



## STC Test Report

**Date: 2016-04-05**

**Page 1 of 87**

**No.: MH192510**

**Applicant:**

Hip Shing Electronics Limited  
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: Multimedia Speaker  
Brand Name: ADCOM  
Model Number: Luna  
FCC ID: BZA0416LUNA

**Date Sample(s) Received:** 2016-03-22

**Date Tested:** 2016-03-28 to 2016-04-05

**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.

**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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## **STC Test Report**

**Date: 2016-04-05**

**No.: MH192510**

**Page 2 of 87**

### **CONTENT:**

Cover	Page 1 of 87
Content	Page 2 of 87
<b><u>1.0 General Details</u></b>	
1.1 Test Laboratory	Page 3 of 87
1.2 Equipment Under Test [EUT] Description of EUT operation	Page 3 of 87
1.3 Date of Order	Page 3 of 87
1.4 Submitted Sample	Page 3 of 87
1.5 Test Duration	Page 3 of 87
1.6 Country of Origin	Page 3 of 87
1.7 RF Module Details	Page 4 of 87
1.8 Antenna Details	Page 4 of 87
<b><u>2.0 Technical Details</u></b>	
2.1 Investigations Requested	Page 5 of 87
2.2 Test Standards and Results Summary	Page 5 of 87
2.3 Table for Test Modes	Page 6 of 87
<b><u>3.0 Test Results</u></b>	
3.1 Emission	Page 7 – 81 of 87
<b><u>Appendix A</u></b>	
List of Measurement Equipment	Page 82 of 87
<b><u>Appendix B</u></b>	
Photographs	Page 83-87 of 87

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## **STC Test Report**

**Date: 2016-04-05**

**Page 3 of 87**

**No.: MH192510**

### **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:	Multimedia Speaker
Manufacturer:	Dongguan Zhi Cheng Electronic Products Co., Ltd. No. 11 Shangbao Road, 188 Industrial Zone, Pingshan, Tangxia, Dongguan, Guangdong, China
Brand Name:	ADCOM
Model Number:	Luna
Rating:	Input: 100-240Va.c. 50/60Hz 0.75A; Output: 12Vd.c. 2000mA.

The AC/DC adaptor was provided by the applicant with following details:  
Brand name: GPE; Model no.: GPE024C-120200-Z

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

The Equipment Under Test (EUT) is a Multimedia Speaker. The r.f. signal was modulated by IC and type of modulation was frequency hopping spread spectrum Modulation.

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

2016-03-22

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

1 Sample

#### **1.5 Test Duration**

2016-03-28 to 2016-04-05

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

China

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## **STC Test Report**

**Date: 2016-04-05**

**Page 4 of 87**

**No.: MH192510**

### **1.7 RF Module Details**

Module Model Number:	JS-BTM8645
Module FCC ID:	
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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## STC Test Report

**Date: 2016-04-05**

**Page 5 of 87**

**No.: MH192510**

### **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.

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

EMISSION Results Summary						
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 C63.10: 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 checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Number of Hopping Frequency	FCC 47CFR 15.247 (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(d)	FCC Pubic Notice DA 00-705	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pseudorandom Hopping Algorithm	FCC 47CFR 15.247(a)(1)	N/A	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Time of Occupancy (Dwell Time)	FCC 47CFR 15.247(a)(1)(iii)	FCC Pubic Notice DA 00-705	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Antenna requirement	FCC 47CFR 15.203	N/A	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
RF Exposure	FCC 47CFR 15.247(i)	N/A	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Note: N/A – Not Applicable

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## STC Test Report

**Date: 2016-04-05**

**Page 6 of 87**

**No.: MH192510**

### **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.

<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 / 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	2MBps / 3MBps

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## STC Test Report

**Date: 2016-04-05**

**Page 7 of 87**

**No.: MH192510**

### **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:	2016-03-31
Mode of Operation:	Tx mode

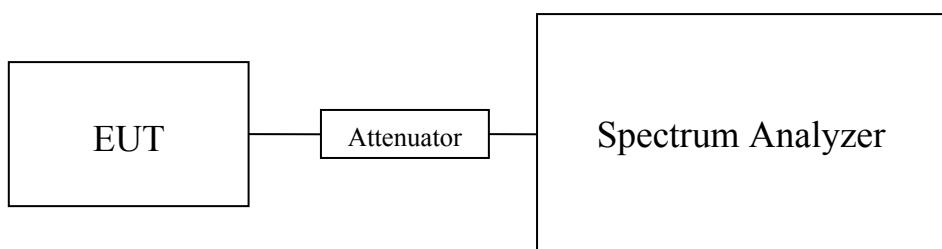
#### **Test Method:**

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 dBm.

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

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

#### **Test Setup:**



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

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## STC Test Report

**Date: 2016-04-05**

**Page 8 of 87**

**No.: MH192510**

### **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**

<b>Transmitter Frequency (MHz)</b>	<b>Maximum conducted output power (Watt)</b>
2402	0.002004

<b>Transmitter Frequency (MHz)</b>	<b>Maximum conducted output power (Watt)</b>
2441	0.002371

<b>Transmitter Frequency (MHz)</b>	<b>Maximum conducted output power (Watt)</b>
2480	0.001782

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

<b>Transmitter Frequency (MHz)</b>	<b>Maximum conducted output power (Watt)</b>
2402	0.001300

<b>Transmitter Frequency (MHz)</b>	<b>Maximum conducted output power (Watt)</b>
2441	0.001841

<b>Transmitter Frequency (MHz)</b>	<b>Maximum conducted output power (Watt)</b>
2480	0.001279

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

<b>Transmitter Frequency (MHz)</b>	<b>Maximum conducted output power (Watt)</b>
2402	0.001459

<b>Transmitter Frequency (MHz)</b>	<b>Maximum conducted output power (Watt)</b>
2441	0.001888

<b>Transmitter Frequency (MHz)</b>	<b>Maximum conducted output power (Watt)</b>
2480	0.001309

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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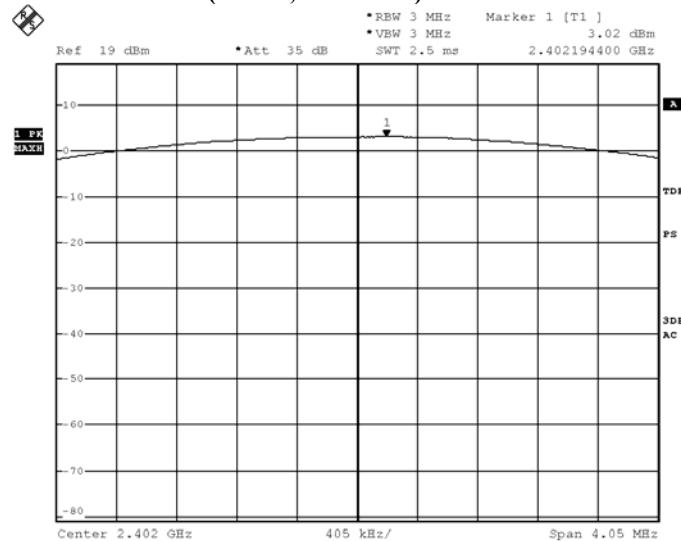
## STC Test Report

**Date: 2016-04-05**

**No.: MH192510**

**Page 9 of 87**

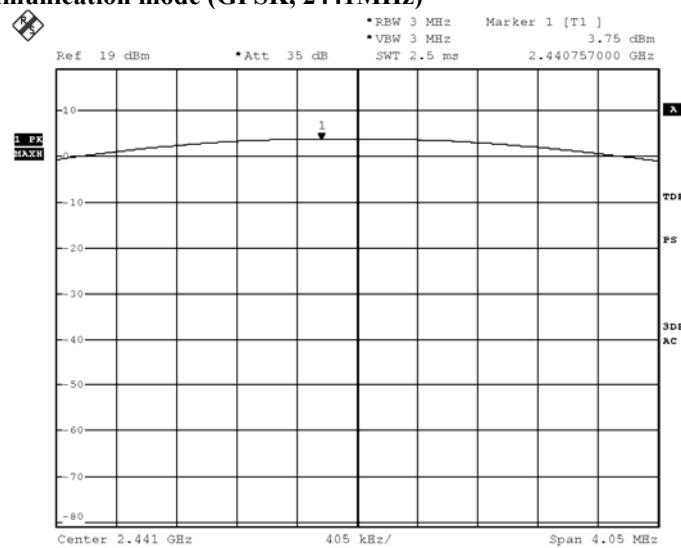
### **Test plot of Maximum Peak Conducted Output Power : Bluetooth Communication mode (GFSK, 2402MHz)**



BMP

Date: 28.MAR.2016 19:54:50

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



BMP

Date: 28.MAR.2016 19:54:29

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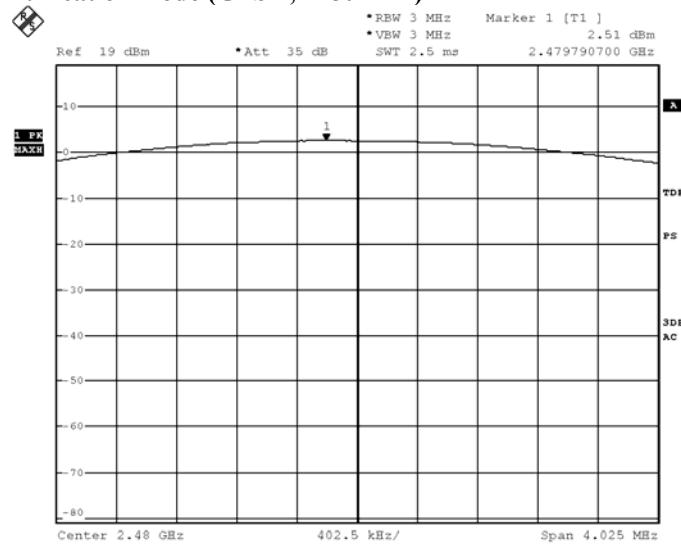
## STC Test Report

Date: 2016-04-05

Page 10 of 87

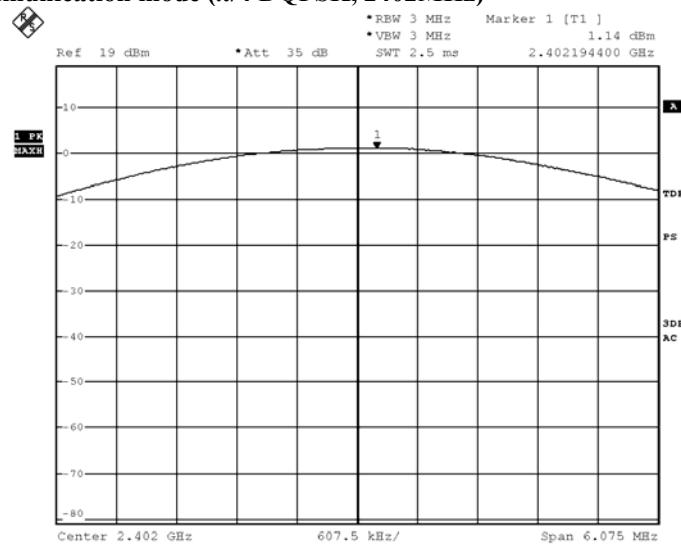
No.: MH192510

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



BMP  
Date: 28.MAR.2016 19:55:20

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



BMP  
Date: 28.MAR.2016 19:57:10

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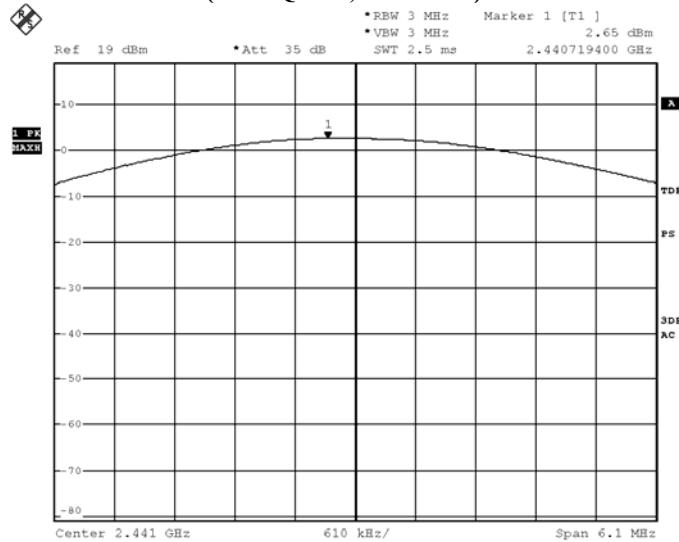
## STC Test Report

