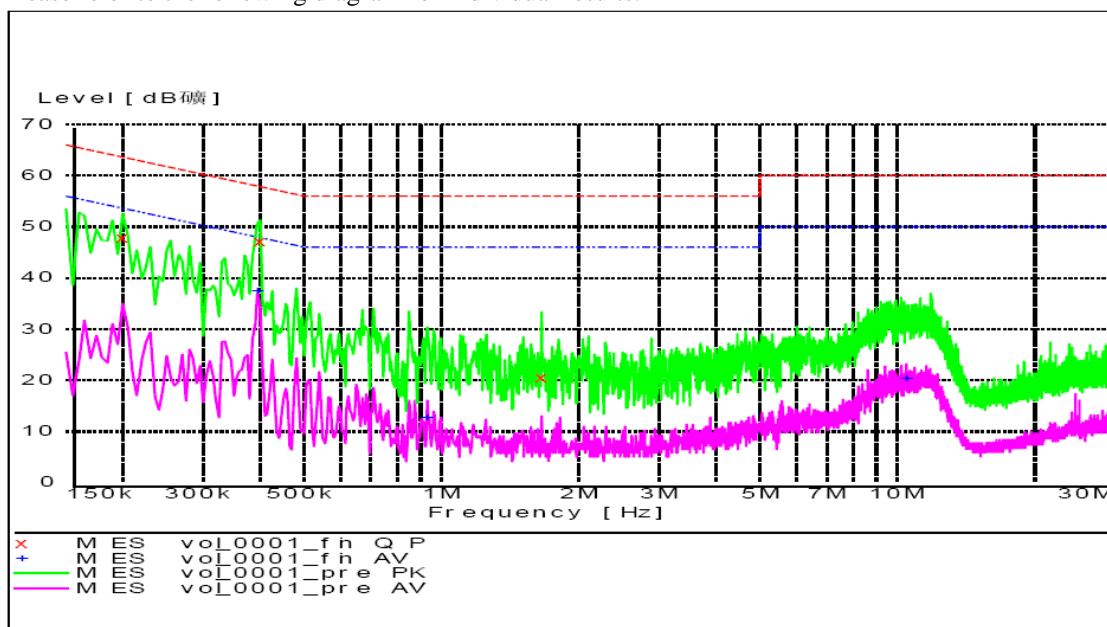
Frequency Range [MHz]	Quasi-Peak Limits [dBμV]	Average [dBμV]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

\* 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 (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	0.200	47.7	64.0	-*-	-*-
Neutral	0.400	47.0	58.0	-*-	-*-
Neutral	1.660	20.3	56.0	-*-	-*-
Neutral	0.395	-*-	-*-	37.4	48.0
Neutral	0.930	-*-	-*-	12.5	46.0
Neutral	10.455	-*-	-*-	20.1	50.0

Remarks:

Calculated measurement uncertainty (0.15MHz – 30MHz): 3.25dB

-\*- 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.

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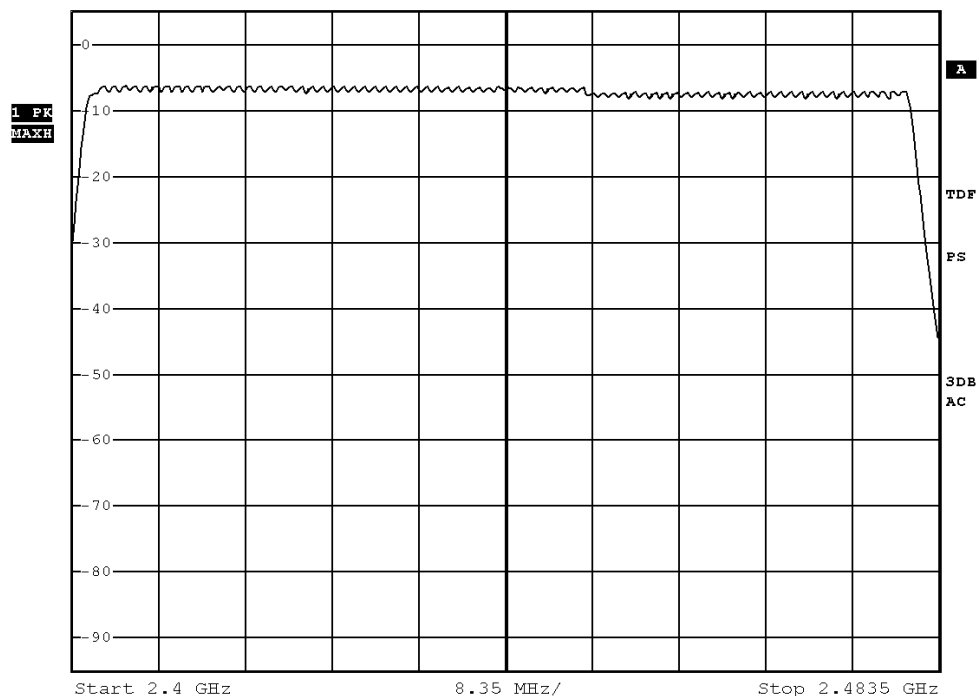
No.: MH191212

### Measurement Data:

**GFSK: 79 of 79 Channel**



Ref 5 dBm      \*Att 25 dB      \*RBW 1 MHz  
\*VBW 1 MHz  
SWT 2.5 ms



Date: 7.FEB.2015 14:16:36

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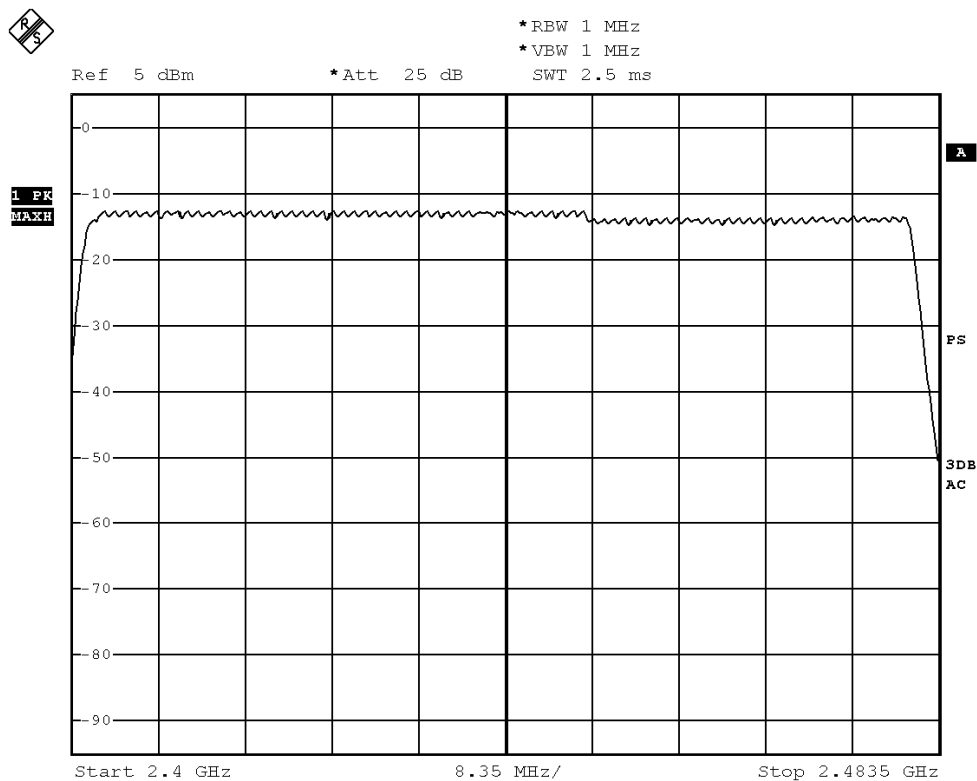
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### $\pi/4$ -DQPSK: 79 of 79 Channel



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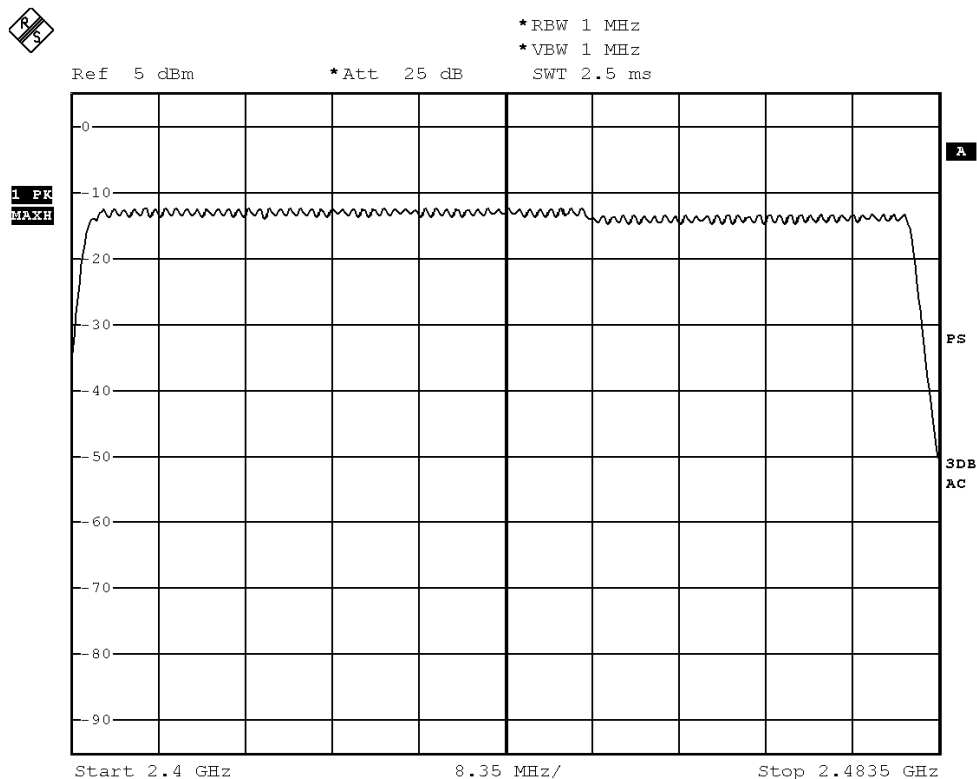
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### 8DPSK: 79 of 79 Channel



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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:	2015-02-07
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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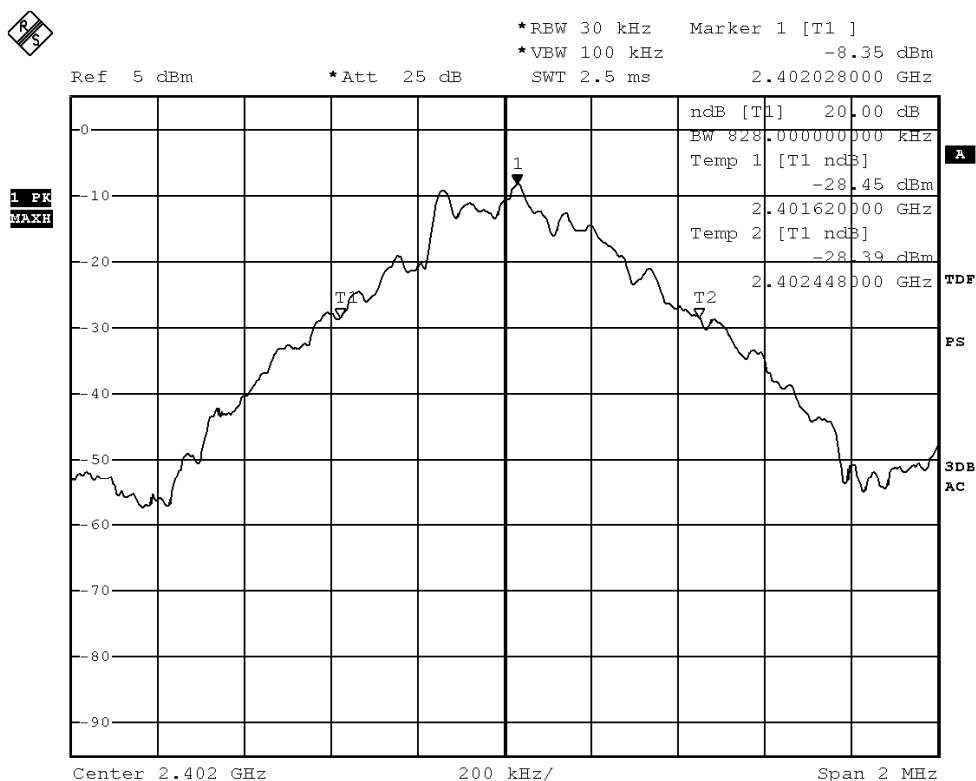
Date: 2015-03-03

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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	0.828	Within 2400-2483.5