Date: 2016-04-05

Page 11 of 87

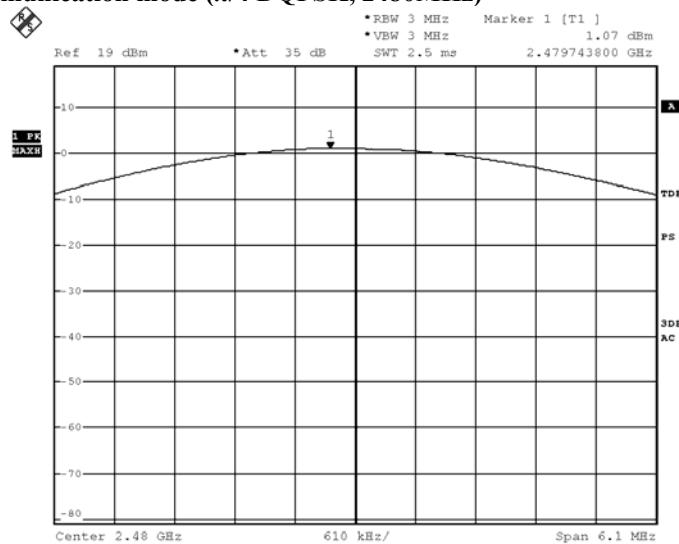
No.: MH192510

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



BMP  
Date: 28.MAR.2016 19:56:41

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



BMP  
Date: 28.MAR.2016 19:56:10

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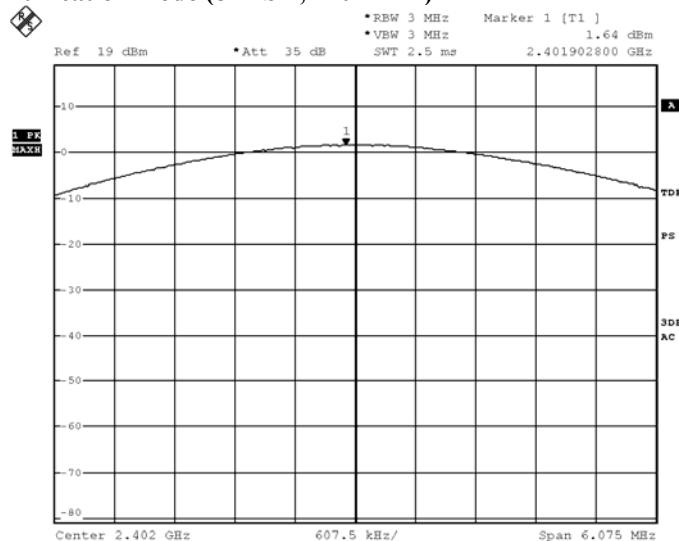
## STC Test Report

Date: 2016-04-05

Page 12 of 87

No.: MH192510

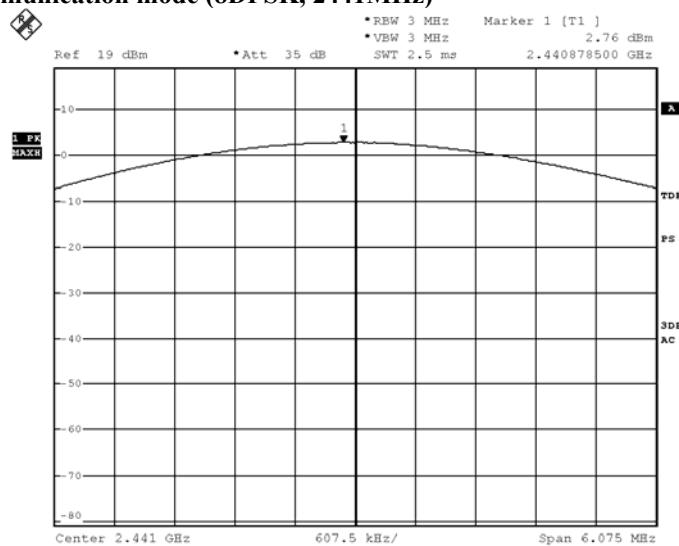
### Bluetooth Communication mode (8DPSK, 2402MHz)



BMP

Date: 28.MAR.2016 19:57:57

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



BMP

Date: 28.MAR.2016 19:58:41

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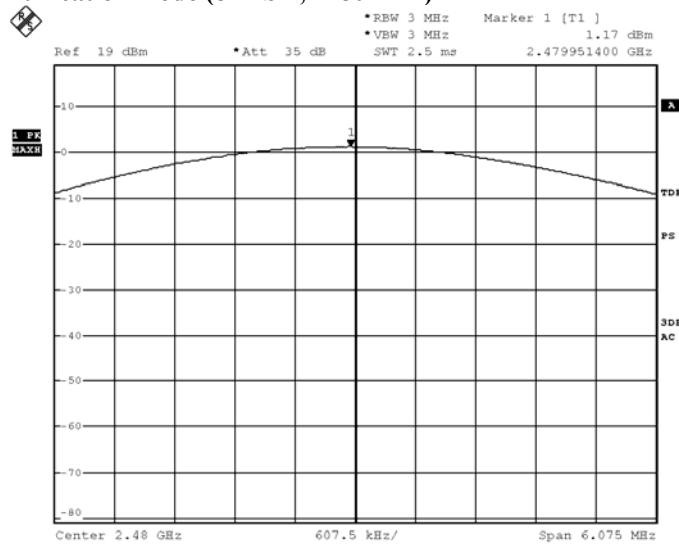
## STC Test Report

**Date: 2016-04-05**

**Page 13 of 87**

**No.: MH192510**

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



BMP

Date: 28.MAR.2016 19:59:14

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## **STC Test Report**

**Date: 2016-04-05**

**Page 14 of 87**

**No.: MH192510**

### **3.1.2 Radiated Spurious Emissions**

Test Requirement:	FCC 47CFR 15.209
Test Method:	ANSI C63.10: 2013
Test Date:	2016-03-31
Mode of Operation:	Tx mode / Bluetooth mode

#### **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, 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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## STC Test Report

**Date: 2016-04-05**

**No.: MH192510**

**Page 15 of 87**

### **Spectrum Analyzer Setting:**

9KHz – 30MHz (Pk & Av)

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

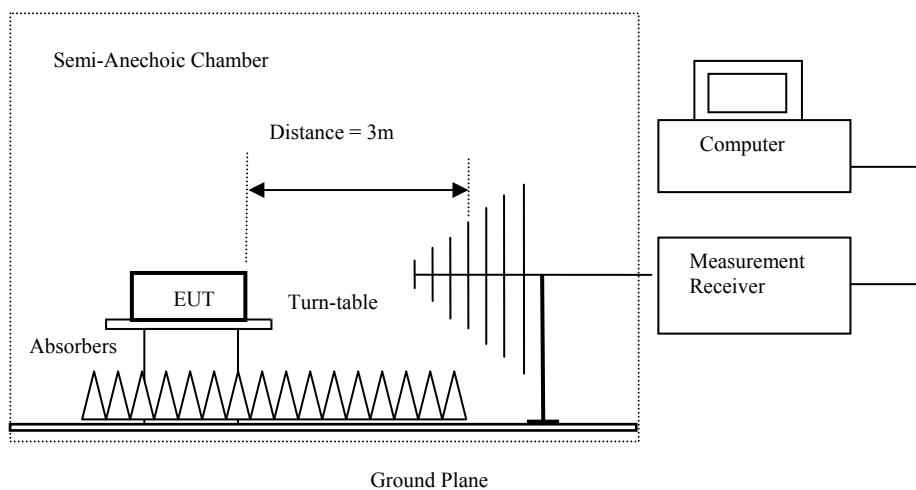
30MHz – 1GHz (QP)

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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## STC Test Report

**Date: 2016-04-05**

**Page 16 of 87**

**No.: MH192510**

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

Frequency Range [MHz]	Quasi-Peak Limits [ $\mu$ 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 dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Field Strength uV/m	Limit uV/m	E-Field Polarity
<b>Emissions detected are more than 20 dB below the FCC Limits</b>						

### **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	15.6	41.5	57.1	74.0	16.9	Vertical
4804.0	13.0	42.4	55.4	74.0	18.6	Horizontal
7206.0	9.0	45.1	54.1	74.0	19.9	Vertical
7206.0	8.5	46.2	54.7	74.0	19.3	Horizontal
9608.0	7.2	48.0	55.2	74.0	18.8	Vertical
9608.0	6.2	48.8	55.0	74.0	19.0	Horizontal
12010.0	4.2	51.8	56.0	74.0	18.0	Vertical
12010.0	3.5	52.4	55.9	74.0	18.1	Horizontal

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## STC Test Report

**Date: 2016-04-05**

**Page 17 of 87**

**No.: MH192510**

**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	-0.3	41.5	41.2	54.0	12.8	Vertical
4804.0	-3.1	42.4	39.3	54.0	14.7	Horizontal
7206.0	-5.0	45.1	40.1	54.0	13.9	Vertical
7206.0	-6.5	46.2	39.7	54.0	14.3	Horizontal
9608.0	-8.3	48.0	39.7	54.0	14.3	Vertical
9608.0	-8.5	48.8	40.3	54.0	13.7	Horizontal
12010.0	-11.9	51.8	39.9	54.0	14.1	Vertical
12010.0	-11.5	52.4	40.9	54.0	13.1	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						

**Result of Tx mode (2441.0 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
4882.0	15.2	41.6	56.8	74.0	17.2	Vertical
4882.0	13.4	42.5	55.9	74.0	18.1	Horizontal
7323.0	1.1	53.2	54.3	74.0	19.7	Vertical
7323.0	8.6	46.3	54.9	74.0	19.1	Horizontal
9764.0	6.6	48.1	54.7	74.0	19.3	Vertical
9764.0	6.3	48.9	55.2	74.0	18.8	Horizontal
12205.0	4.3	51.6	55.9	74.0	18.1	Vertical
12205.0	3.2	52.5	55.7	74.0	18.3	Horizontal

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## STC Test Report

**Date: 2016-04-05**

**Page 18 of 87**

**No.: MH192510**

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

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4882.0	-0.6	41.6	41.0	54.0	13.0	Vertical
4882.0	-2.5	42.5	40.0	54.0	14.0	Horizontal
7323.0	-6.1	45.2	39.1	54.0	14.9	Vertical
7323.0	-6.3	46.3	40.0	54.0	14.0	Horizontal
9764.0	-9.2	48.1	38.9	54.0	15.1	Vertical
9764.0	-9.8	48.9	39.1	54.0	14.9	Horizontal
12205.0	-11.5	51.6	40.1	54.0	13.9	Vertical
12205.0	-12.2	52.5	40.3	54.0	13.7	Horizontal

**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						

**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	15.6	41.4	57.0	74.0	17.0	Vertical
4960.0	13.3	42.7	56.0	74.0	18.0	Horizontal
7440.0	8.9	45.6	54.5	74.0	19.5	Vertical
7440.0	8.5	46.5	55.0	74.0	19.0	Horizontal
9920.0	6.6	48.6	55.2	74.0	18.8	Vertical
9920.0	4.3	49.7	54.0	74.0	20.0	Horizontal
12400.0	3.9	51.7	55.6	74.0	18.4	Vertical
12400.0	3.3	52.7	56.0	74.0	18.0	Horizontal

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## STC Test Report

**Date: 2016-04-05**

**Page 19 of 87**

**No.: MH192510**

**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	0.0	41.4	41.4	54.0	12.6	Vertical
4960.0	-3.1	42.7	39.6	54.0	14.4	Horizontal
7440.0	-6.7	45.6	38.9	54.0	15.1	Vertical
7440.0	-7.2	46.5	39.3	54.0	14.7	Horizontal
9920.0	-9.4	48.6	39.2	54.0	14.8	Vertical
9920.0	-9.7	49.7	40.0	54.0	14.0	Horizontal
12400.0	-12.0	51.7	39.7	54.0	14.3	Vertical
12400.0	-12.0	52.7	40.7	54.0	13.3	Horizontal

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

Field Strength of Spurious Emissions						
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) (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	15.4	41.5	56.9	74.0	17.1	Vertical
4804.0	13.4	42.4	55.8	74.0	18.2	Horizontal
7206.0	9.8	45.1	54.9	74.0	19.1	Vertical
7206.0	8.3	46.2	54.5	74.0	19.5	Horizontal
9608.0	6.9	48.0	54.9	74.0	19.1	Vertical
9608.0	6.4	48.8	55.2	74.0	18.8	Horizontal
12010.0	4.1	51.8	55.9	74.0	18.1	Vertical
12010.0	3.7	52.4	56.1	74.0	17.9	Horizontal

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## STC Test Report

**Date: 2016-04-05**

**Page 20 of 87**

**No.: MH192510**

**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 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	-0.3	41.5	41.2	54.0	12.8	Vertical
4804.0	-2.9	42.4	39.5	54.0	14.5	Horizontal
7206.0	-4.7	45.1	40.4	54.0	13.6	Vertical
7206.0	-6.8	46.2	39.4	54.0	14.6	Horizontal
9608.0	-9.7	48.0	38.3	54.0	15.7	Vertical
9608.0	-8.4	48.8	40.4	54.0	13.6	Horizontal
12010.0	-11.8	51.8	40.0	54.0	14.0	Vertical
12010.0	-11.8	52.4	40.6	54.0	13.4	Horizontal

**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 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						

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

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level @3m dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB $\mu$ V/m	E-Field Polarity
4882.0	15.6	41.6	57.2	74.0	16.8	Vertical
4882.0	13.4	42.5	55.9	74.0	18.1	Horizontal
7323.0	1.1	53.2	54.3	74.0	19.7	Vertical
7323.0	8.9	46.3	55.2	74.0	18.8	Horizontal
9764.0	6.8	48.1	54.9	74.0	19.1	Vertical
9764.0	6.3	48.9	55.2	74.0	18.8	Horizontal
12205.0	4.5	51.6	56.1	74.0	17.9	Vertical
12205.0	3.2	52.5	55.7	74.0	18.3	Horizontal