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



Date: 7.FEB.2015 13:59:35



## STC Test Report

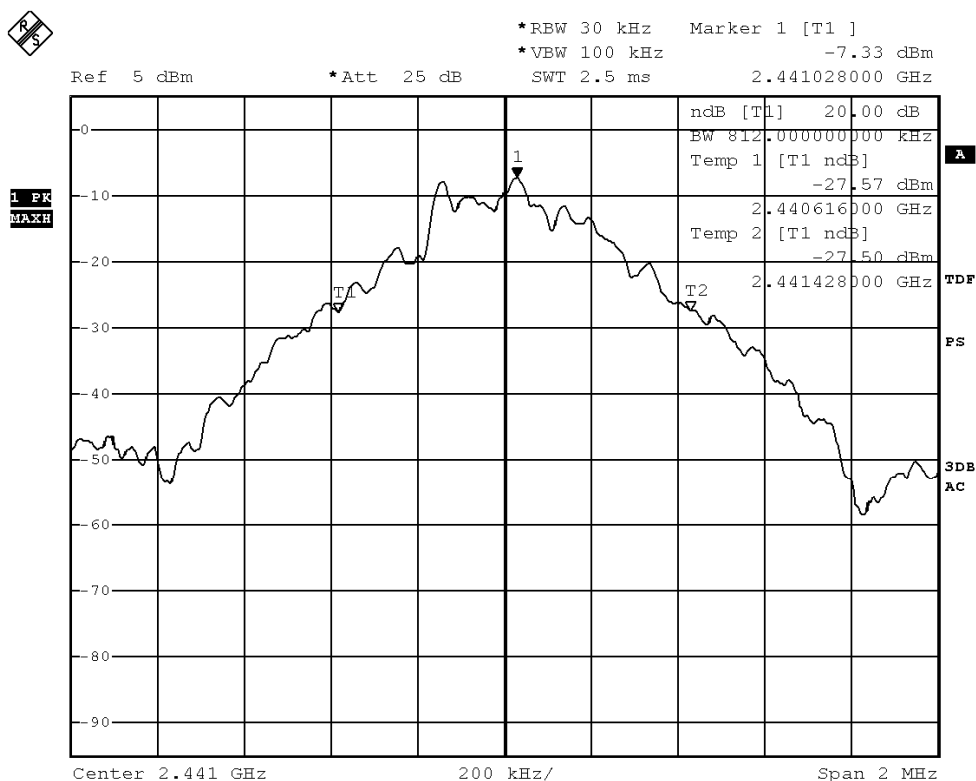
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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2441	0.812	Within 2400-2483.5

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



Date: 7.FEB.2015 13:59:56

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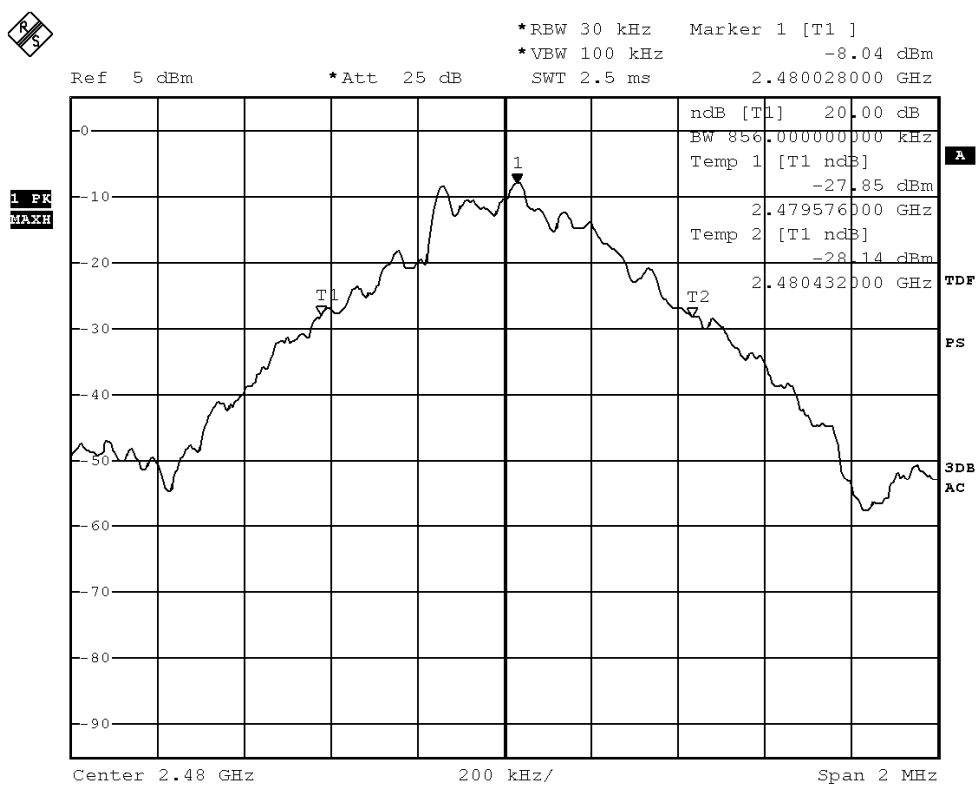
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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2480	0.856	Within 2400-2483.5

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



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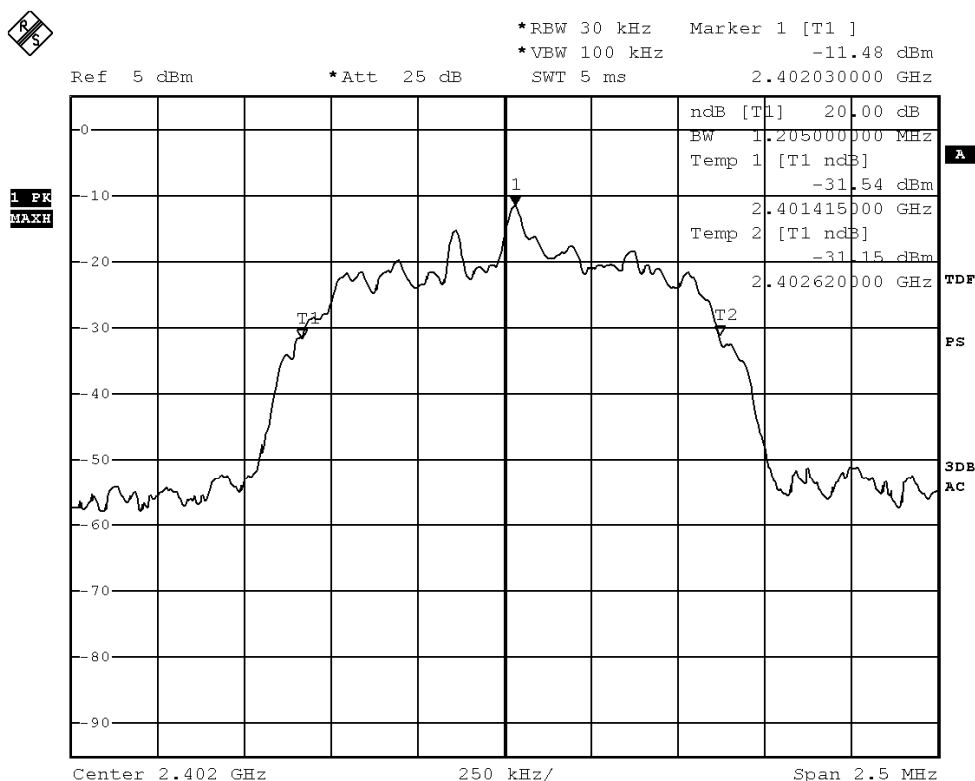
Date: 2015-03-03

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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	1.205	Within 2400-2483.5

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





## STC Test Report

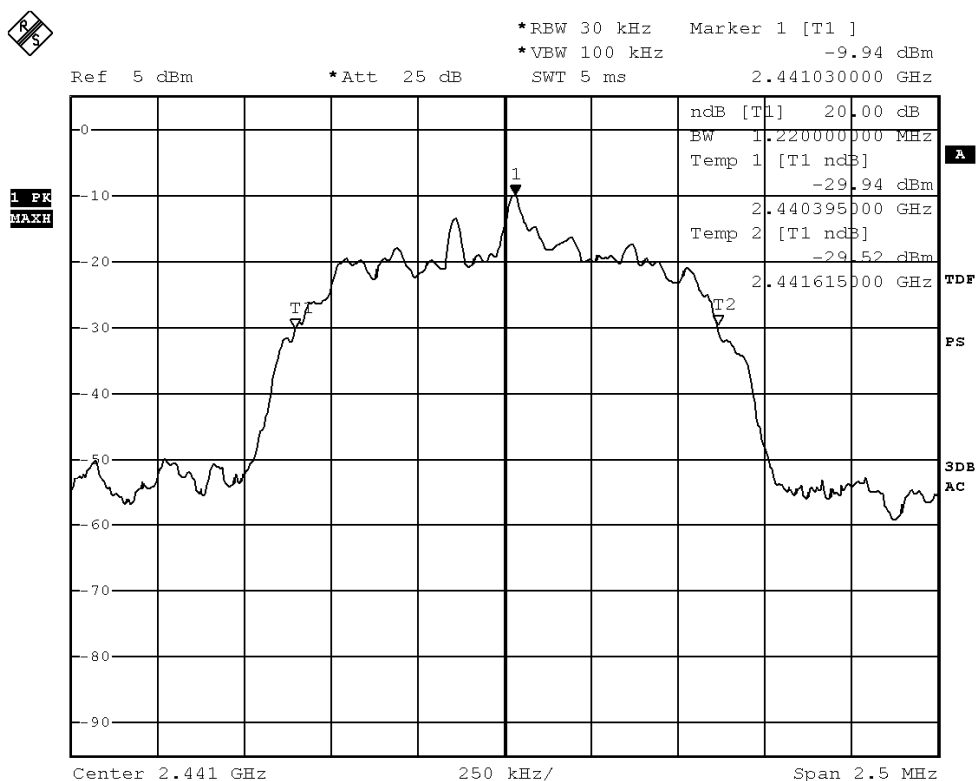
Date: 2015-03-03

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No.: MH191212

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

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



Date: 7.FEB.2015 14:01:21



## STC Test Report

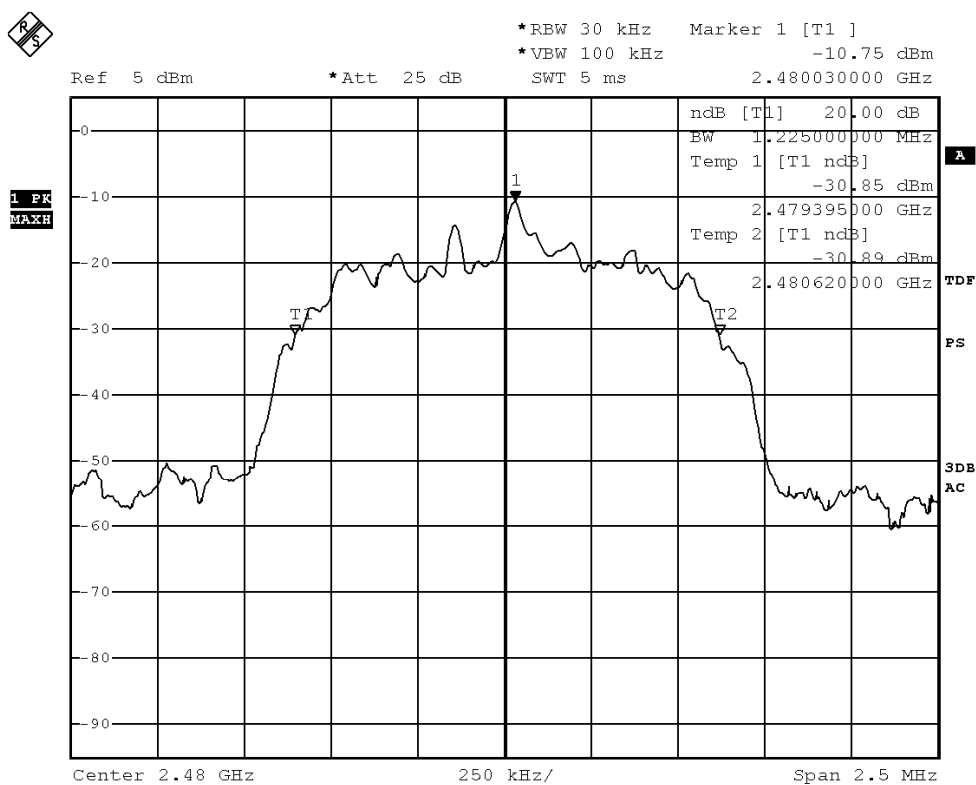
Date: 2015-03-03

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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2480	1.225	Within 2400-2483.5