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## STC Test Report

**Date: 2016-04-05**

**Page 21 of 87**

**No.: MH192510**

**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	-0.5	41.6	41.1	54.0	12.9	Vertical
4882.0	-2.4	42.5	40.1	54.0	13.9	Horizontal
7323.0	-6.3	45.2	38.9	54.0	15.1	Vertical
7323.0	-6.9	46.3	39.4	54.0	14.6	Horizontal
9764.0	-8.6	48.1	39.5	54.0	14.5	Vertical
9764.0	-8.8	48.9	40.1	54.0	13.9	Horizontal
12205.0	-11.1	51.6	40.5	54.0	13.5	Vertical
12205.0	-12.3	52.5	40.2	54.0	13.8	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						

**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	15.3	41.4	56.7	74.0	17.3	Vertical
4960.0	13.0	42.7	55.7	74.0	18.3	Horizontal
7440.0	9.3	45.6	54.9	74.0	19.1	Vertical
7440.0	8.2	46.5	54.7	74.0	19.3	Horizontal
9920.0	7.1	48.6	55.7	74.0	18.3	Vertical
9920.0	5.6	49.7	55.3	74.0	18.7	Horizontal
12400.0	4.2	51.7	55.9	74.0	18.1	Vertical
12400.0	3.4	52.7	56.1	74.0	17.9	Horizontal

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## STC Test Report

Date: 2016-04-05

Page 22 of 87

No.: MH192510

**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	-0.8	41.4	40.6	54.0	13.4	Vertical
4960.0	-3.3	42.7	39.4	54.0	14.6	Horizontal
7440.0	-6.7	45.6	38.9	54.0	15.1	Vertical
7440.0	-7.5	46.5	39.0	54.0	15.0	Horizontal
9920.0	-9.2	48.6	39.4	54.0	14.6	Vertical
9920.0	-9.1	49.7	40.6	54.0	13.4	Horizontal
12400.0	-11.9	51.7	39.8	54.0	14.2	Vertical
12400.0	-12.2	52.7	40.5	54.0	13.5	Horizontal

**Result of Tx mode (2402.0 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						

**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	15.4	41.5	56.9	74.0	17.1	Vertical
4804.0	12.9	42.4	55.3	74.0	18.7	Horizontal
7206.0	9.8	45.1	54.9	74.0	19.1	Vertical
7206.0	8.9	46.2	55.1	74.0	18.9	Horizontal
9608.0	6.8	48.0	54.8	74.0	19.2	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	3.7	52.4	56.1	74.0	17.9	Horizontal

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## STC Test Report

**Date: 2016-04-05**

**Page 23 of 87**

**No.: MH192510**

**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	-1.4	41.5	40.1	54.0	13.9	Vertical
4804.0	-3.2	42.4	39.2	54.0	14.8	Horizontal
7206.0	-5.9	45.1	39.2	54.0	14.8	Vertical
7206.0	-6.9	46.2	39.3	54.0	14.7	Horizontal
9608.0	-8.4	48.0	39.6	54.0	14.4	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	-11.8	52.4	40.6	54.0	13.4	Horizontal

**Result of Tx mode (2441.0 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						

**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	15.4	41.6	57.0	74.0	17.0	Vertical
4882.0	13.4	42.5	55.9	74.0	18.1	Horizontal
7323.0	1.6	53.2	54.8	74.0	19.2	Vertical
7323.0	8.7	46.3	55.0	74.0	19.0	Horizontal
9764.0	7.3	48.1	55.4	74.0	18.6	Vertical
9764.0	6.3	48.9	55.2	74.0	18.8	Horizontal
12205.0	4.4	51.6	56.0	74.0	18.0	Vertical
12205.0	3.4	52.5	55.9	74.0	18.1	Horizontal

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## STC Test Report

Date: 2016-04-05

Page 24 of 87

No.: MH192510

**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	-0.9	41.6	40.7	54.0	13.3	Vertical
4882.0	-3.2	42.5	39.3	54.0	14.7	Horizontal
7323.0	-6.1	45.2	39.1	54.0	14.9	Vertical
7323.0	-7.4	46.3	38.9	54.0	15.1	Horizontal
9764.0	-9	48.1	39.1	54.0	14.9	Vertical
9764.0	-9.6	48.9	39.3	54.0	14.7	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

**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						

**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	13.3	42.7	56.0	74.0	18.0	Horizontal
7440.0	9.3	45.6	54.9	74.0	19.1	Vertical
7440.0	8.5	46.5	55.0	74.0	19.0	Horizontal
9920.0	6.3	48.6	54.9	74.0	19.1	Vertical
9920.0	5.9	49.7	55.6	74.0	18.4	Horizontal
12400.0	4.1	51.7	55.8	74.0	18.2	Vertical
12400.0	3.4	52.7	56.1	74.0	17.9	Horizontal

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## STC Test Report

**Date: 2016-04-05**

**Page 25 of 87**

**No.: MH192510**

**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	-0.3	41.4	41.1	54.0	12.9	Vertical
4960.0	-3.4	42.7	39.3	54.0	14.7	Horizontal
7440.0	-6.9	45.6	38.7	54.0	15.3	Vertical
7440.0	-6.3	46.5	40.2	54.0	13.8	Horizontal
9920.0	-9.5	48.6	39.1	54.0	14.9	Vertical
9920.0	-9.7	49.7	40.0	54.0	14.0	Horizontal
12400.0	-11.6	51.7	40.1	54.0	13.9	Vertical
12400.0	-13.6	52.7	39.1	54.0	14.9	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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## STC Test Report

**Date: 2016-04-05**

**Page 26 of 87**

**No.: MH192510**

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

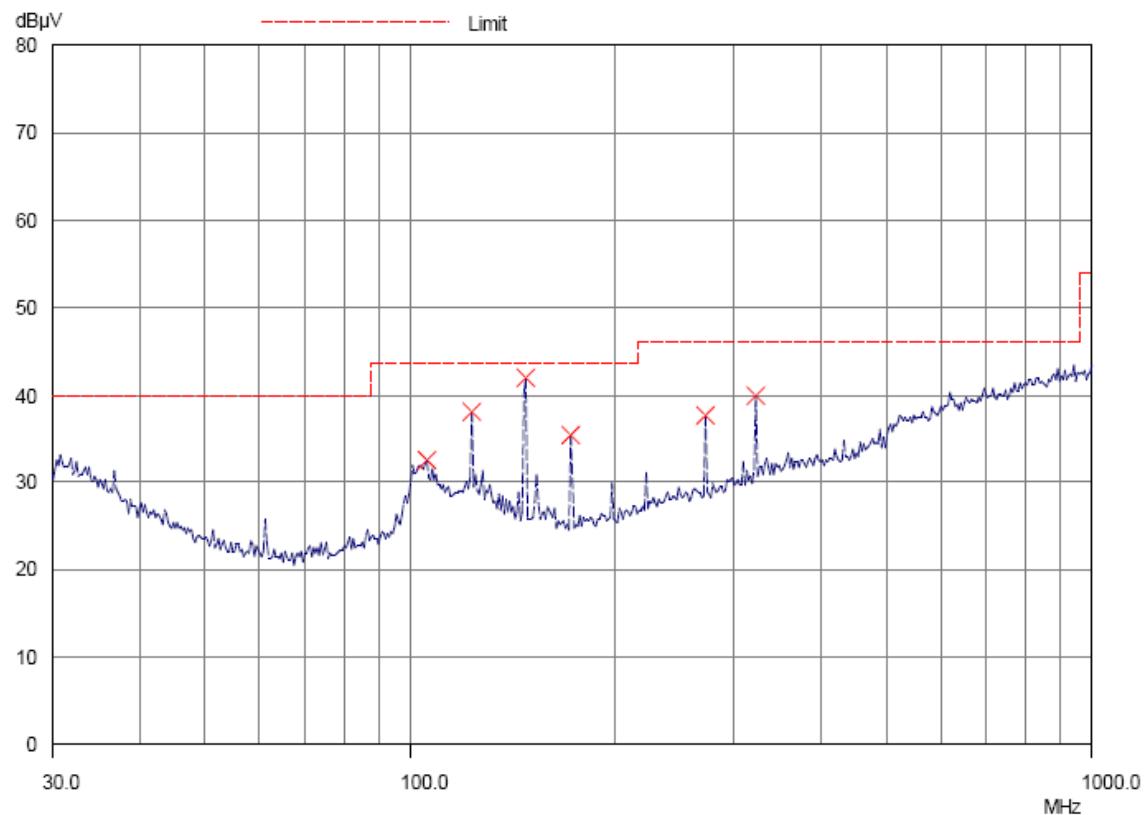
Frequency Range [MHz]	Quasi-Peak Limits [ $\mu$ V/m]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above 960	500

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 (2402MHz, GFSK) (30MHz – 1GHz): Pass**

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

Horizontal



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## **STC Test Report**

**Date: 2016-04-05**

**Page 27 of 87**

**No.: MH192510**

**Result of TX mode (2402MHz, GFSK) (30MHz – 1GHz): Pass**

<b>Radiated Emissions Quasi-Peak</b>					
<b>Emission Frequency MHz</b>	<b>E-Field Polarity</b>	<b>Level @3m dB<math>\mu</math>V/m</b>	<b>Limit @3m dB<math>\mu</math>V/m</b>	<b>Level @3m <math>\mu</math>V/m</b>	<b>Limit @3m <math>\mu</math>V/m</b>
106.0	Horizontal	32.6	43.5	42.7	150
122.9	Horizontal	40.5	43.5	105.9	150
147.5	Horizontal	42.5	43.5	133.4	150
172.1	Horizontal	35.3	43.5	58.2	150
270.4	Horizontal	37.7	46.0	76.7	200
319.5	Horizontal	39.9	46.0	98.9	200.0

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## STC Test Report

**Date: 2016-04-05**

**Page 28 of 87**

**No.: MH192510**

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

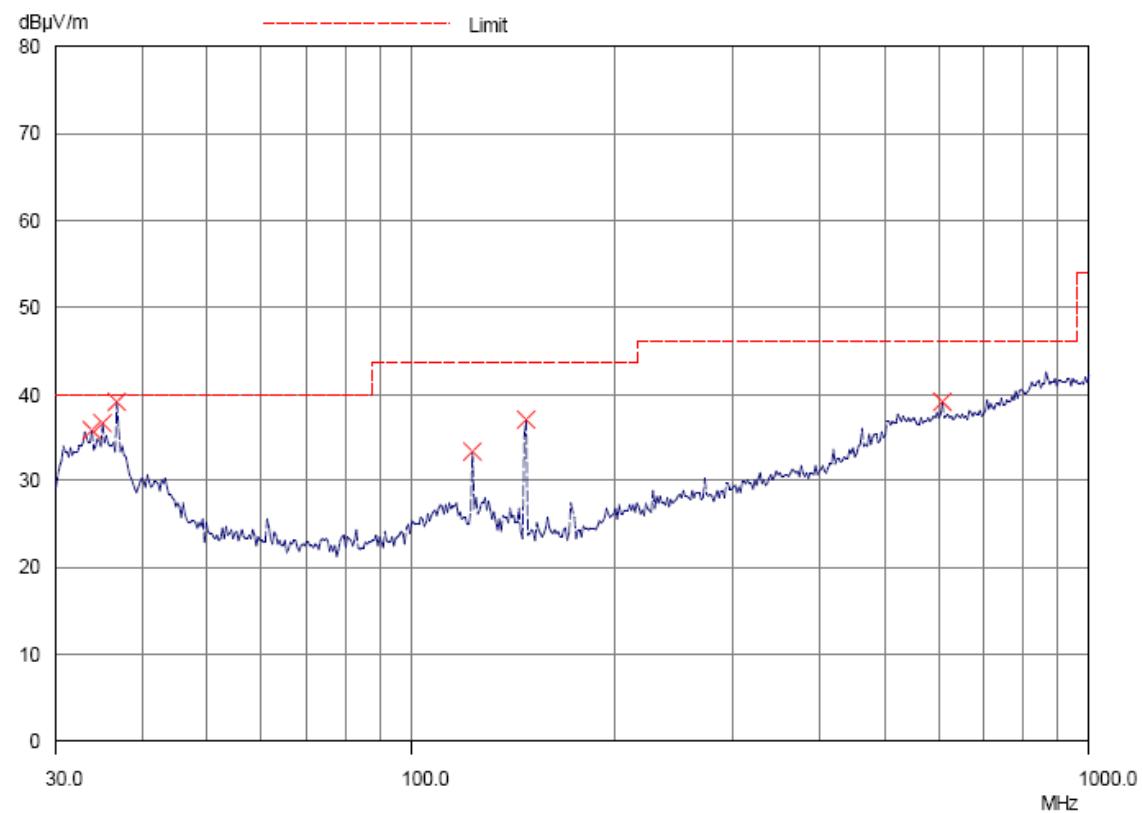
Frequency Range [MHz]	Quasi-Peak Limits [ $\mu$ V/m]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above 960	500

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 (2402MHz, GFSK) (30MHz – 1GHz): Pass**

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

Vertical



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## **STC Test Report**

**Date: 2016-04-05**

**Page 29 of 87**

**No.: MH192510**

**Result of TX mode (2402MHz, GFSK) (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
33.8	Vertical	35.7	40.0	61.0	100
34.9	Vertical	36.0	40.0	63.1	100
36.9	Vertical	38.2	40.0	81.3	100
122.9	Vertical	33.3	43.5	46.2	150
147.5	Vertical	37.0	43.5	70.8	150
604.7	Vertical	39.0	46.0	89.1	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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**Page 30 of 87**