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



Date: 7.FEB.2015 14:00:55



## STC Test Report

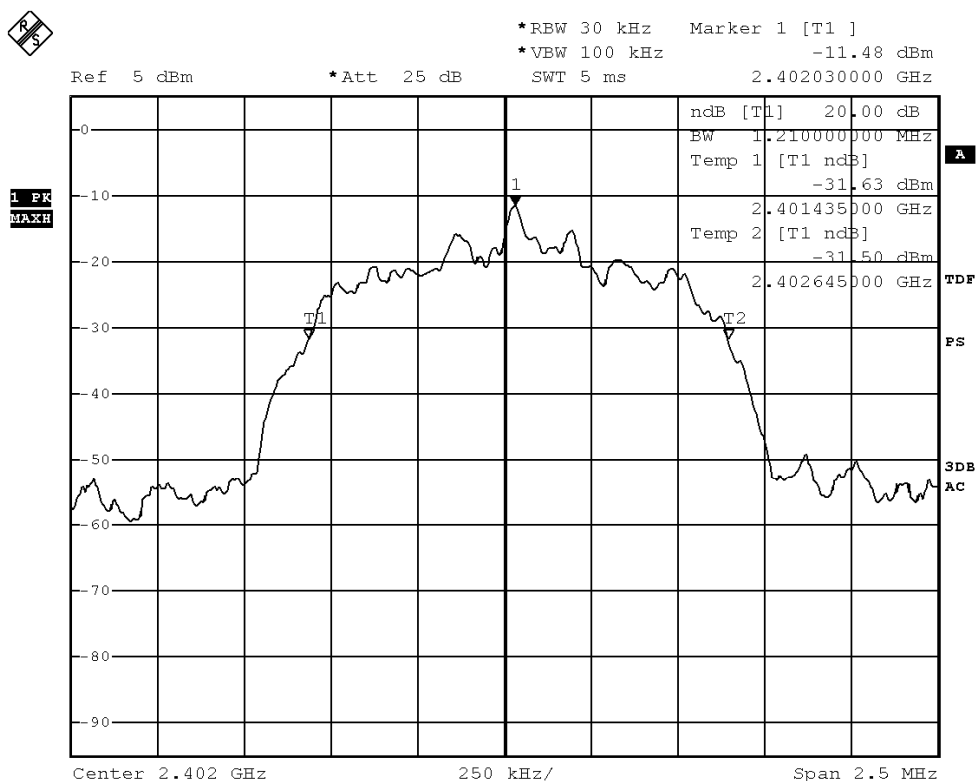
Date: 2015-03-03

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

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



Date: 7.FEB.2015 14:02:31

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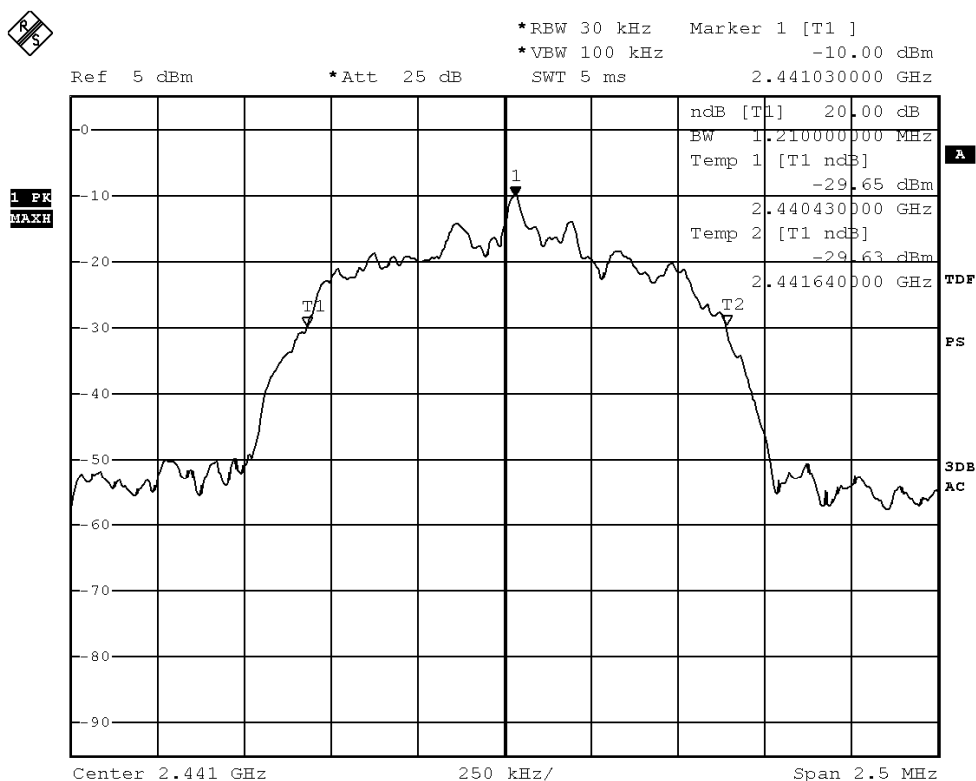
Date: 2015-03-03

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No.: MH191212

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

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



Date: 7.FEB.2015 14:03:08

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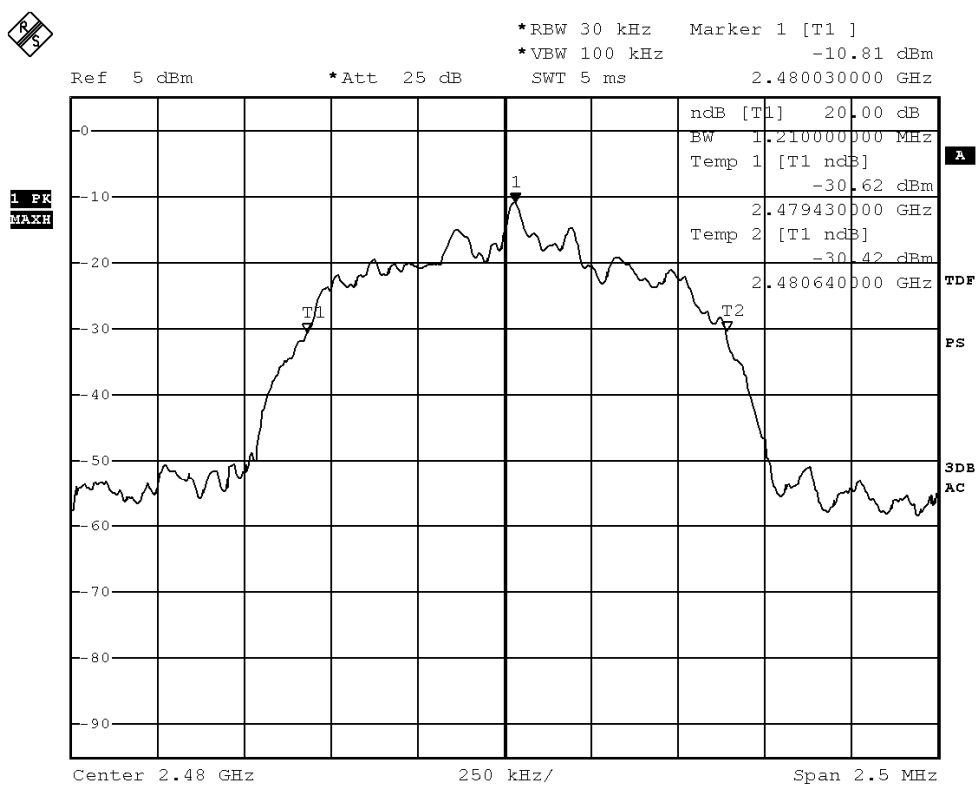
Date: 2015-03-03

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No.: MH191212

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

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



Date: 7.FEB.2015 14:03:33

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## **STC Test Report**

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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 minimum bandwidth  $\times \frac{2}{3} = 1.225\text{MHz} \times \frac{2}{3} = 816.7\text{kHz}$

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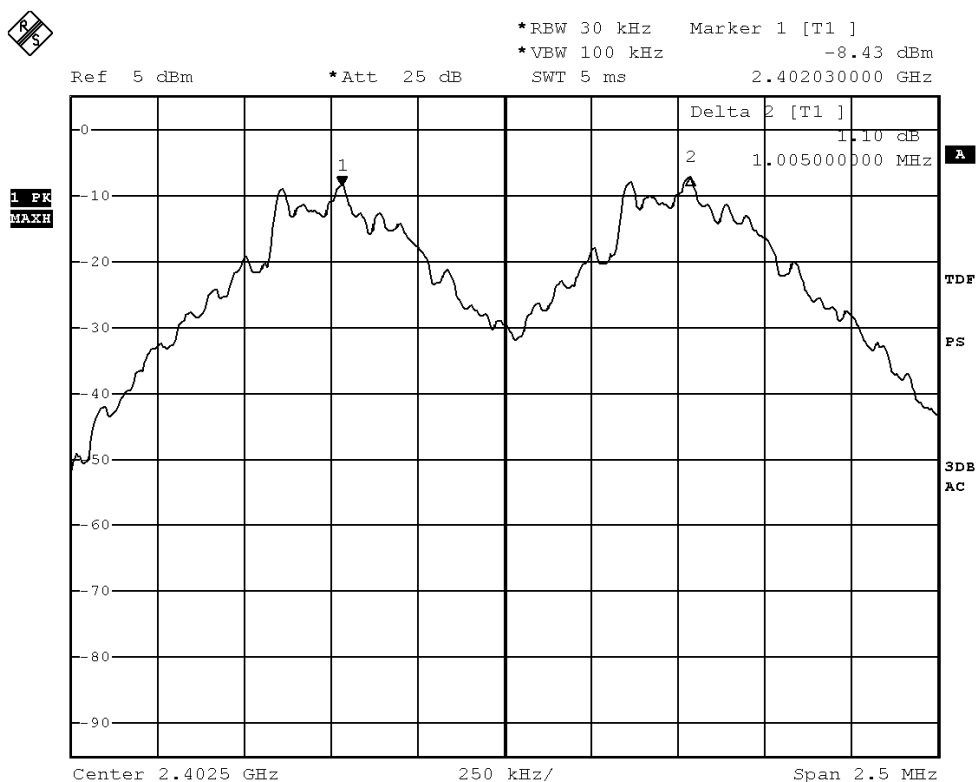
Date: 2015-03-03

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Channel separation = 1MHz (>816.7kHz) (GFSK)

Channel 1 – Channel 2, Pass



Date: 7.FEB.2015 14:14:18

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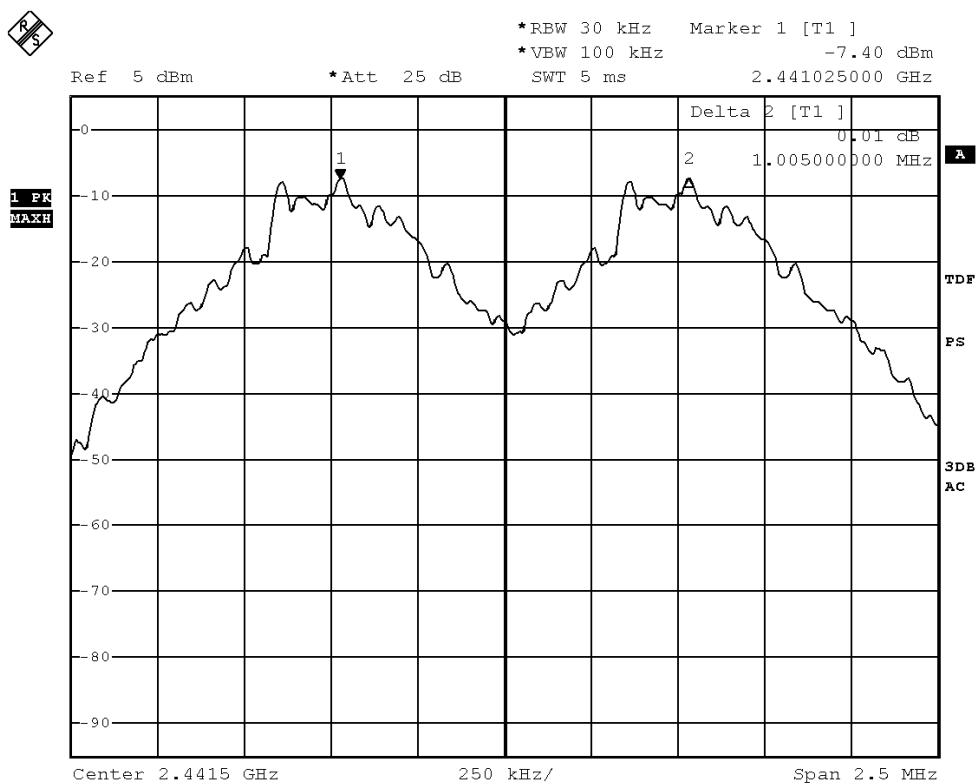
## STC Test Report

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No.: MH191212

### Channel 40 – Channel 41, Pass



Date: 7.FEB.2015 14:13:14



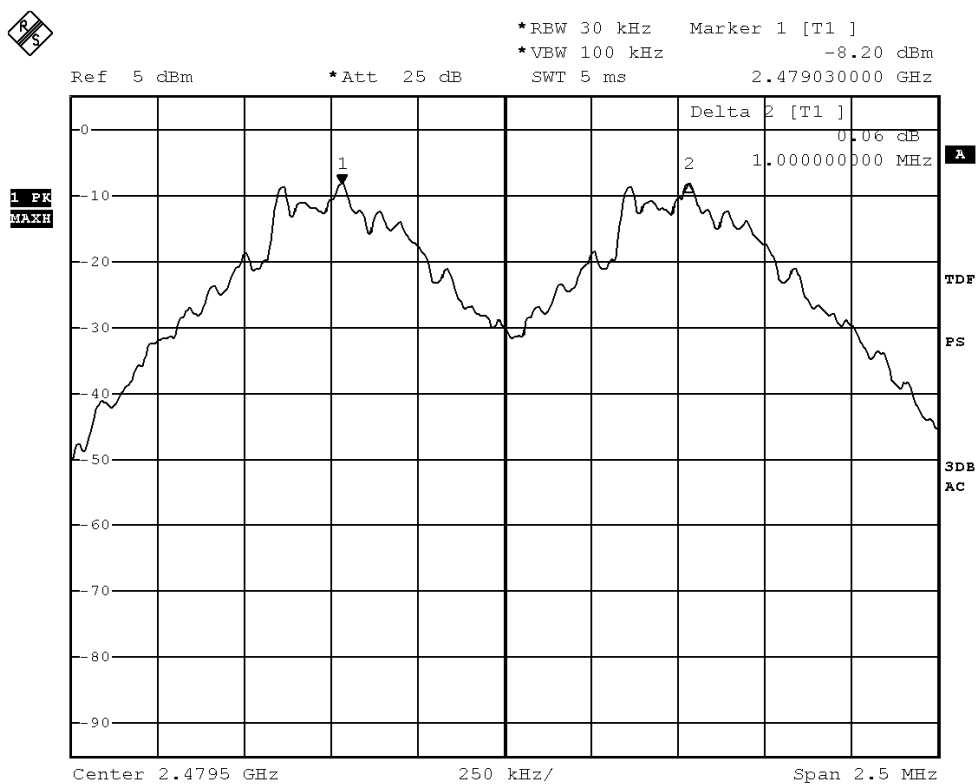
## STC Test Report

Date: 2015-03-03

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### Channel 78 – Channel 79, Pass