**No.: MH192510**

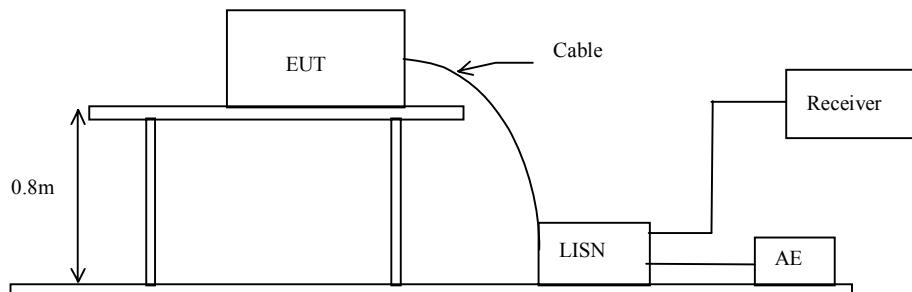
### **3.1.3 AC Mains Conducted Emissions (0.15MHz to 30MHz)**

Test Requirement:	FCC 47CFR 15.207
Test Method:	ANSI C63.10: 2013
Test Date:	2016-03-29
Mode of Operation:	Bluetooth mode
Test Voltage:	120V a.c. 60Hz

#### **Test Method:**

The test was performed in accordance with ANSI C63.10: 2013, 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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## STC Test Report

Date: 2016-04-05

Page 31 of 87

No.: MH192510

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

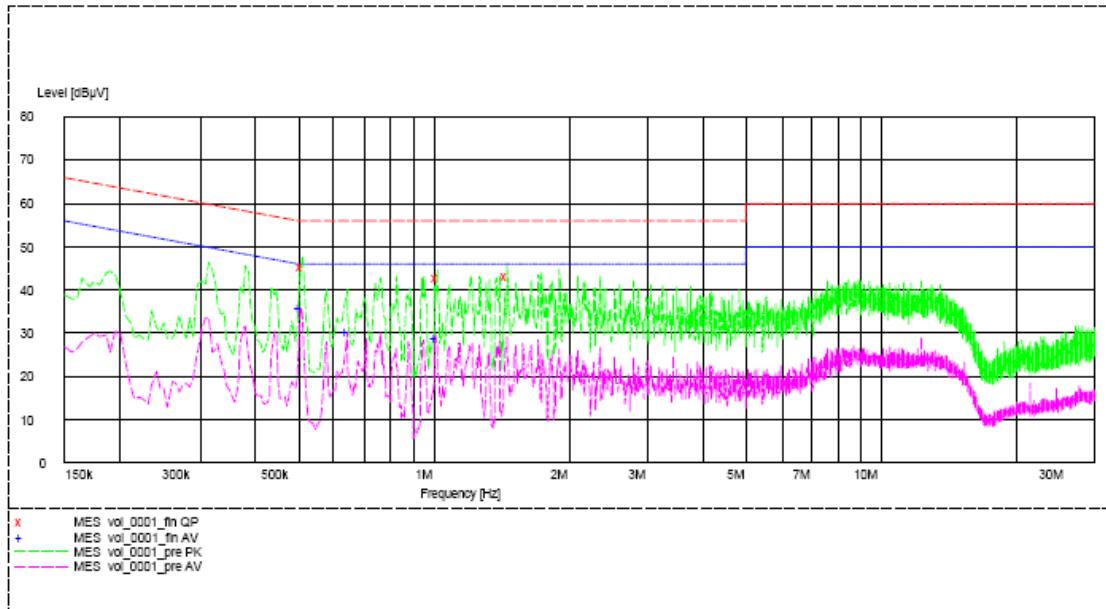
Frequency Range [MHz]	Quasi-Peak Limits [dB $\mu$ V]	Average [dB $\mu$ V]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

\* 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 mode (L): PASS

Please refer to the following diagram for individual results.



Conductor Live or Neutral	Frequency MHz	Quasi-peak		Average	
		Level dB $\mu$ V	Limit dB $\mu$ V	Level dB $\mu$ V	Limit dB $\mu$ V
Live	0.510	45.5	56.0	-*-	-*-
Live	1.020	42.7	56.0	-*-	-*-
Live	1.465	43.1	56.0	-*-	-*-
Live	0.505	-*-	-*-	35.9	46.0
Live	0.640	-*-	-*-	30.4	46.0
Live	1.010	-*-	-*-	28.8	46.0

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## STC Test Report

Date: 2016-04-05

Page 32 of 87

No.: MH192510

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

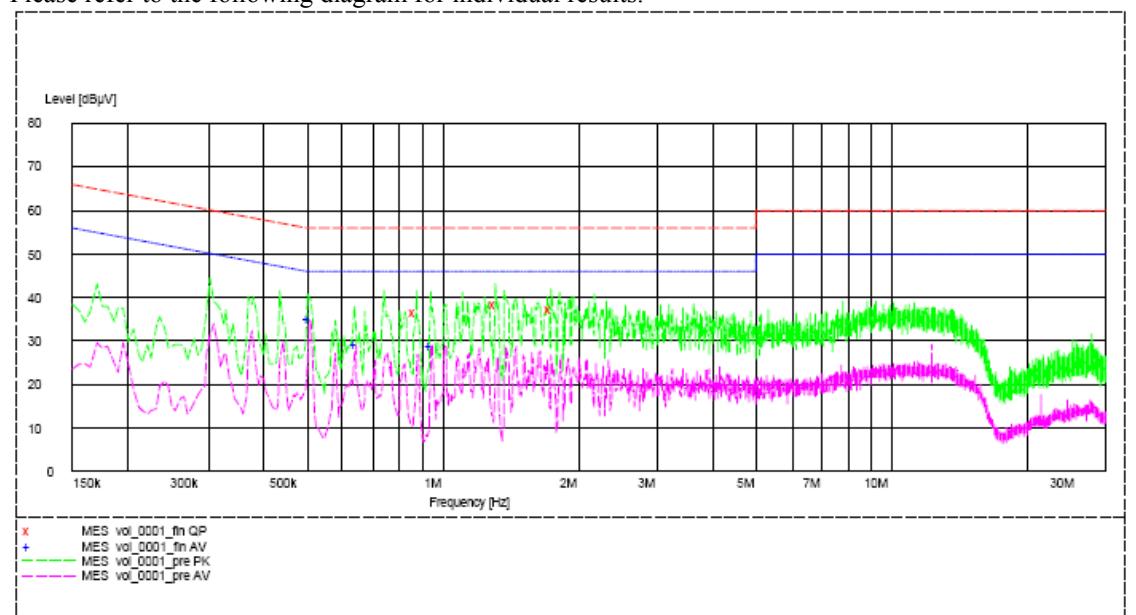
Frequency Range [MHz]	Quasi-Peak Limits [dB $\mu$ V]	Average [dB $\mu$ V]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

\* 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 mode (N): PASS

Please refer to the following diagram for individual results.



Conductor Live or Neutral	Frequency MHz	Quasi-peak		Average	
		Level dB $\mu$ V	Limit dB $\mu$ V	Level dB $\mu$ V	Limit dB $\mu$ V
Neutral	0.875	36.9	56.0	-*-	-*-
Neutral	1.310	38.2	56.0	-*-	-*-
Neutral	1.750	37.6	56.0	-*-	-*-
Neutral	0.505	-*-	-*-	35.3	46.0
Neutral	0.640	-*-	-*-	29.2	46.0
Neutral	0.945	-*-	-*-	28.8	46.0

Remarks:

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

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

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## STC Test Report

**Date: 2016-04-05**

**Page 33 of 87**

**No.: MH192510**

### **3.1.4 Number of Hopping Frequency**

#### **Limit of Number of Hopping Frequency**

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

#### **Test Method:**

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

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

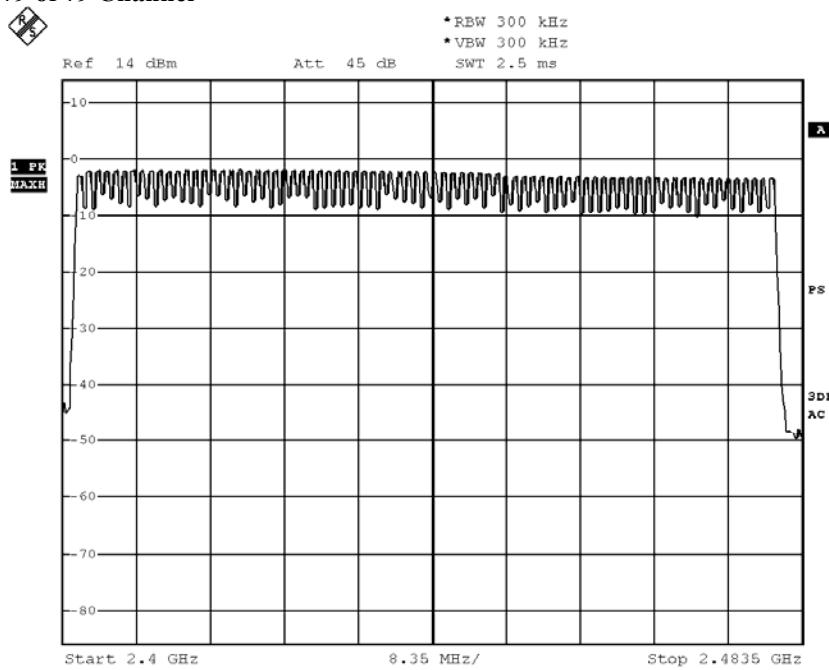
RBW = 1MHz, VBW  $\geq$  RBW, Sweep = Auto, Span = the frequency band of operation  
Detector = Peak, Trace = Max. hold

#### **Test Setup:**

As Test Setup of clause 3.1.1 in this test report.

#### **Measurement Data:**

#### **GFSK: 79 of 79 Channel**



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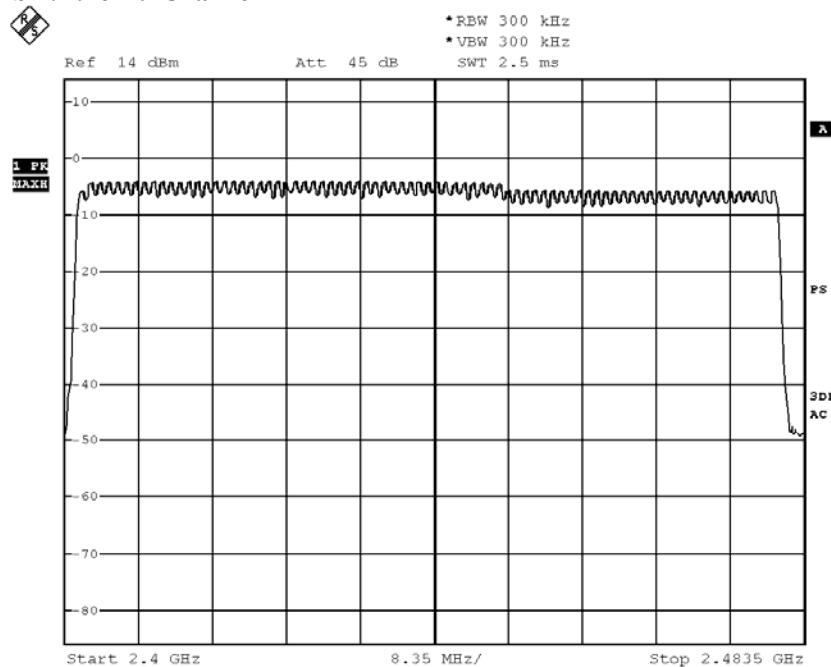
## STC Test Report

**Date: 2016-04-05**

**Page 34 of 87**

**No.: MH192510**

**$\pi/4$  DQPSK: 79 of 79 Channel**



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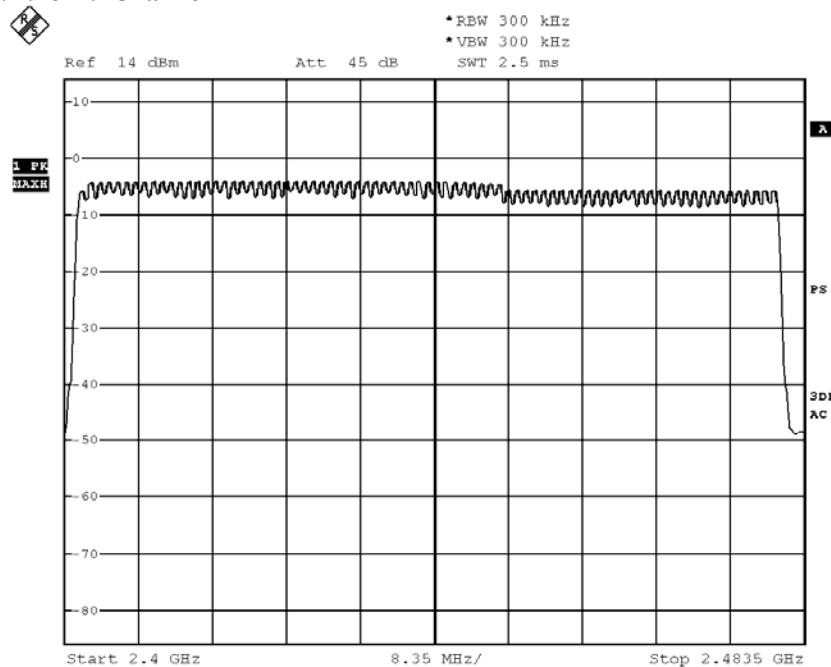
## STC Test Report