Date: 7.FEB.2015 14:11:47

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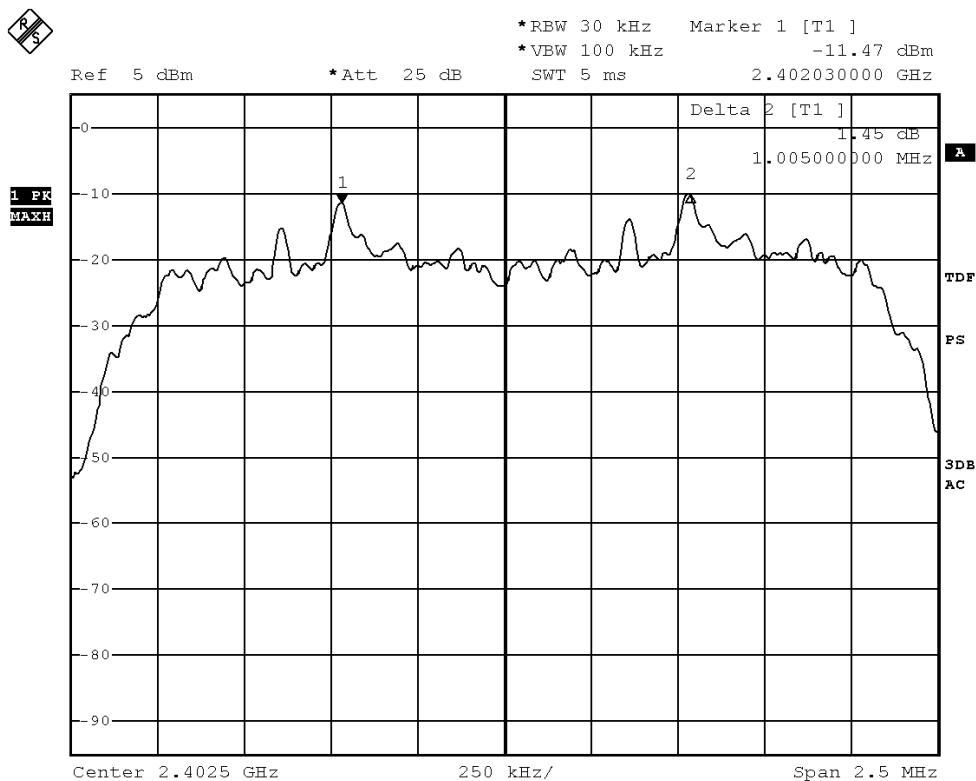
Date: 2015-03-03

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Channel separation = 1MHz (>816.7kHz) ( $\pi/4$ - DQPSK)

Channel 1 – Channel 2, Pass



Date: 7.FEB.2015 14:06:47

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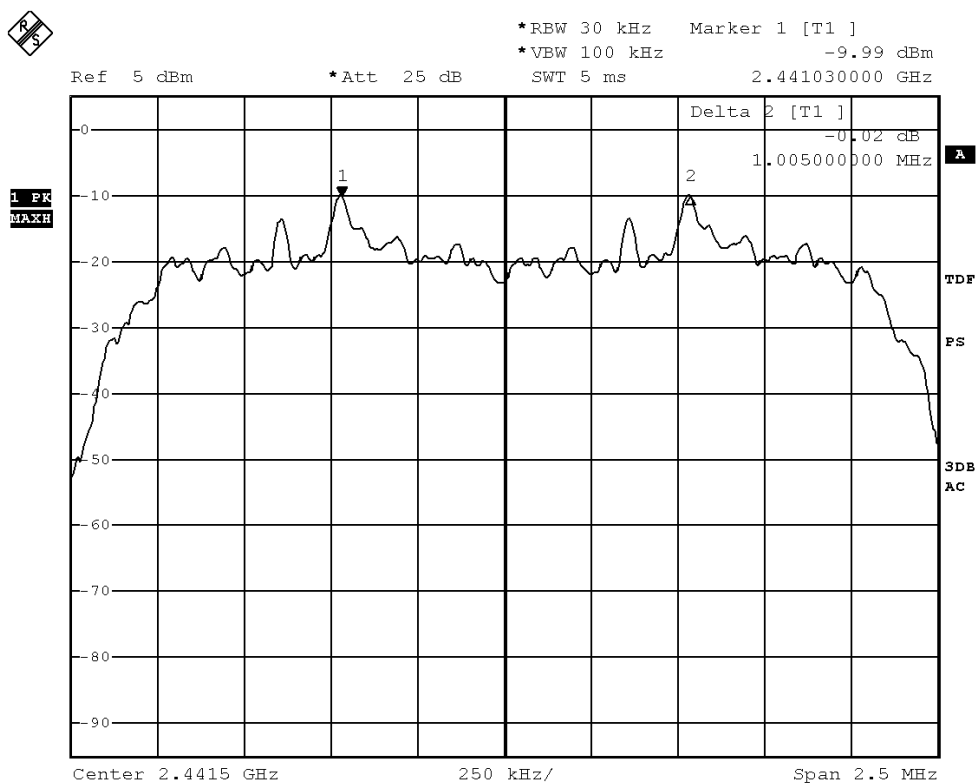
## STC Test Report

Date: 2015-03-03

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No.: MH191212

### Channel 40 – Channel 41, Pass



Date: 7.FEB.2015 14:08:53



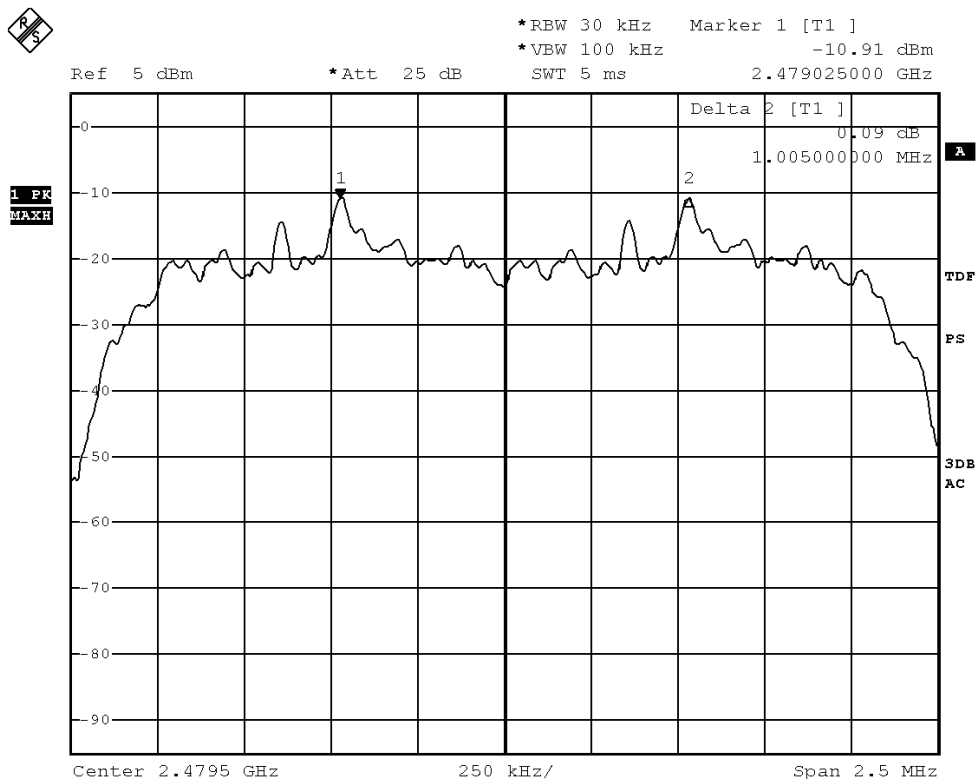
## STC Test Report

Date: 2015-03-03

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No.: MH191212

### Channel 78 – Channel 79, Pass



Date: 7.FEB.2015 14:09:49



## STC Test Report

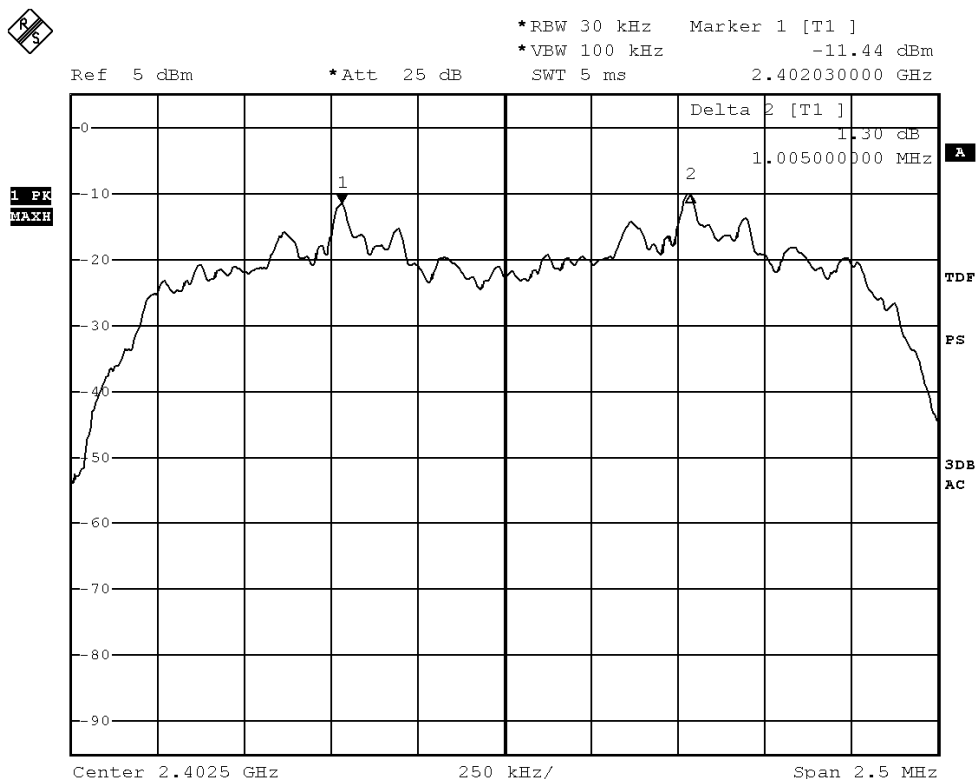
Date: 2015-03-03

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No.: MH191212

Channel separation = 1MHz (>816.7kHz) (8DPSK)

Channel 1 – Channel 2, Pass



Date: 7.FEB.2015 14:05:41

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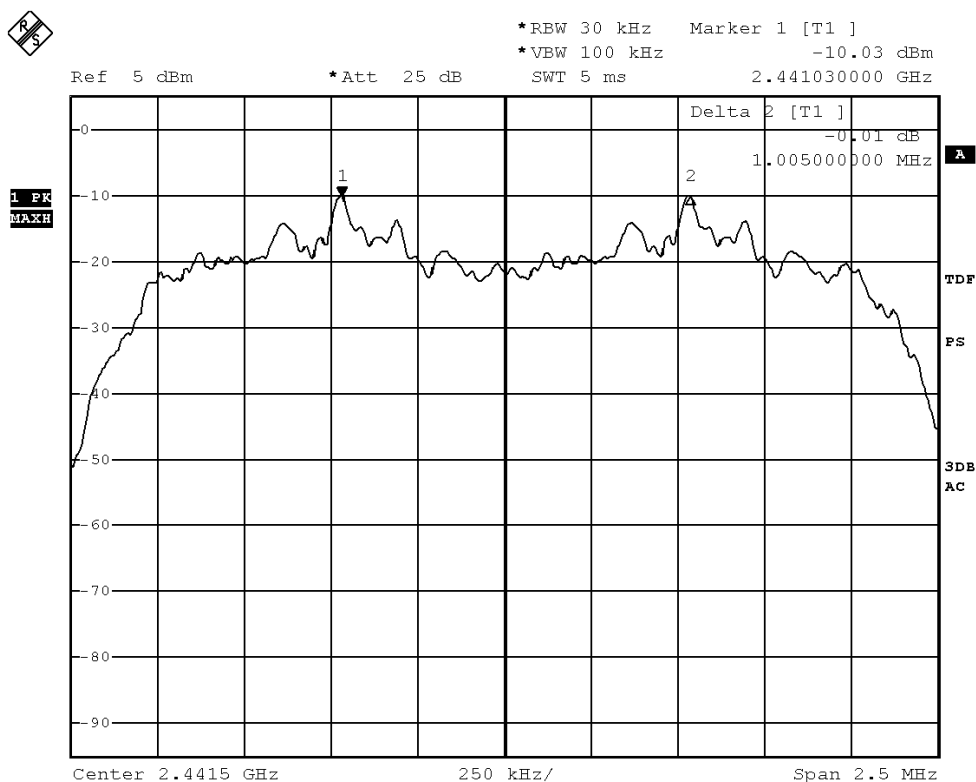
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Date: 2015-03-03

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### Channel 40– Channel 41, Pass



Date: 7.FEB.2015 14:04:51

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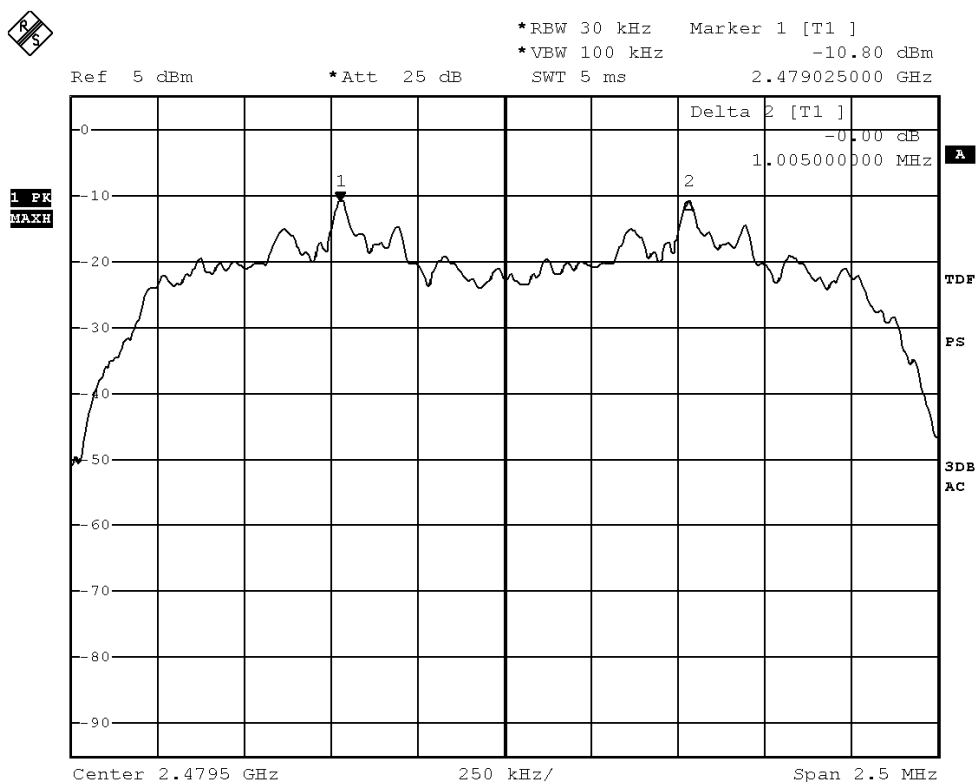
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### Channel 78 – Channel 79, Pass



Date: 7.FEB.2015 14:04:12



## STC Test Report

Date: 2015-03-03

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### 3.1.7 Band Edges Measurement

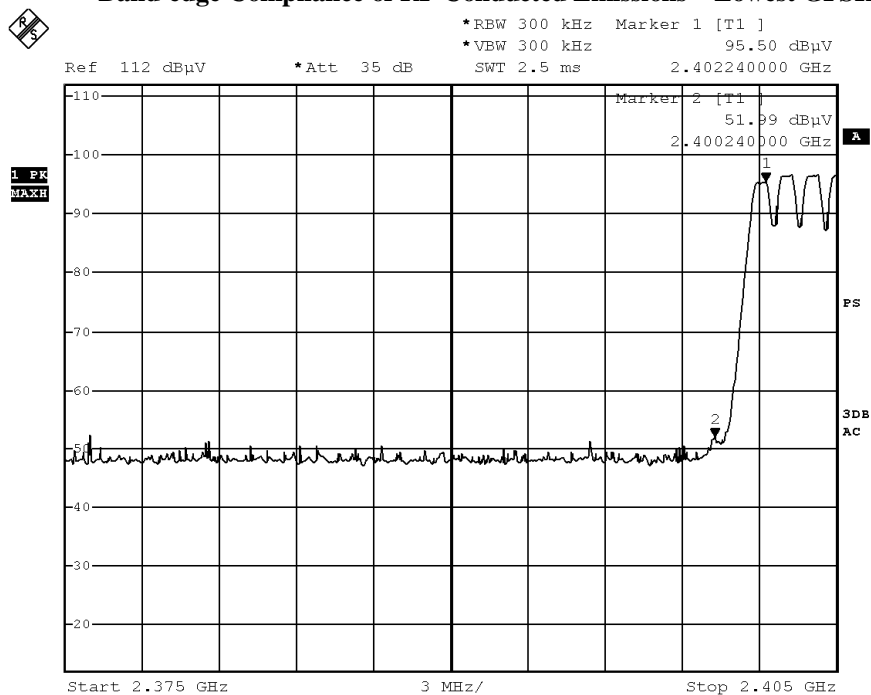
#### Band-edge Compliance of RF Conducted Emissions Measurement:

##### 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)	43.51

#### Band-edge Compliance of RF Conducted Emissions – Lowest GFSK)



Date: 7.FEB.2015 14:35:47

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Date: 2015-03-03

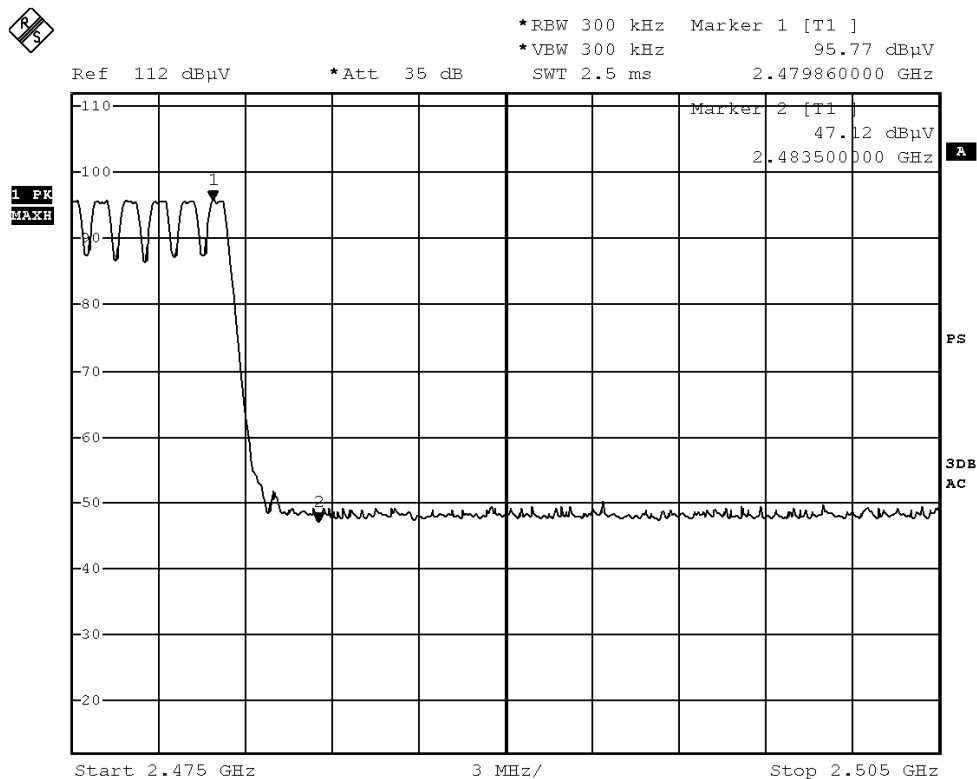
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### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range	Radiated Emission Attenuated below the Fundamental
[MHz]	[dB]
2483.5 - Highest Fundamental (2480)	48.65

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



Date: 7.FEB.2015 14:37:16

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Date: 2015-03-03

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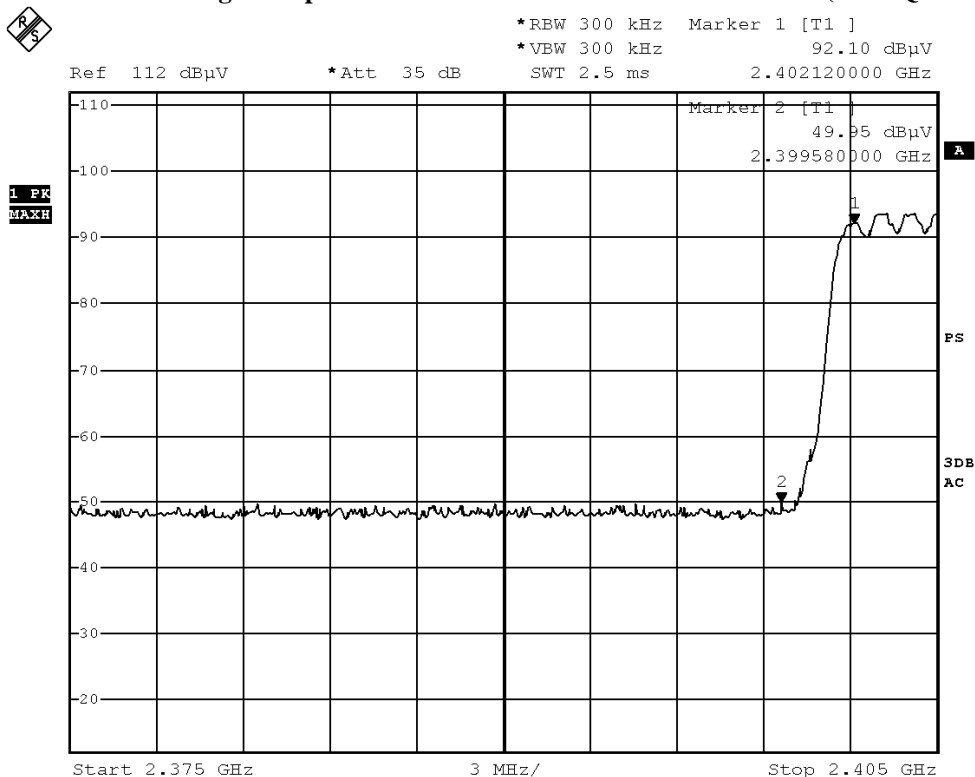
### Band-edge Compliance of RF Conducted Emissions Measurement:

#### 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)	42.15

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



Date: 7.FEB.2015 14:41:06

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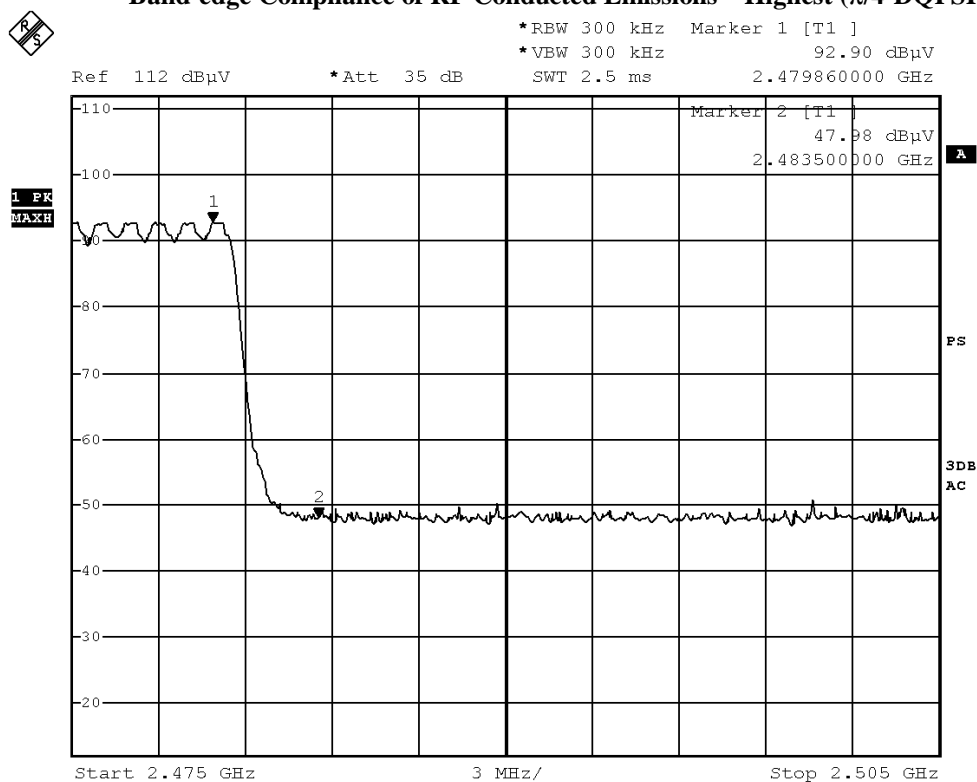
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### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range	Radiated Emission Attenuated below the Fundamental
[MHz]	[dB]
2483.5 - Highest Fundamental (2480)	44.92

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



Date: 7.FEB.2015 14:38:29

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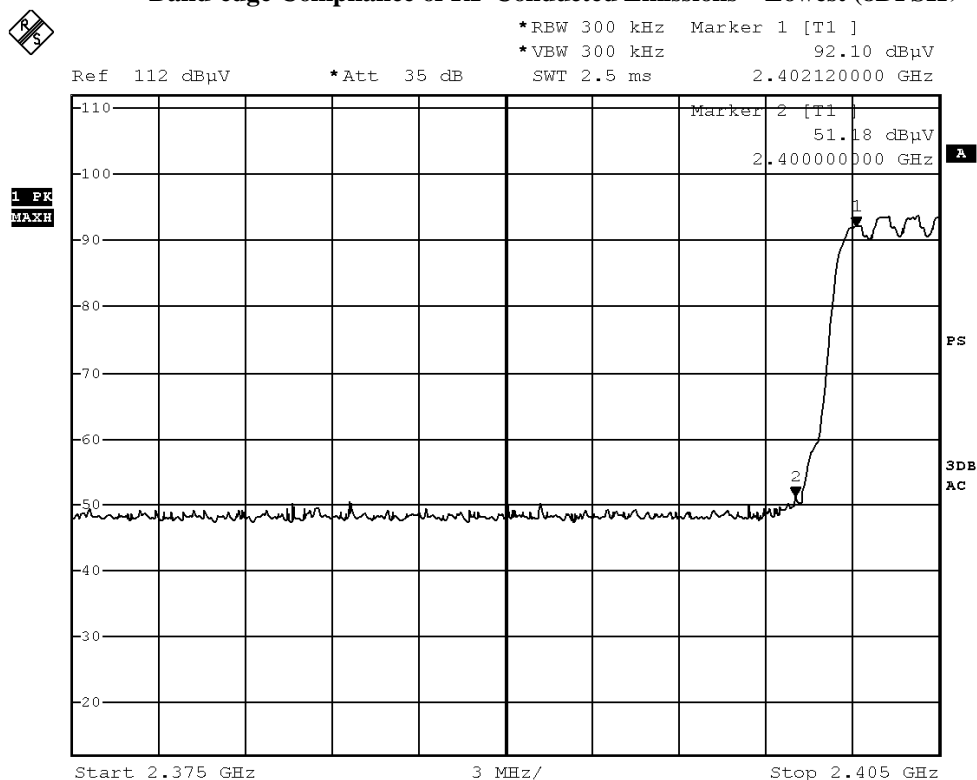
### Band-edge Compliance of RF Conducted Emissions Measurement:

#### 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)	40.92

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



Date: 7.FEB.2015 14:44:04

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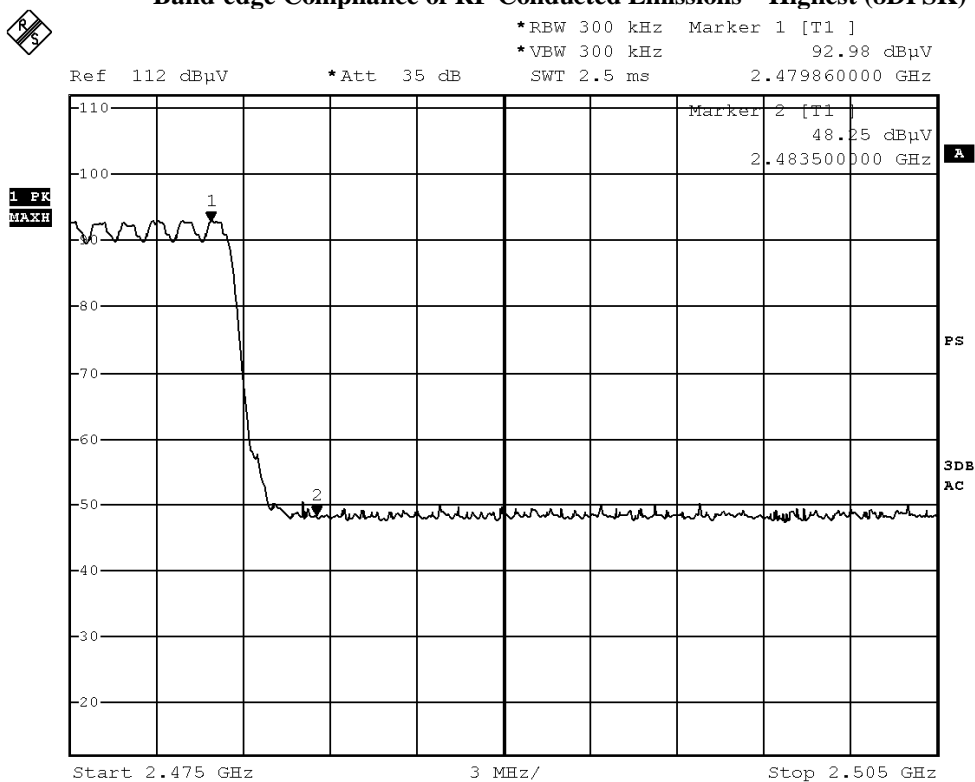
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### Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range	Radiated Emission Attenuated below the Fundamental
[MHz]	[dB]
2483.5 - Highest Fundamental (2480)	44.73

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



Date: 7.FEB.2015 14:47:04

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## STC Test Report

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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 –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	27.6	36.8	64.4	74.0	9.6	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	4.5	36.8	41.3	54.0	12.7	Vertical

### **Result: Band-edge Compliance of 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	25.5	36.8	62.3	74.0	11.7	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	4.1	36.8	40.9	54.0	13.1	Horizontal

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Date: 2015-03-03

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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 –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
2400.0	27.0	36.8	63.8	74.0	10.2	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	3.6	36.8	40.4	54.0	13.6	Vertical

### **Result: Band-edge Compliance of 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	24.7	36.8	61.5	74.0	12.5	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	3.3	36.8	40.1	54.0	13.9	Horizontal

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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 –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
2400.0	26.8	36.8	63.6	74.0	10.4	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	3.3	36.8	40.1	54.0	13.9	Vertical

### **Result: Band-edge Compliance of 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	24.2	36.8	61.0	74.0	13.0	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	3.3	36.8	40.1	54.0	13.9	Horizontal

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### 3.1.8 Time of Occupancy (Dwell Time)

#### Requirements:

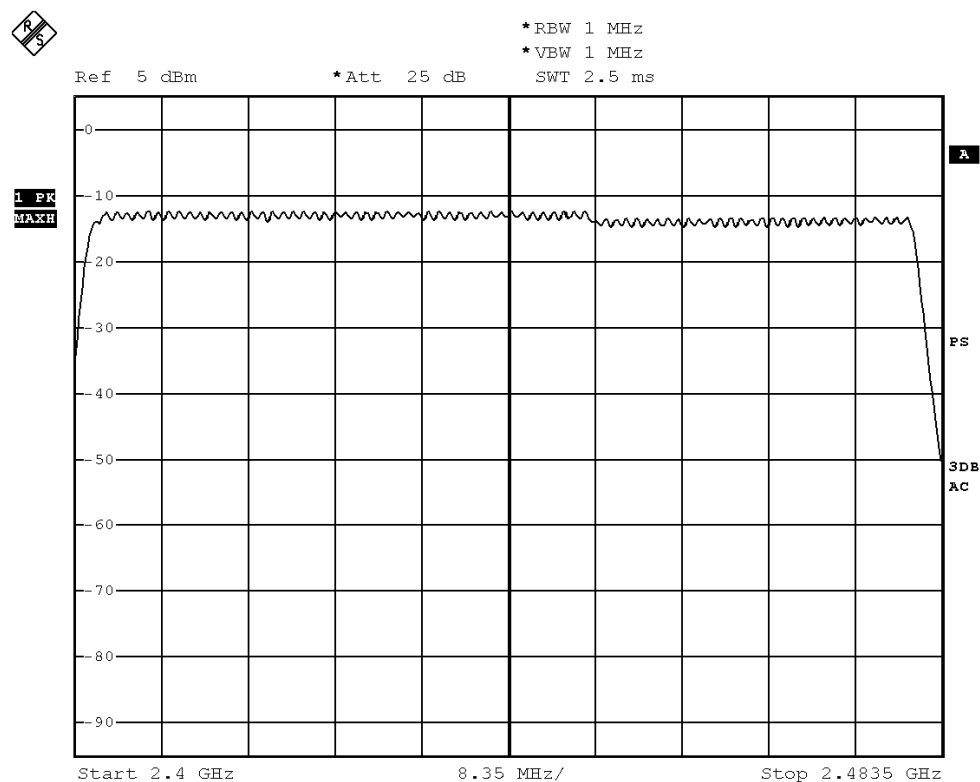
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channel employed.  
No requirements for Digital Transmission System.

**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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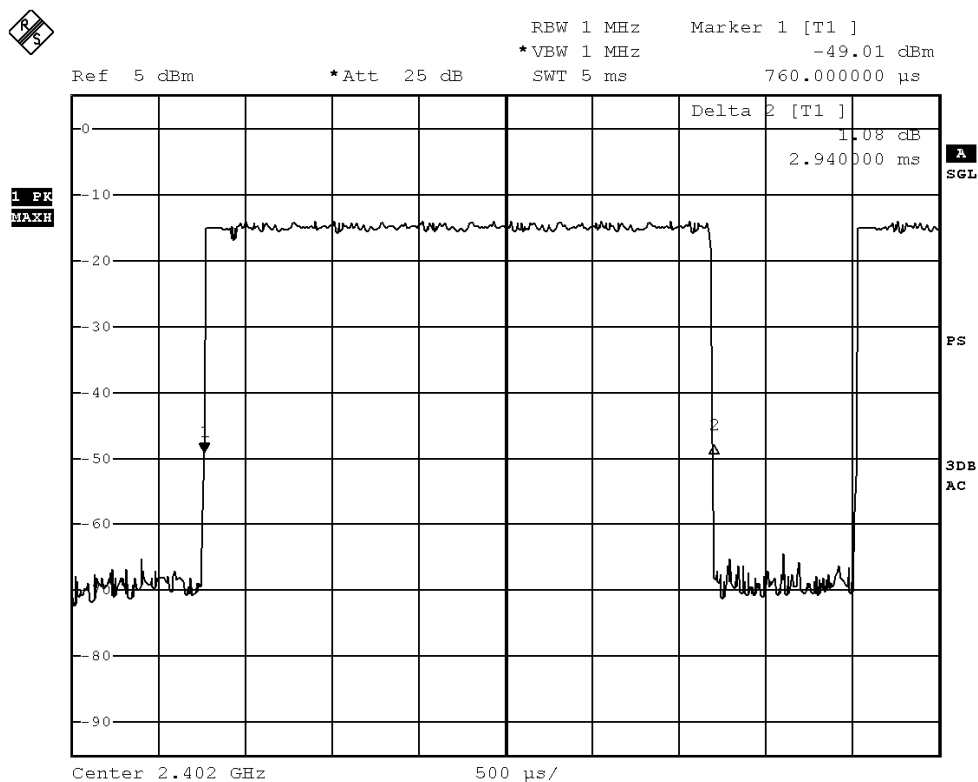
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### DH5 Packet:

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]**



Date: 7.FEB.2015 14:32:21

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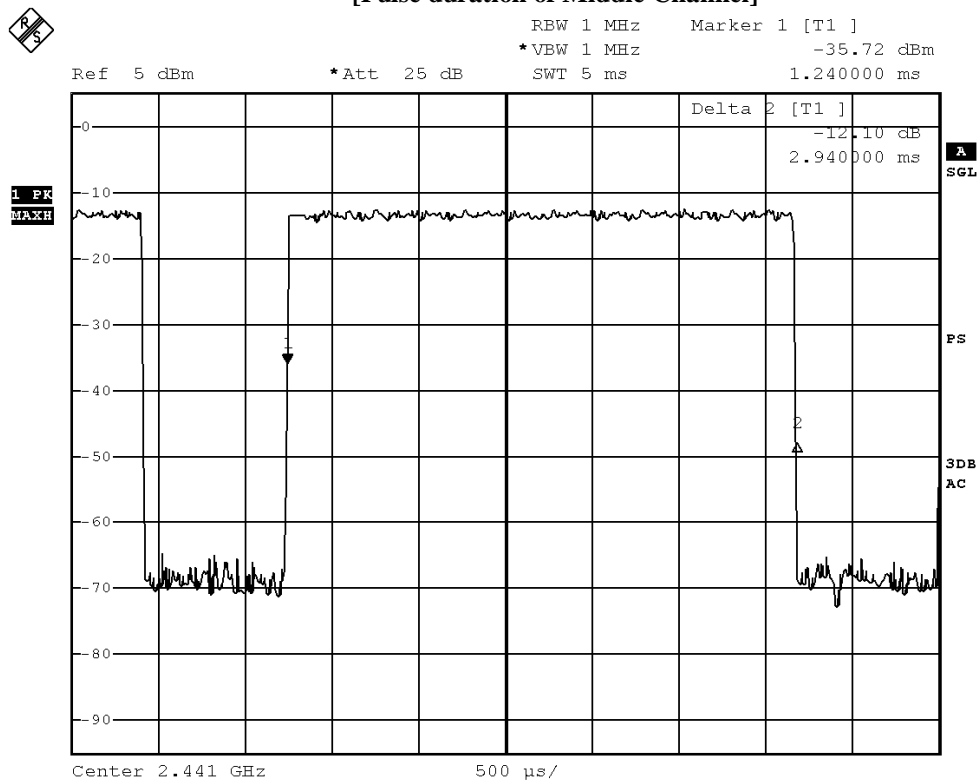
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**Fig. B**  
**[Pulse duration of Middle Channel]**



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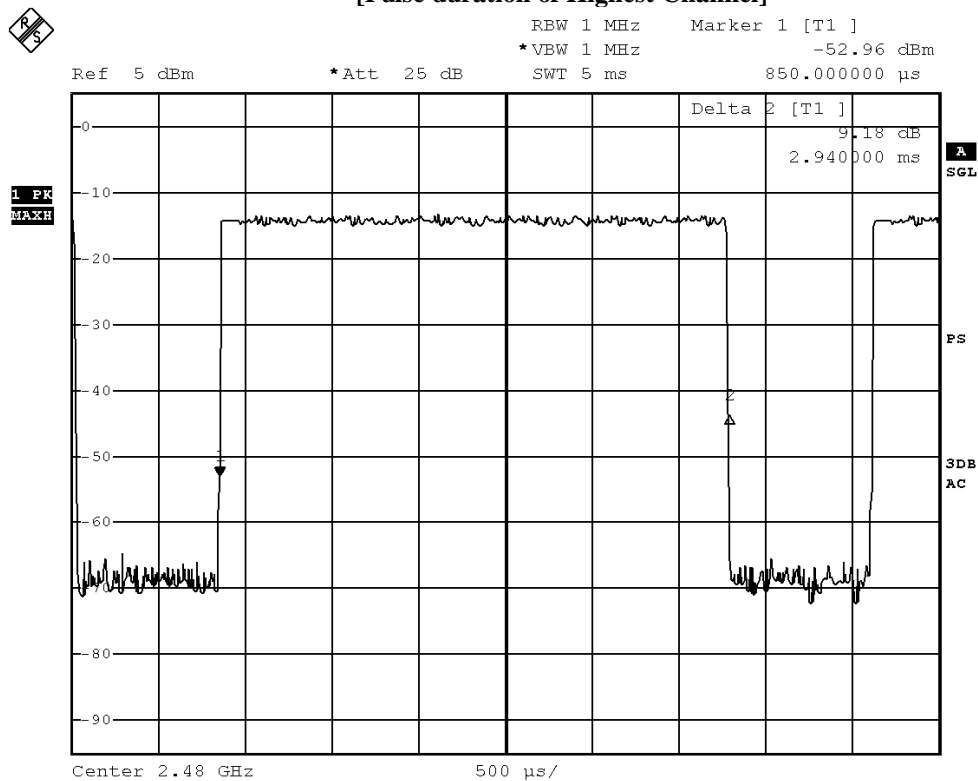
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**Fig. C**  
**[Pulse duration of Highest Channel]**