**Date: 2016-04-05**

**Page 35 of 87**

**No.: MH192510**

**8DPSK: 79 of 79 Channel**



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## **STC Test Report**

**Date: 2016-04-05**

**Page 36 of 87**

**No.: MH192510**

### **3.1.5 20dB Bandwidth**

Test Requirement:	FCC 47CFR 15.247(a)(1)
Test Method:	ANSI C63.10: 2013
Test Date:	2016-03-28
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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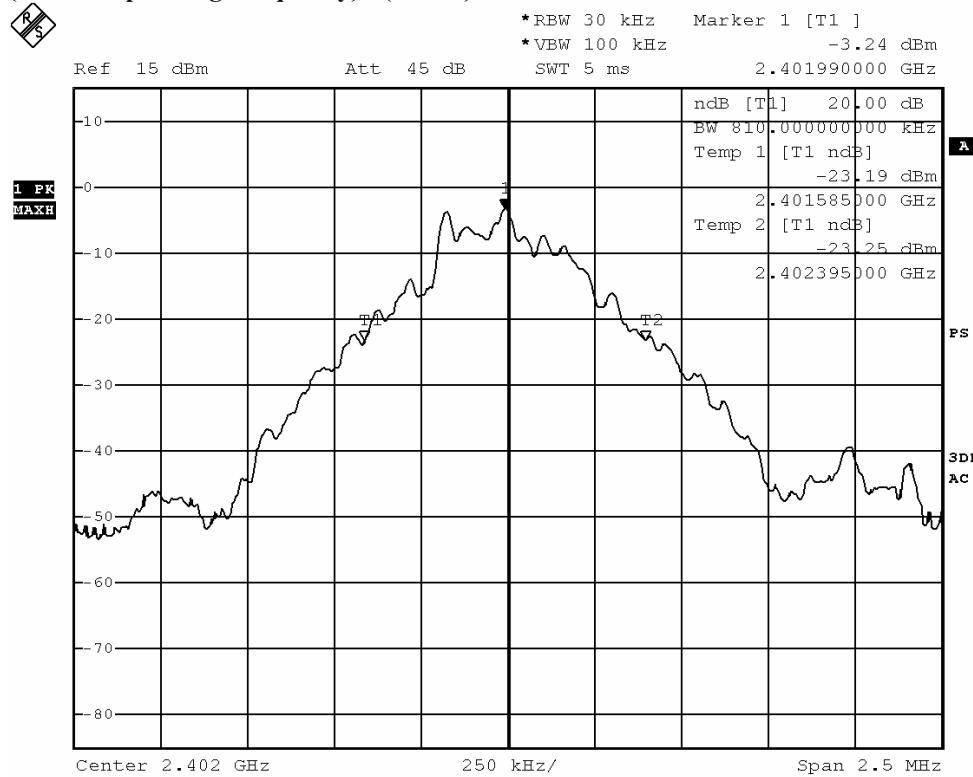
Date: 2016-04-05

Page 37 of 87

No.: MH192510

Fundamental Frequency [MHz]	20dB Bandwidth [kHz]	FCC Limits [MHz]
2402	810.0	Within 2400-2483.5

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



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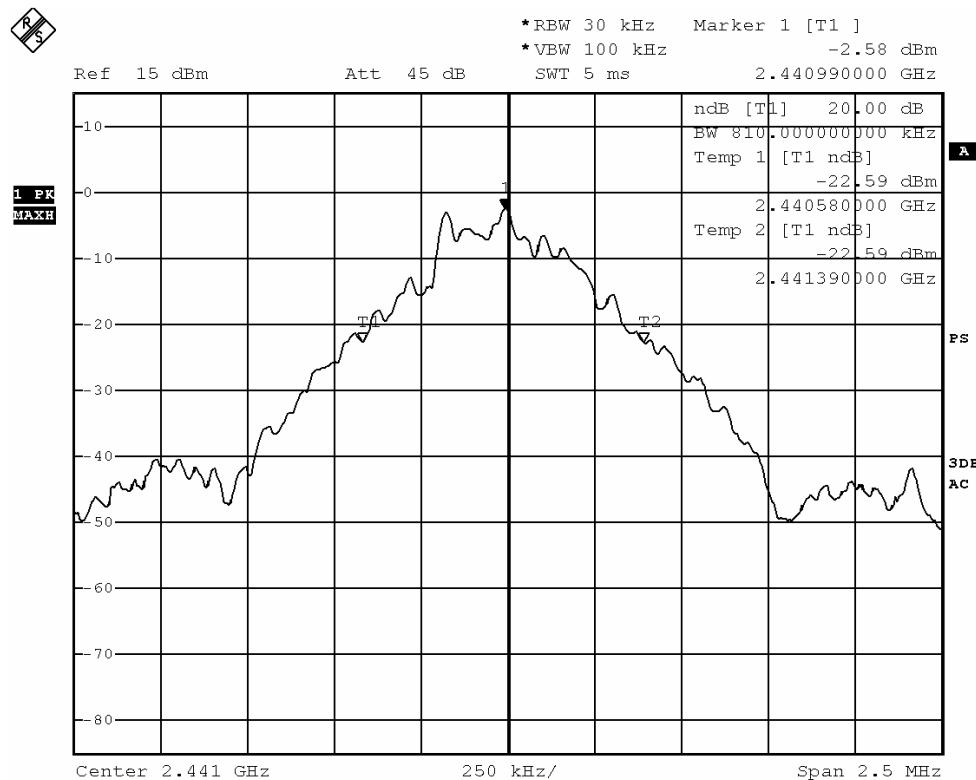
**Date: 2016-04-05**

**Page 38 of 87**

**No.: MH192510**

Fundamental Frequency [MHz]	20dB Bandwidth [kHz]	FCC Limits [MHz]
2441	810.0	Within 2400-2483.5

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



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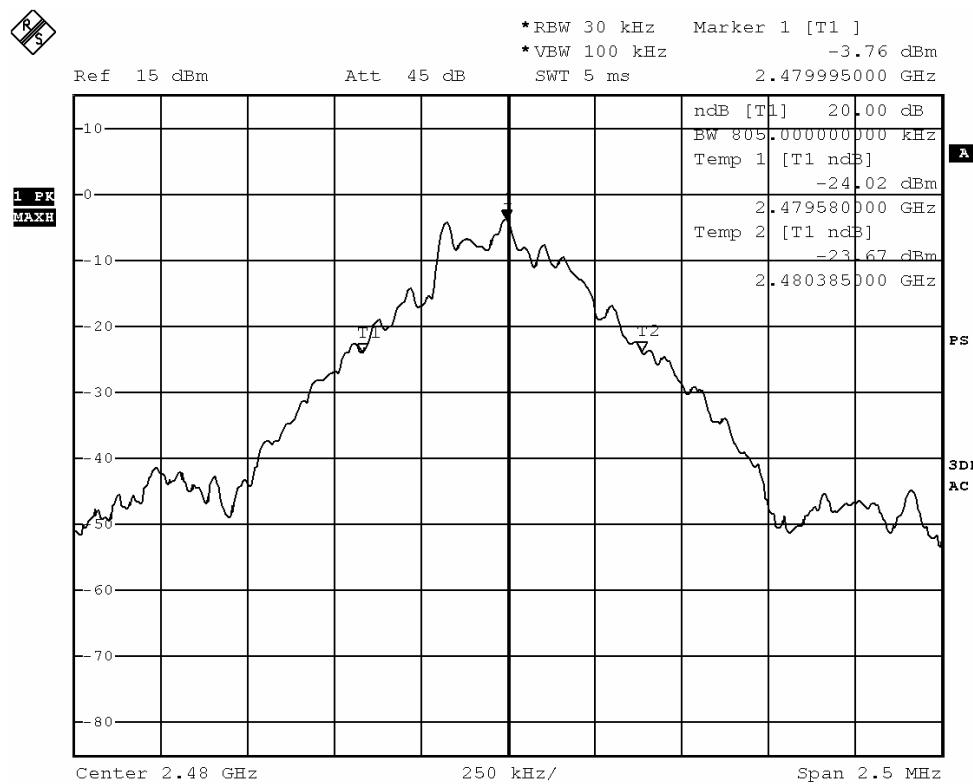
**Date: 2016-04-05**

**Page 39 of 87**

**No.: MH192510**

Fundamental Frequency [MHz]	20dB Bandwidth [kHz]	FCC Limits [MHz]
2480	805.0	Within 2400-2483.5

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



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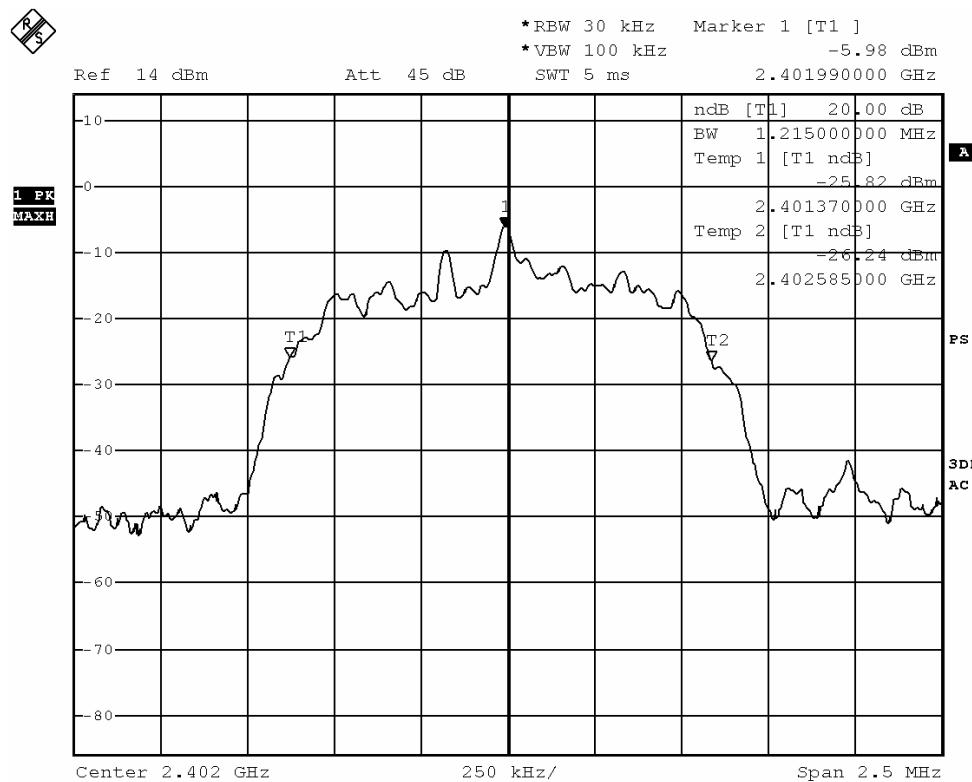
Date: 2016-04-05

Page 40 of 87

No.: MH192510

Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	1.215	Within 2400-2483.5

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



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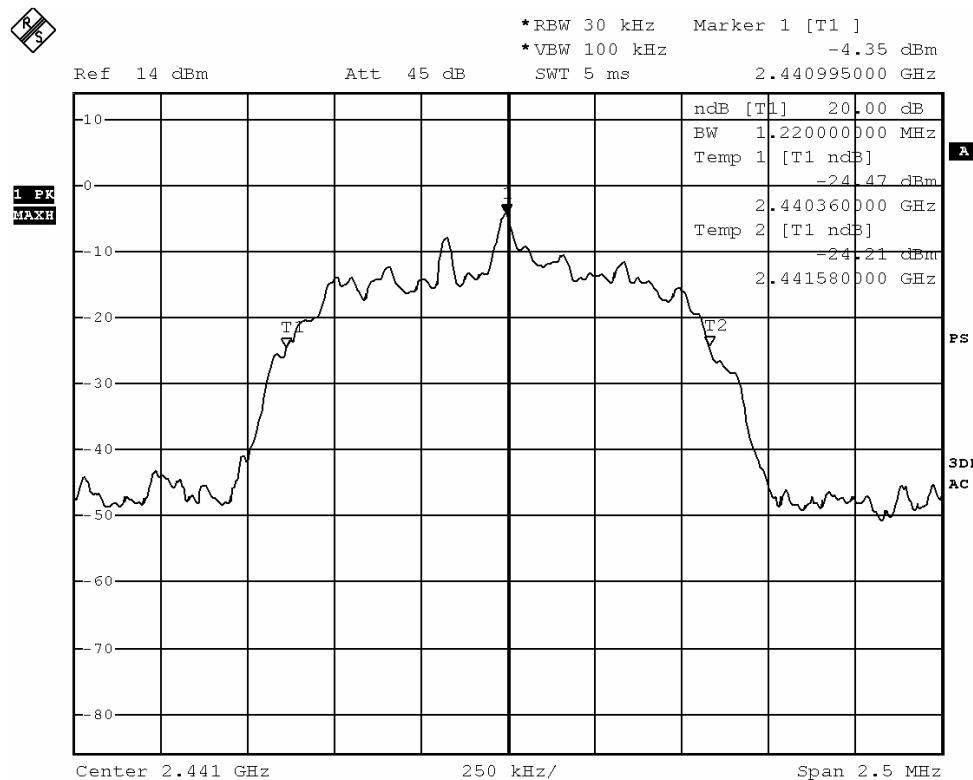
Date: 2016-04-05

Page 41 of 87

No.: MH192510

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

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



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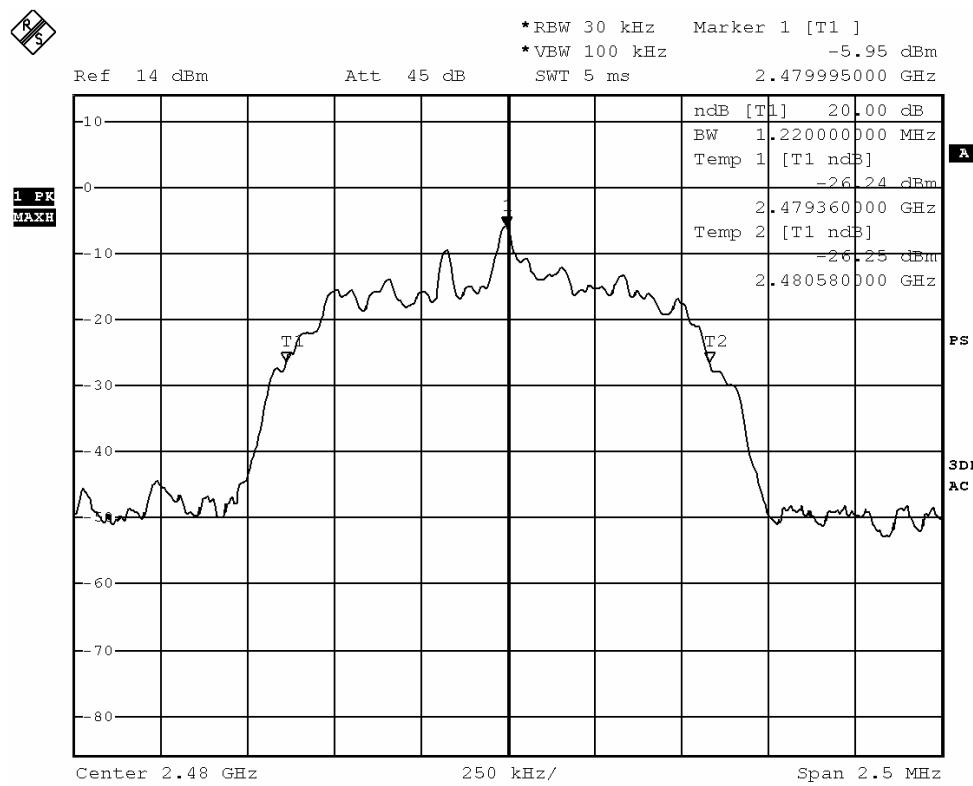
Date: 2016-04-05

Page 42 of 87

No.: MH192510

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

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



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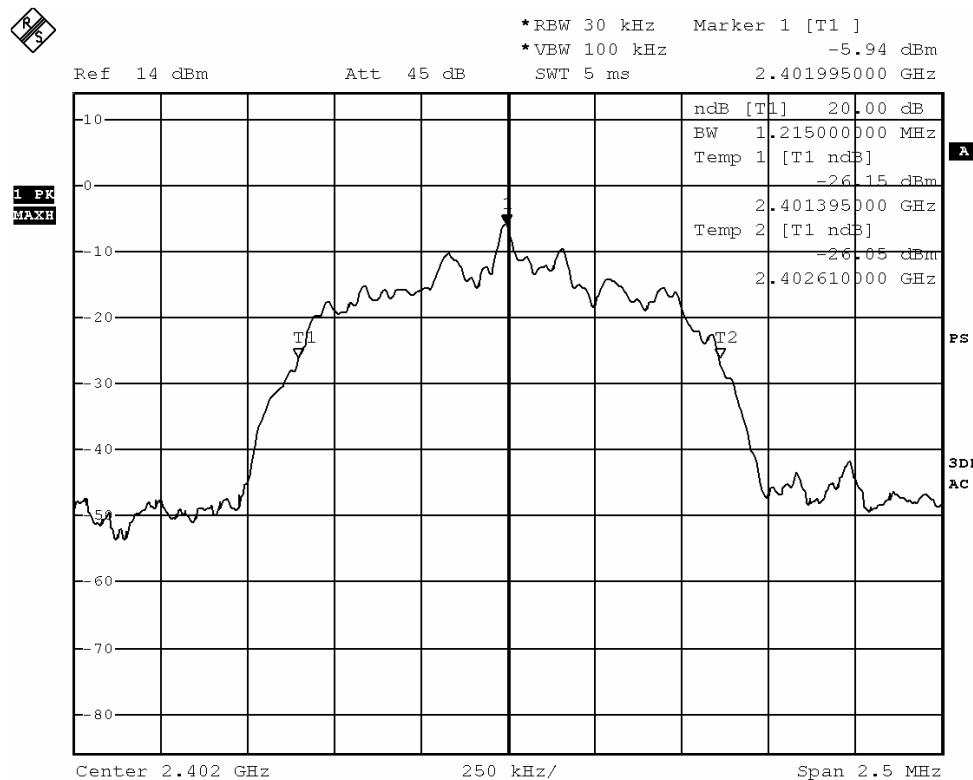
Date: 2016-04-05

Page 43 of 87

No.: MH192510

Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	1.215	Within 2400-2483.5

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



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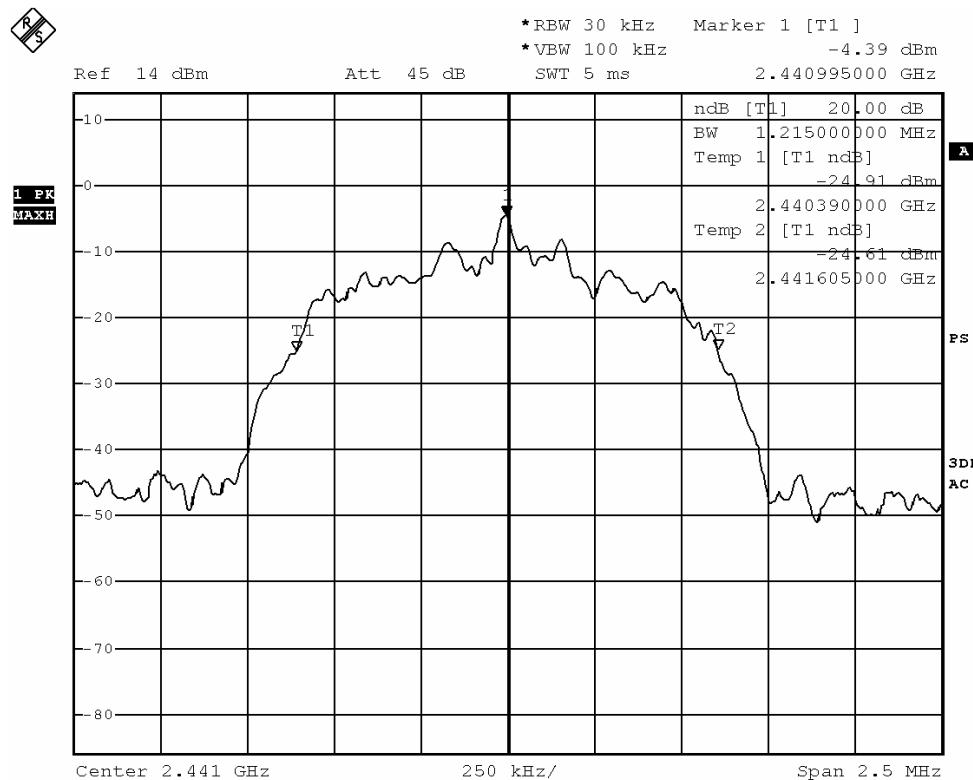
Date: 2016-04-05

Page 44 of 87

No.: MH192510

Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2441	1.215	Within 2400-2483.5

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



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## STC Test Report

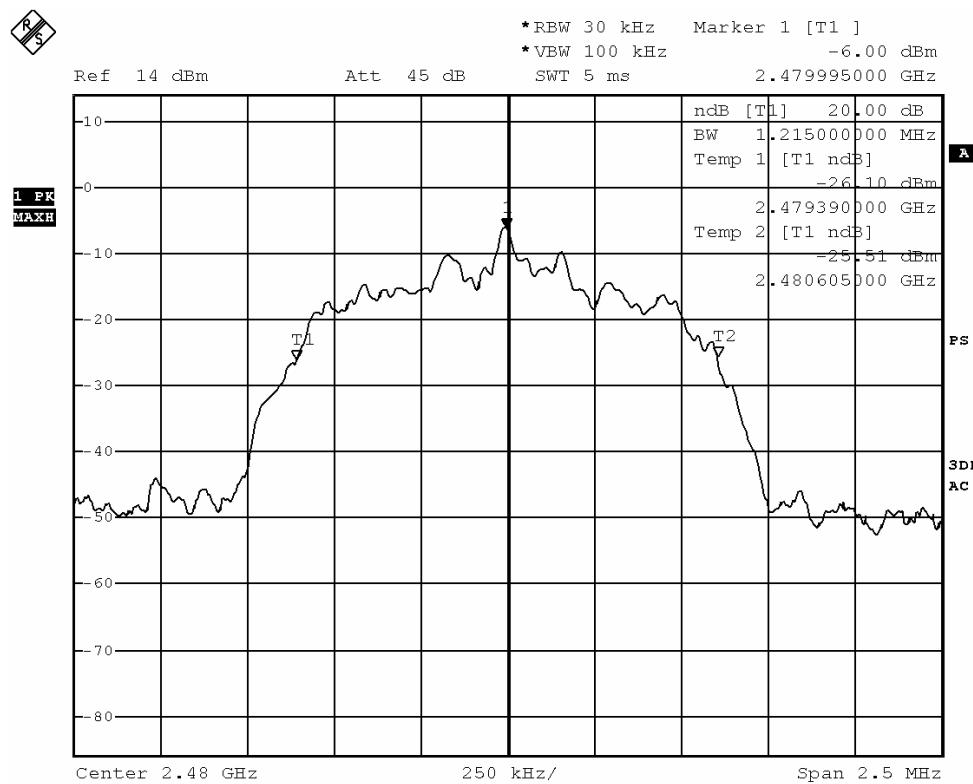
**Date: 2016-04-05**

**Page 45 of 87**

**No.: MH192510**

Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2480	1.215	Within 2400-2483.5

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



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## **STC Test Report**

**Date: 2016-04-05**

**Page 46 of 87**

**No.: MH192510**

### **3.1.6 Hopping Channel Separation**

#### **Requirements:**

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

#### **Limit:**

The measured maximum bandwidth \* 2/3 = 1.22MHz \* 2/3 = 813.3kHz

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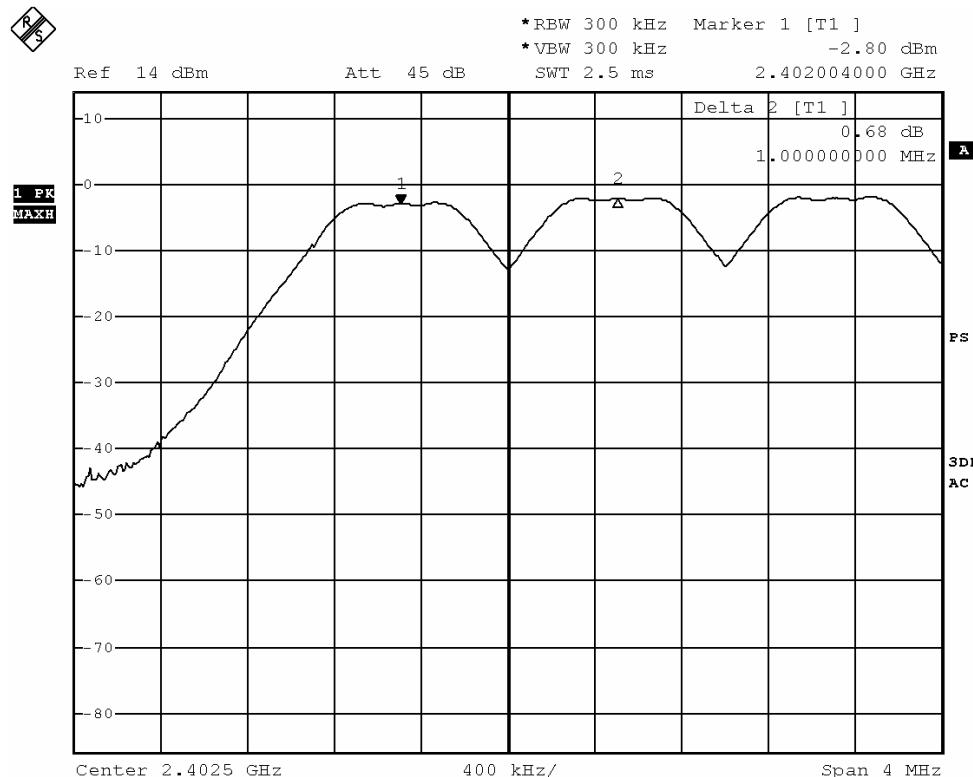
## STC Test Report

Date: 2016-04-05

Page 47 of 87

No.: MH192510

Channel separation = 1MHz (>813.3kHz) (Lowest) (GFSK)