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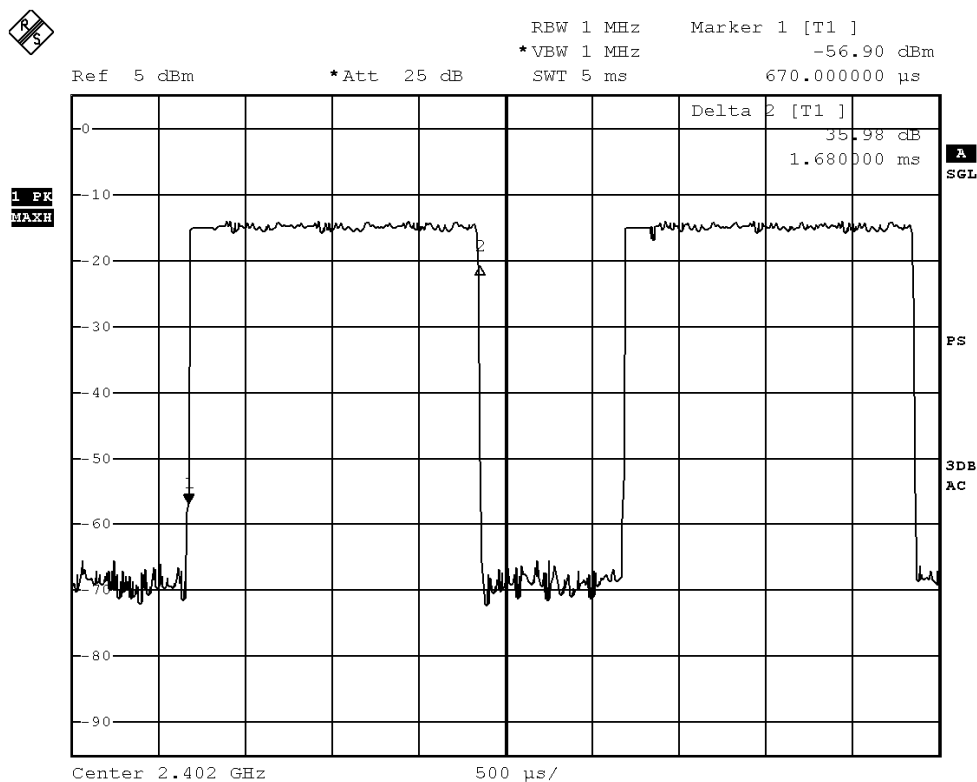
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### DH3 Packet:

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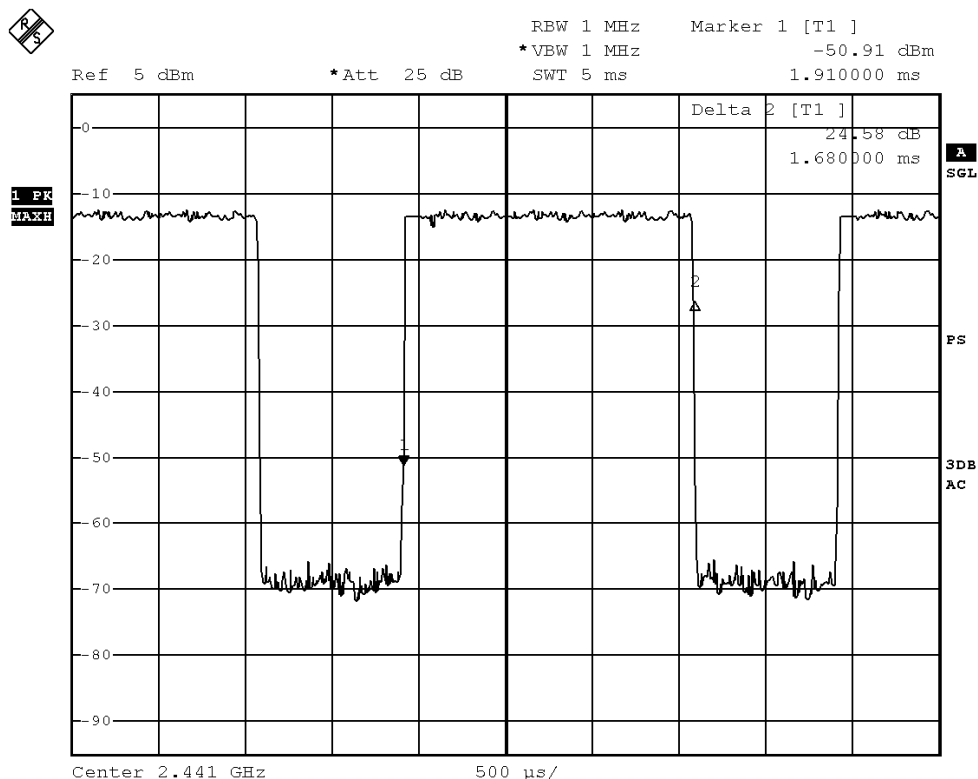
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**Fig. E**  
**[Pulse duration of Middle Channel]**



Date: 7.FEB.2015 14:30:53



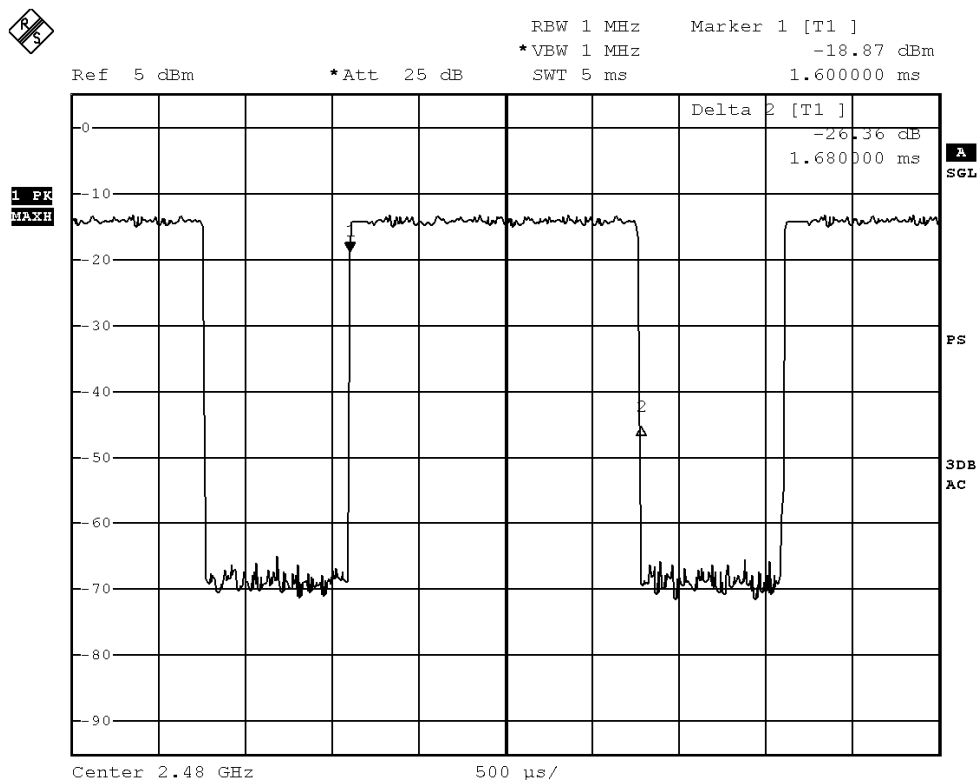
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**Fig. F**  
**[Pulse duration of Highest Channel]**



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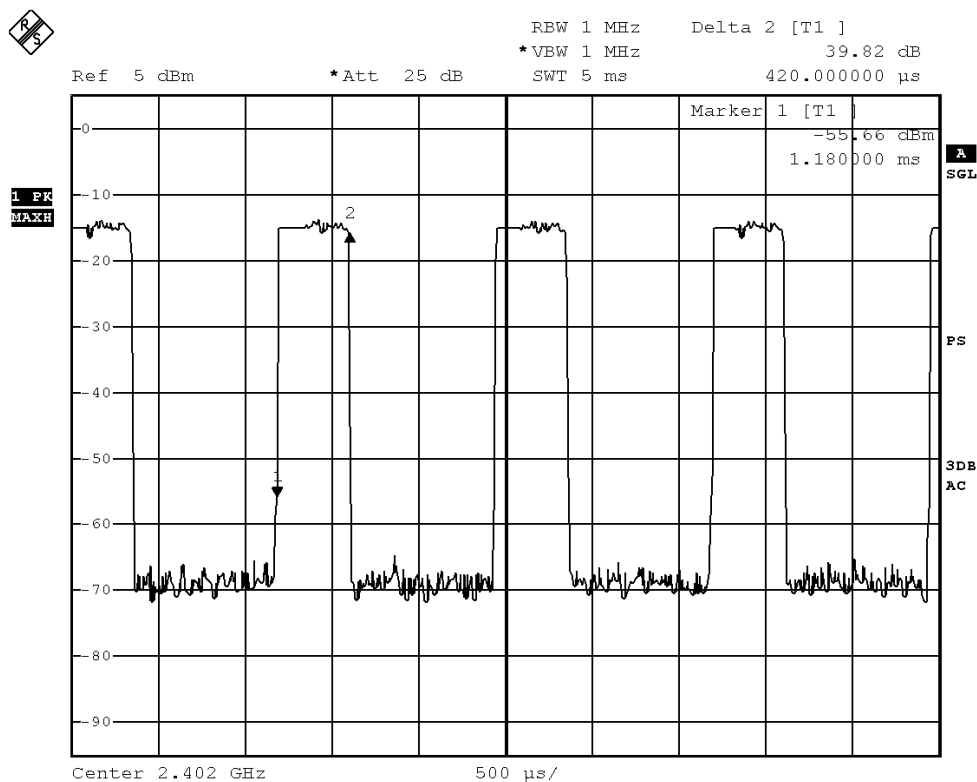
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### DH1 Packet:

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]**



Date: 7.FEB.2015 14:27:48

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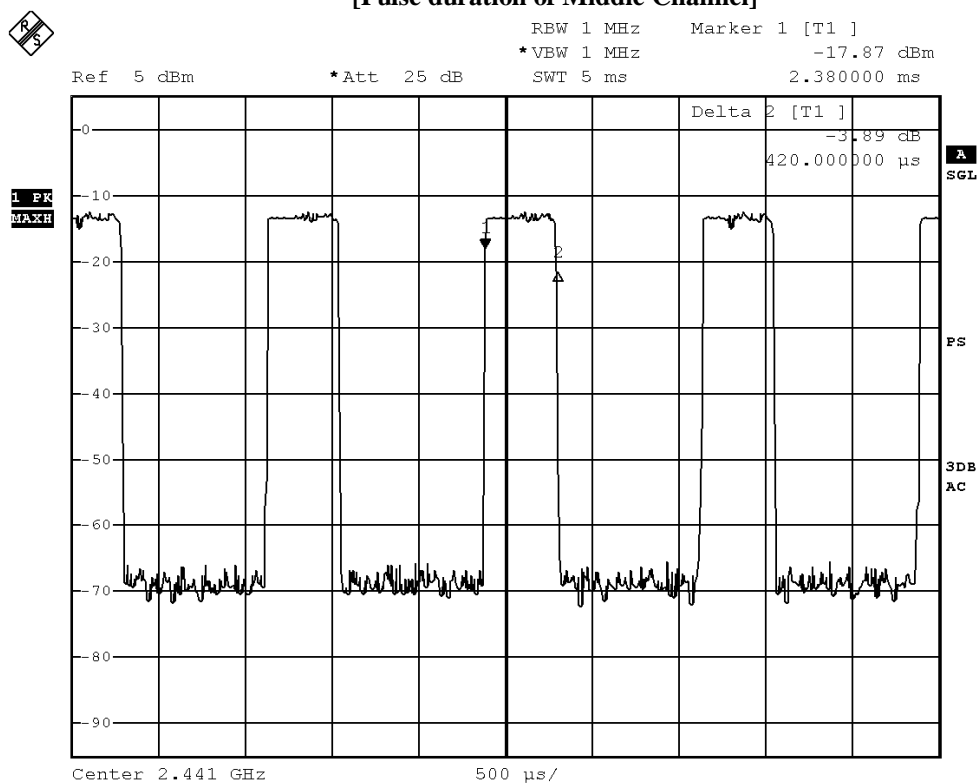
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**Fig. H**  
**[Pulse duration of Middle Channel]**



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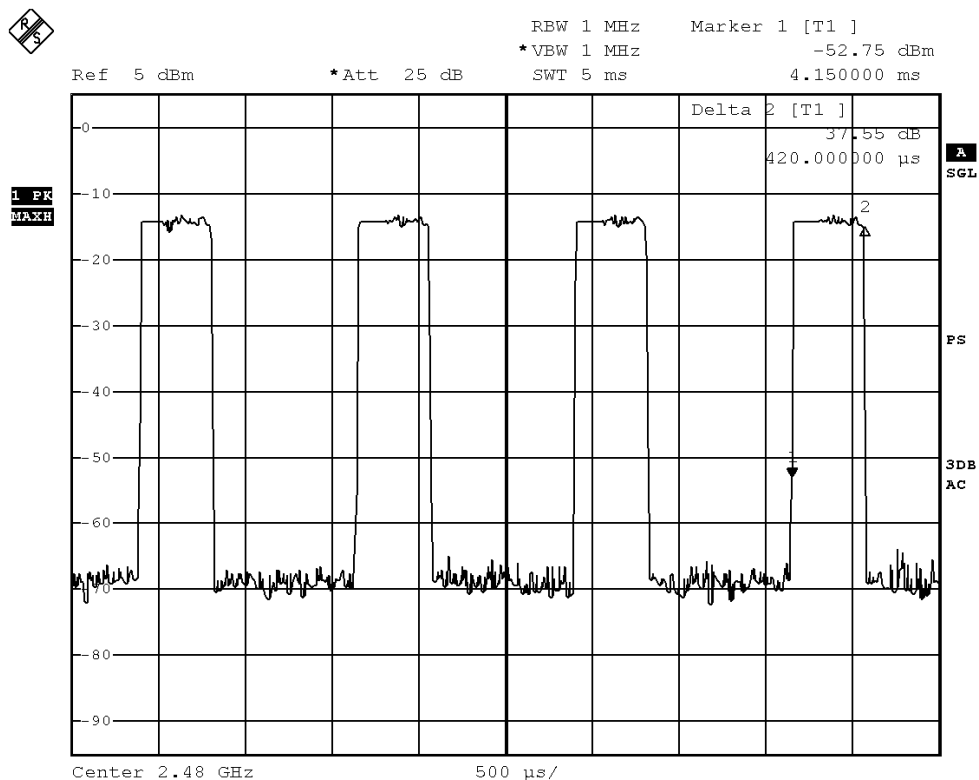
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**Fig. I**  
**[Pulse duration of Highest Channel]**



Date: 7.FEB.2015 14:29:48

### Time of occupancy (Dwell Time):

Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (s)	Limits (s)	Test Results
DH5	2402	2.940	0.313	0.400	Complies
DH5	2441	2.940	0.313	0.400	Complies
DH5	2480	2.940	0.313	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 Meander line antenna. There is no external antenna, the antenna gain = 2.12dBi. User is unable to remove or changed the Antenna.