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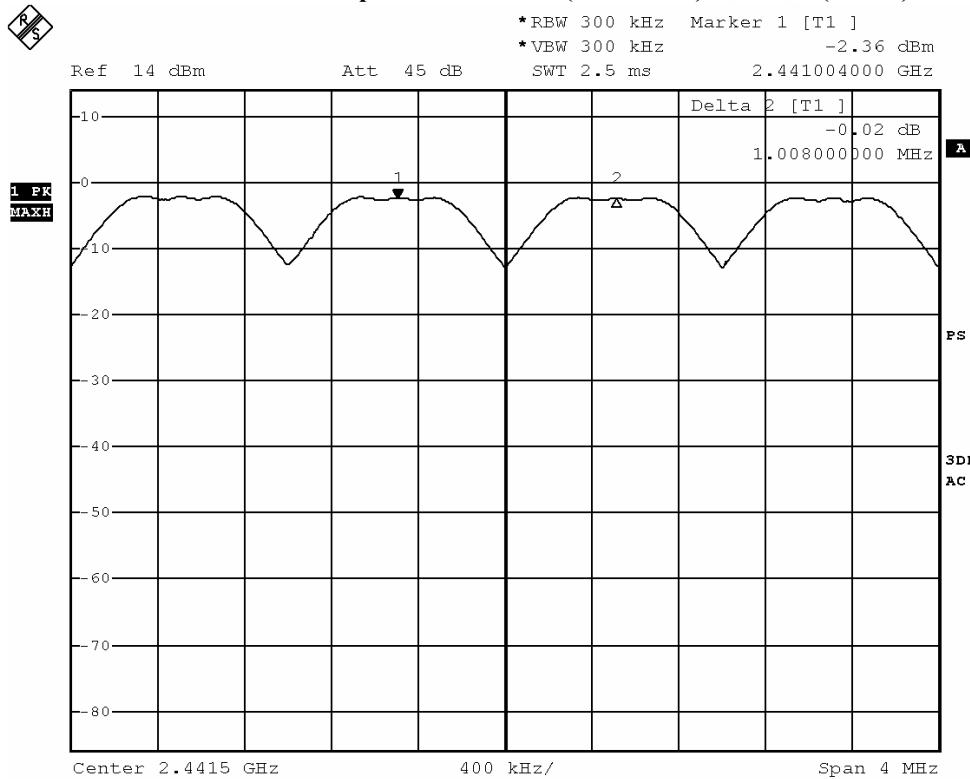
## STC Test Report

Date: 2016-04-05

Page 48 of 87

No.: MH192510

### Channel separation = 1MHz (>813.3kHz) (Mid) (GFSK)



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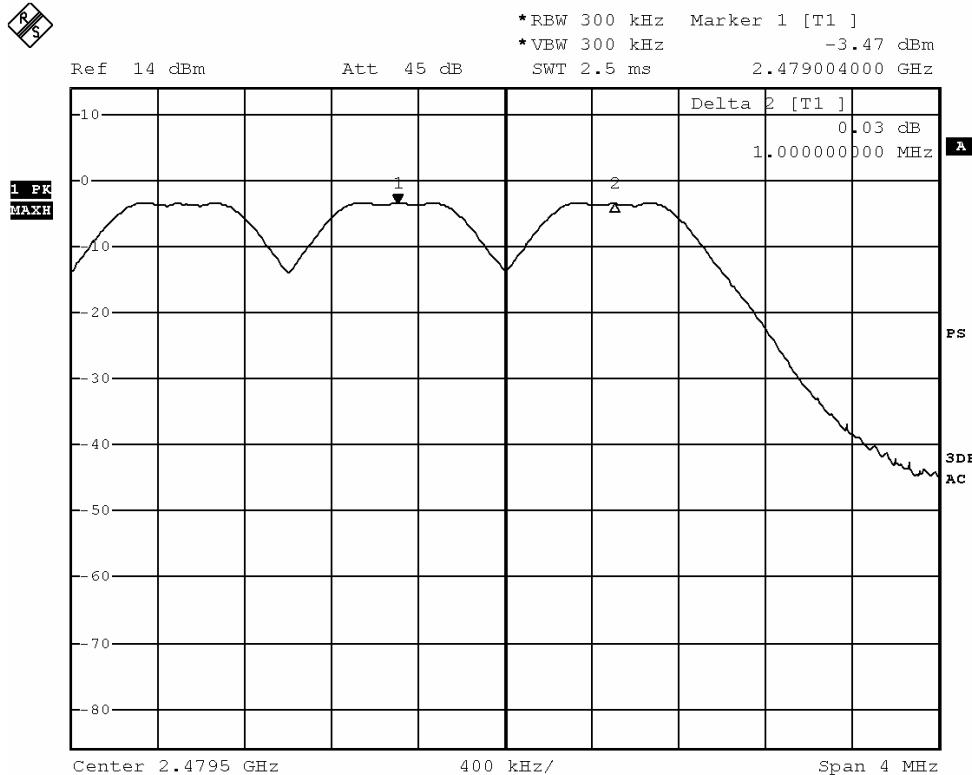
## STC Test Report

Date: 2016-04-05

Page 49 of 87

No.: MH192510

Channel separation = 1MHz (>813.3kHz) (Highest) (GFSK)



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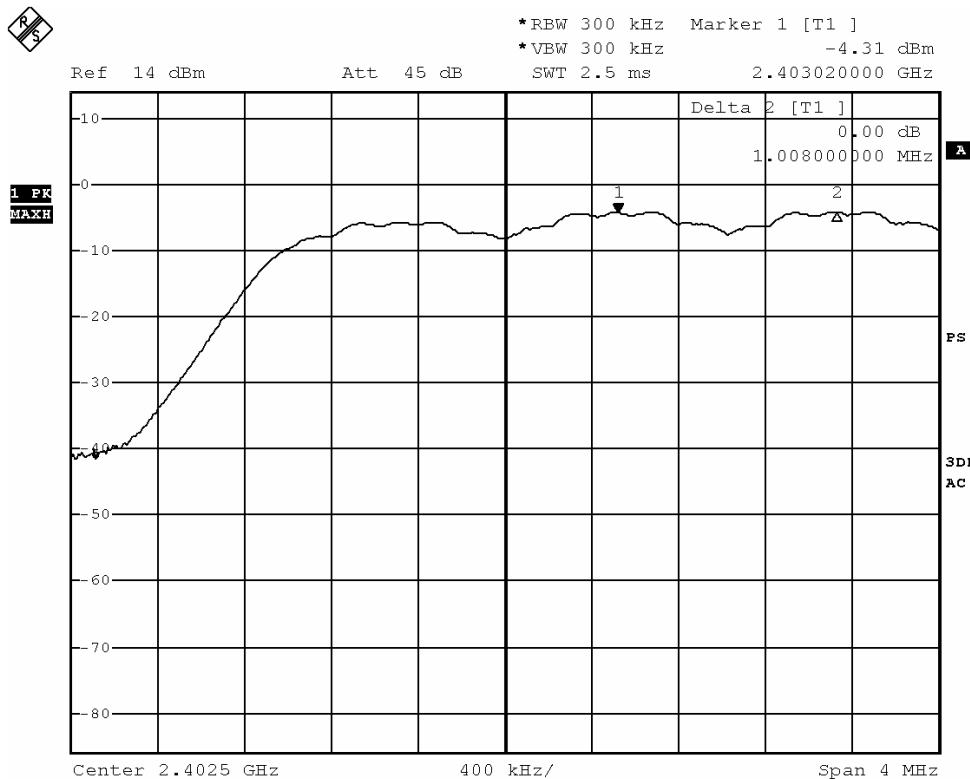
## STC Test Report

Date: 2016-04-05

Page 50 of 87

No.: MH192510

Channel separation = 1MHz (>813.3kHz) (Lowest) ( $\pi/4$ - DQPSK)



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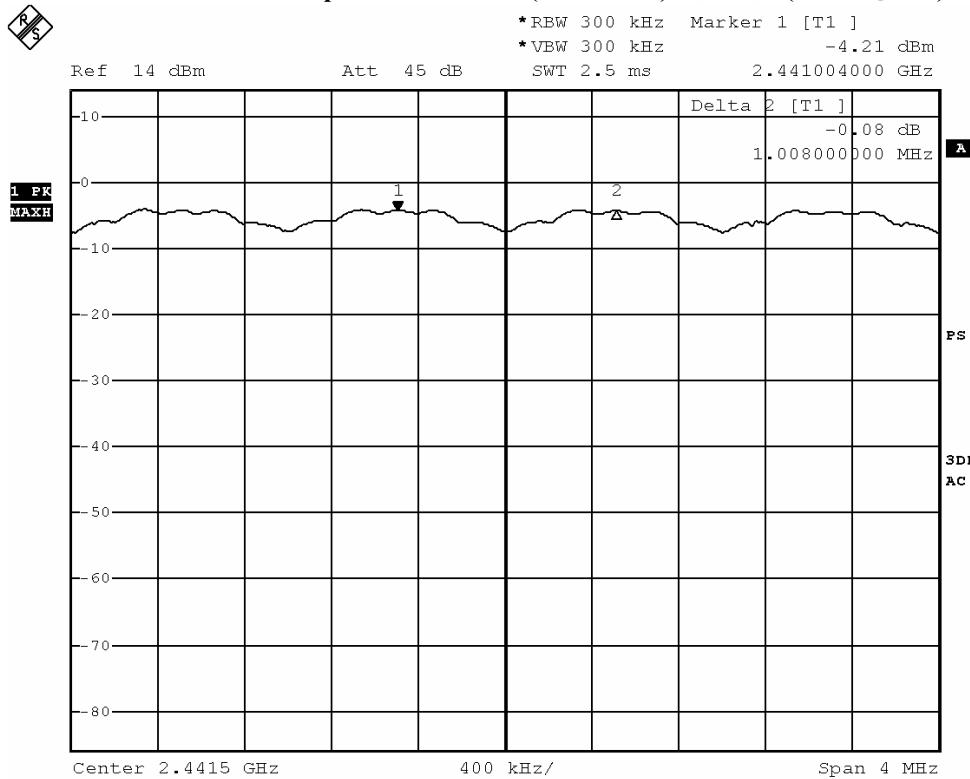
## STC Test Report

Date: 2016-04-05

Page 51 of 87

No.: MH192510

### Channel separation = 1MHz (>813.3kHz) (Mid) ( $\pi/4$ - DQPSK)



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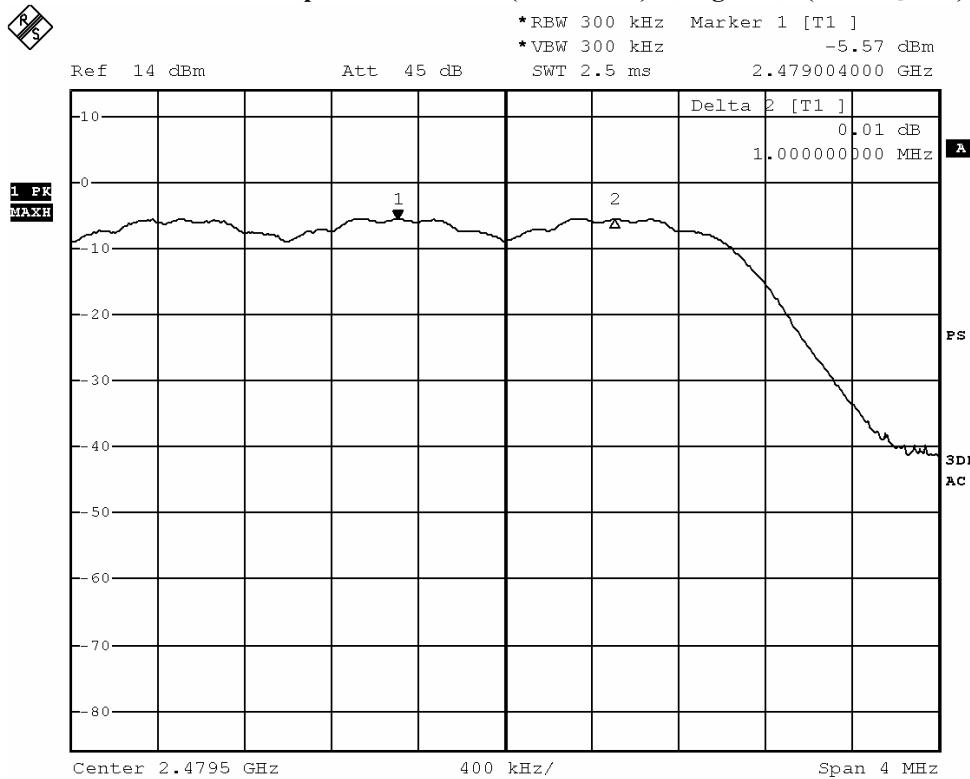
## STC Test Report