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### **3.1.12 RF Exposure**

Test Requirement: FCC 47CFR 15.247(i)  
Test Date: 2015-02-14  
Mode of Operation: Tx mode

#### **Test Method:**

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

#### **Test Results:**

The EUT complied with the requirement(s) of this section.  
EUT meets the requirements of these sections as proven through MPE calculation  
The MPE calculation for EUT @ 20cm  
Based on the highest P = 1.774 mW

$$\begin{aligned} P_d &= PG / 4\pi R^2 = (1.774 \times 1.63) / 12.566 \times (20)^2 \\ &= (2.803) / 12.566 \times 400 = 2.892 / 5026.4 \\ &= 0.000575 \text{ mW/cm}^2 \end{aligned}$$

where:

- \*Pd = power density in mW/cm<sup>2</sup>
- \* G = Antenna numeric gain (1.63); Log G = g/10 ( g = 2.12dBi ).
- \* P = Conducted RF power to antenna (1.774mW).
- \* R = Minimum allowable distance.(20 cm)

- \*The power density Pd = 0.000575mW/cm<sup>2</sup> is less than 1 mW/cm<sup>2</sup> (listed MPE limit)
- \*The SAR evaluation is not needed ( this is a desk top device, R> 20 cm )
- \* The EUT( antenna ) must be 0.2 meters away from the General Population.

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### **Appendix A**

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

##### **Radiated Emission**

<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>
EM299	DOUBLE-RIDGED WAVEGUIDE HORN ANTENNA	ETS-LINDGREN	3115	00114120	2014/01/15	2016/01/25
EM300	PYRAMIDAL STANDARD GAIN HORN ANTENNA	ETS-LINDGREN	3160-09	00130130	2014/01/23	2016/01/23
EM215	MULTIDEVICE CONTROLLER	EMCO	2090	00024676	N/A	N/A
EM216	MINI MAST SYSTEM	EMCO	2075	00026842	N/A	N/A
EM217	ELECTRIC POWERED TURNTABLE	EMCO	2088	00029144	N/A	N/A
EM218	ANECHOIC CHAMBER	ETS-LINDGREN	FACT-3	--	2014/09/29	2015/09/29
EM219	BICONILOG ANTENNA	EMCO	3142C	00029071	2013/04/25	2015/04/25
EM022	LOOP ANTENNA	EMCO	6502	1189-2424	2014/01/15	2016/01/15
EM229	EMI TEST RECEIVER	R&S	ESIB40	100248	2014/05/26	2015/05/26

##### **Line Conducted**

<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>
EM232	LISN	SCHAFFNER	NNB41	04/100082	2014/12/08	2015/12/08
EM181	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB7	100072	2014/05/26	2015/05/26
EM179	IMPULSE LIMITER	ROHDE & SCHWARZ	ESH3-Z2	357-8810.52/54	2015/01/14	2016/01/14
EM154	SHIELDING ROOM	SIEMENS MATSUSHITA COMPONENTS	N/A	803-740-057-99A	2012/02/03	2017/02/03

Remarks:-

N/A Not Applicable or Not Available

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### **Appendix B**

#### **Photographs of EUT**

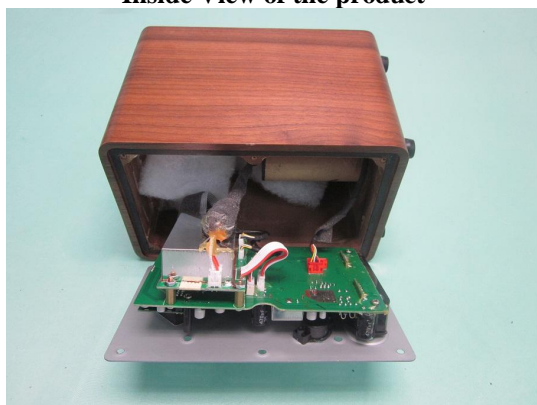
**Front View of the product**



**Rear View of the product**



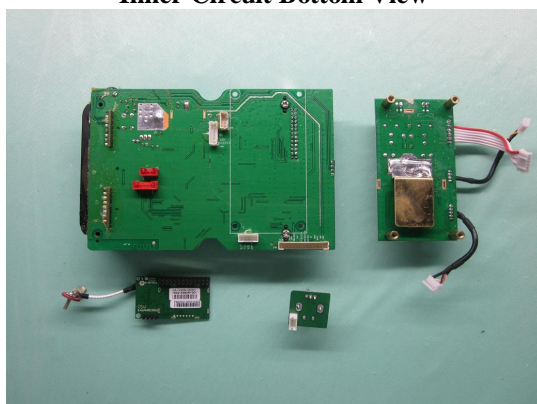
**Inside View of the product**



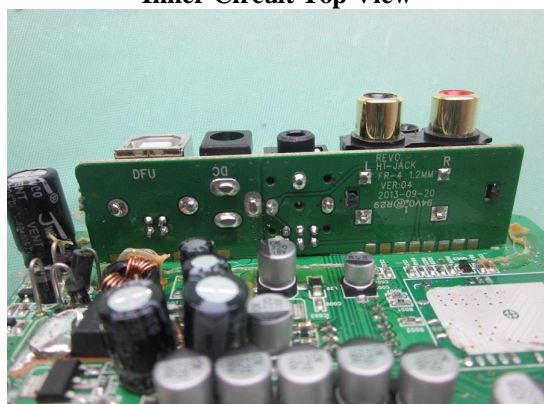
**Inner Circuit Top View**



**Inner Circuit Bottom View**



**Inner Circuit Top View**



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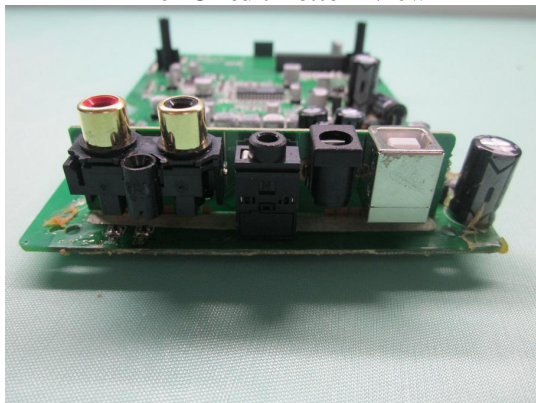
Date: 2015-03-03

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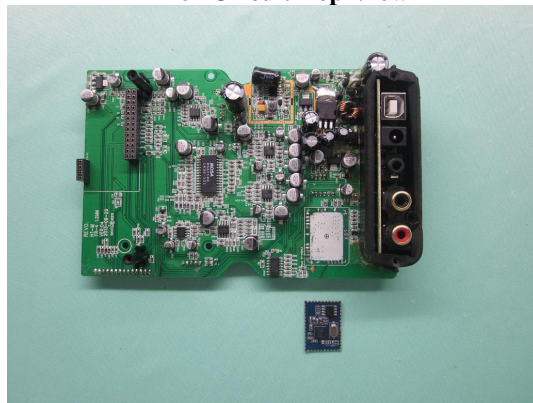
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### **Photographs of EUT**

**Inner Circuit Bottom View**



**Inner Circuit Top View**



**Inner Circuit Bottom View**



**Inner Circuit Top View**



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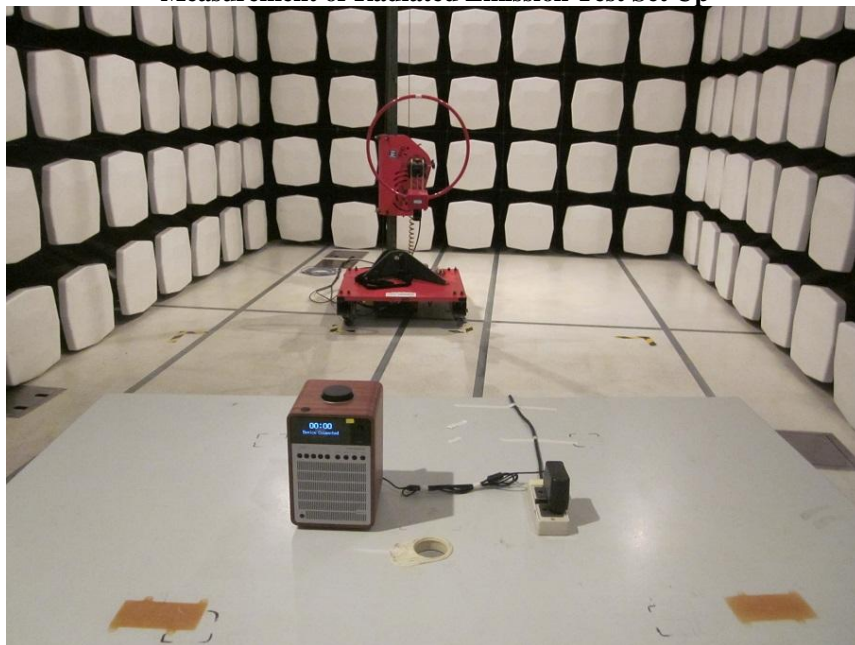
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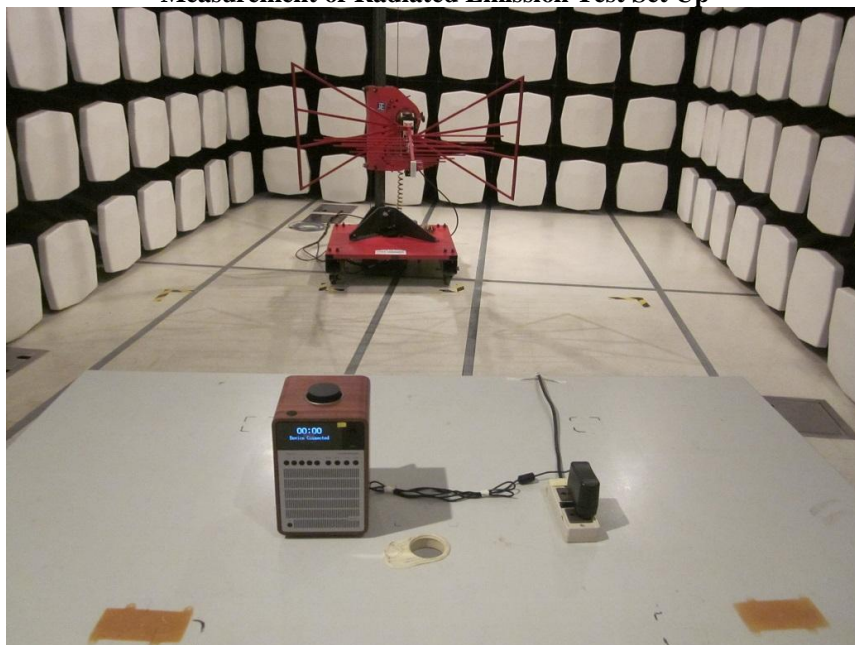
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### **Photographs of EUT**

**Measurement of Radiated Emission Test Set Up**



**Measurement of Radiated Emission Test Set Up**



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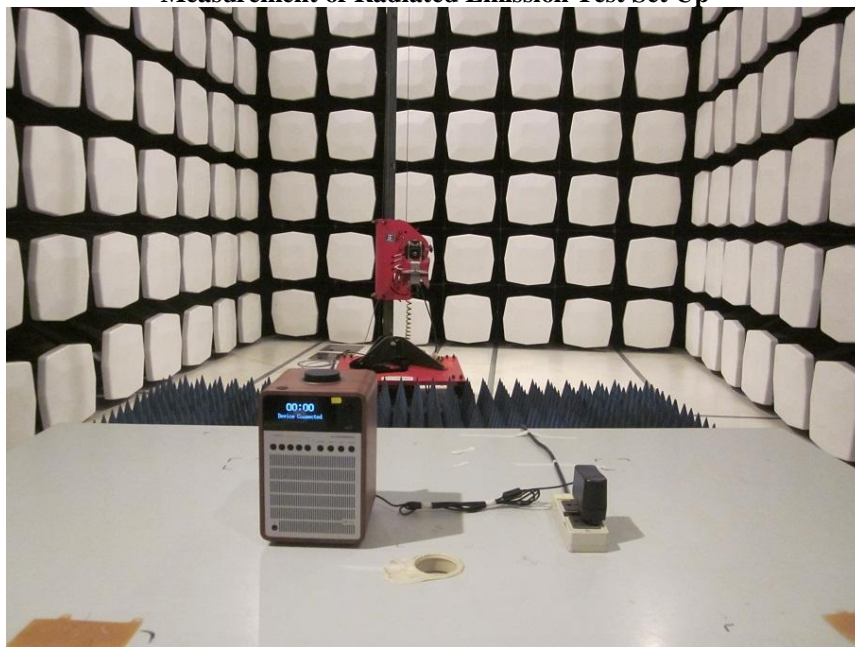
Date: 2015-03-03

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### **Photographs of EUT**

**Measurement of Radiated Emission Test Set Up**



**Measurement of Conducted Emission Test Set Up**



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