Date: 2016-04-05

Page 52 of 87

No.: MH192510

### Channel separation = 1MHz (>813.3kHz) (Highest) ( $\pi/4$ - DQPSK)



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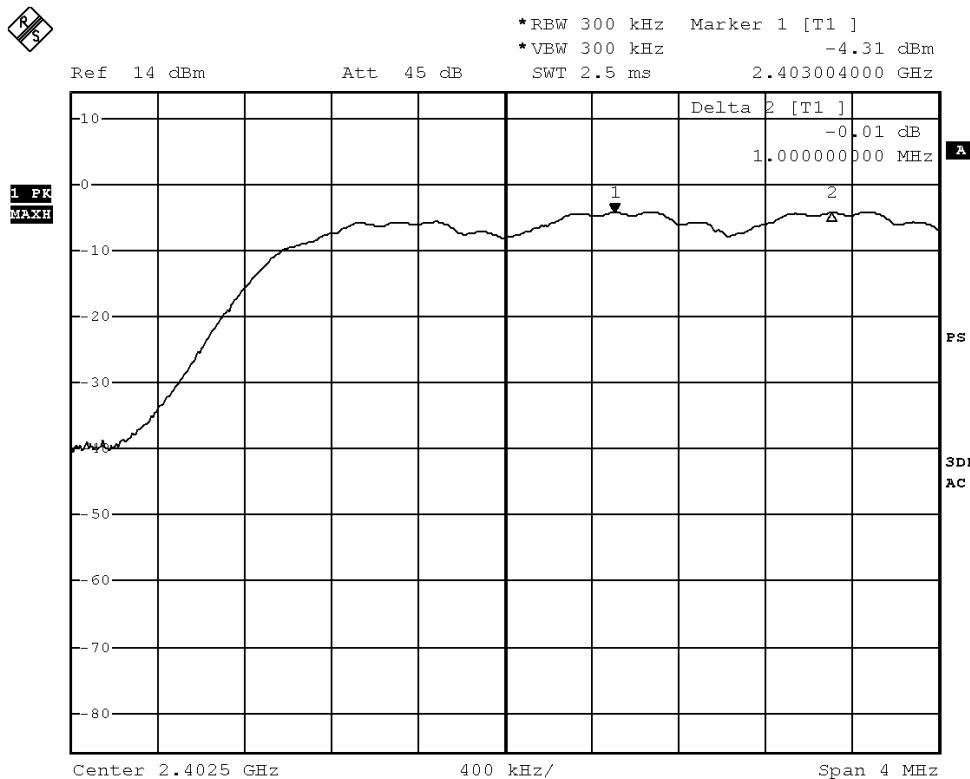
## STC Test Report

Date: 2016-04-05

Page 53 of 87

No.: MH192510

Channel separation = 1MHz (>813.3kHz) (Lowest) (8DPSK)



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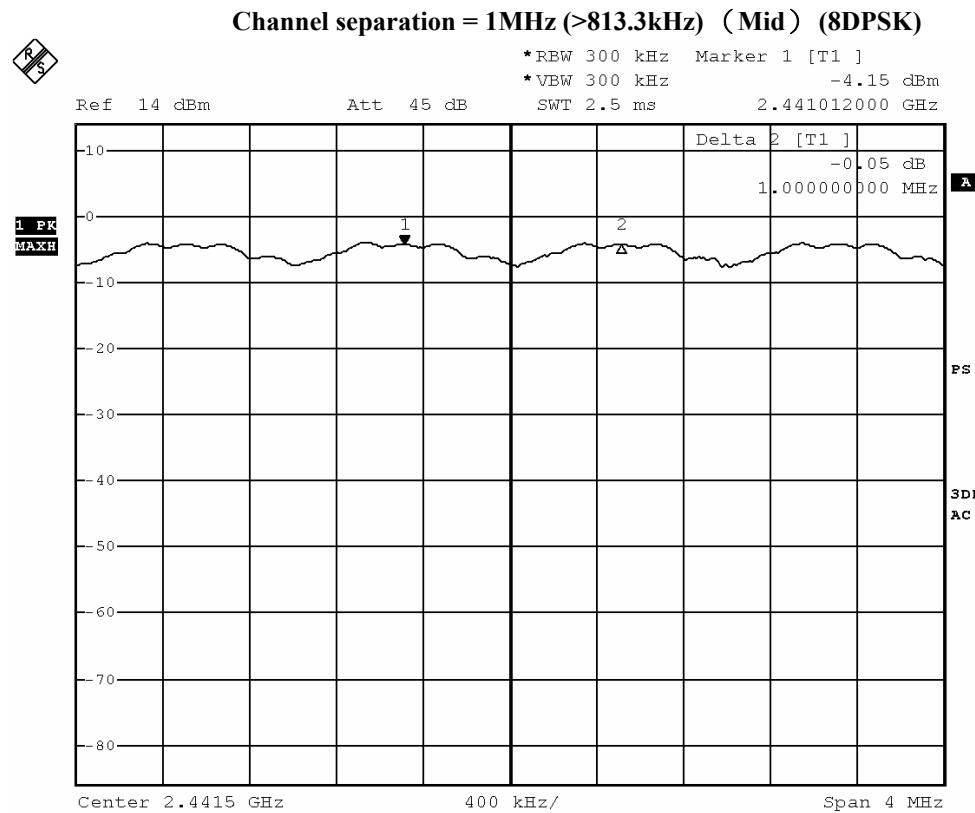


## STC Test Report

Date: 2016-04-05

Page 54 of 87

No.: MH192510



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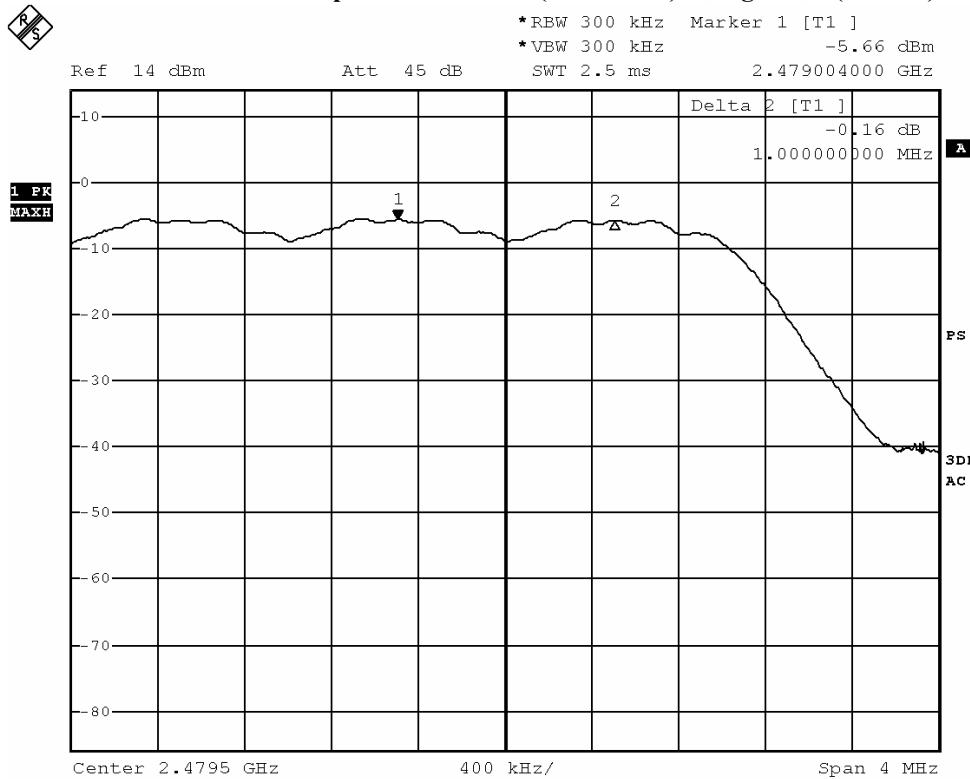
## STC Test Report

Date: 2016-04-05

Page 55 of 87

No.: MH192510

Channel separation = 1MHz (>813.3kHz) (Highest) (8DPSK)



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**Page 56 of 87**

**No.: MH192510**

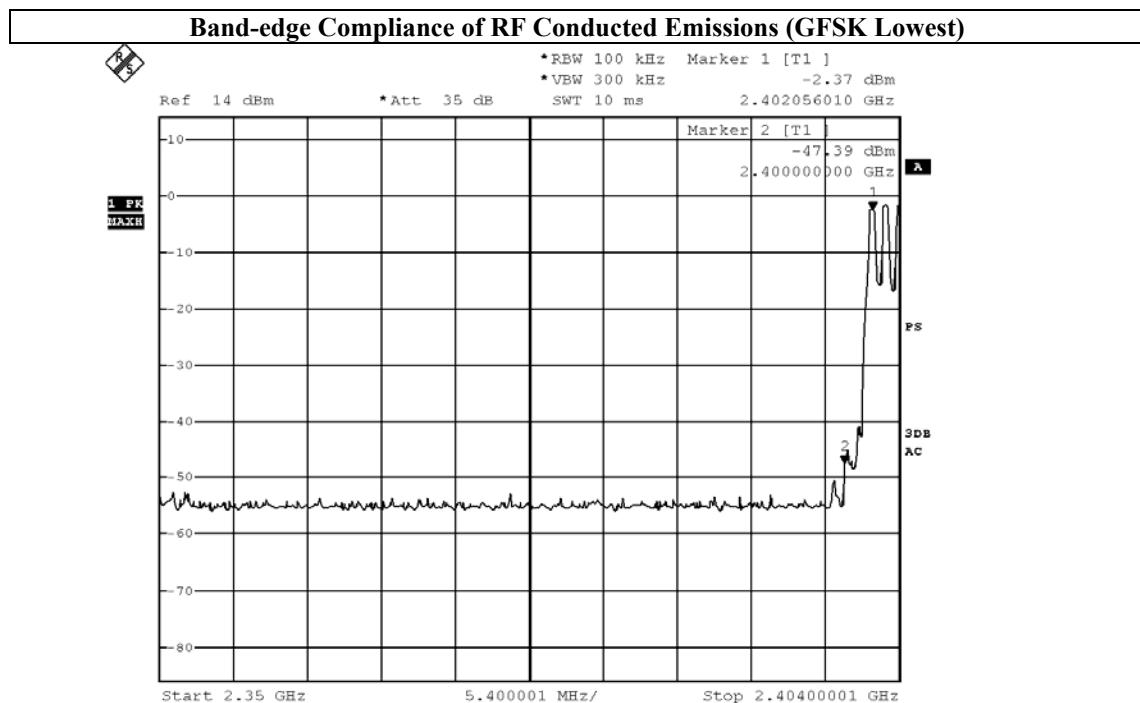
### **3.1.7 Band-edge Compliance of RF Conducted Emissions Measurement:**

#### **Limit :**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. According to the test method DA 00-705.

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

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	45.02



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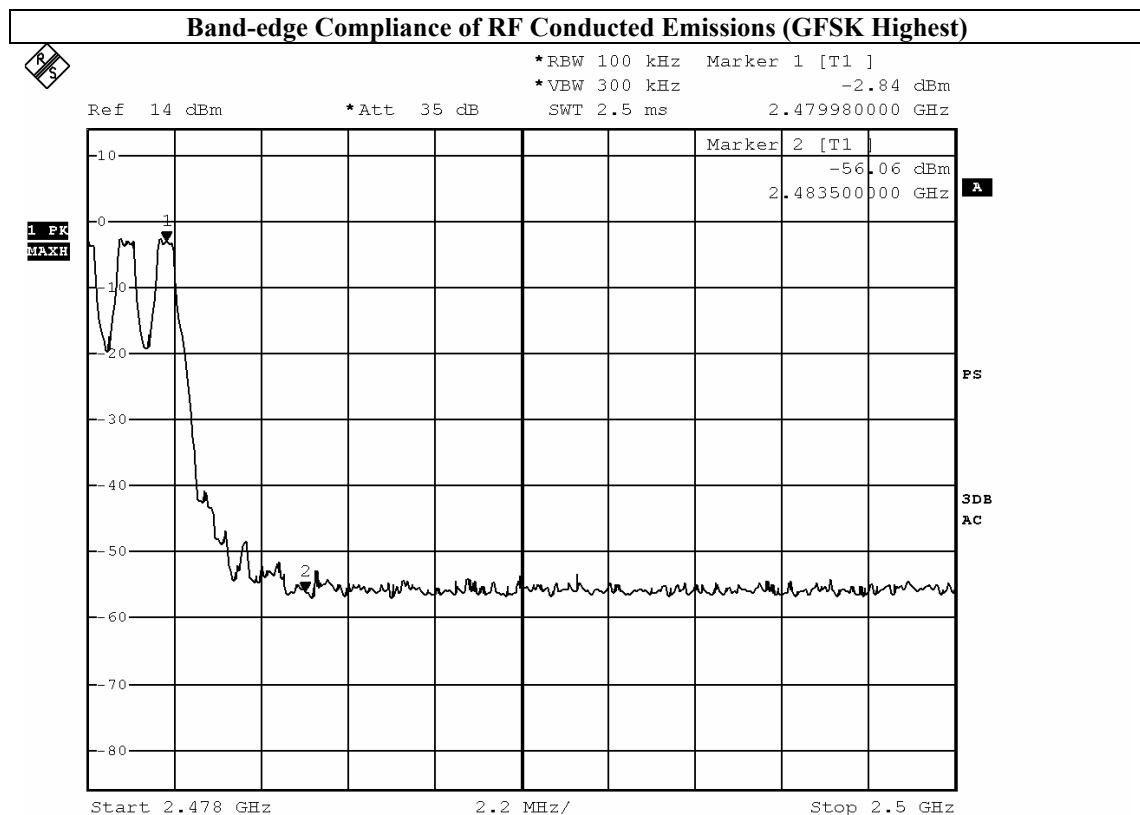
Date: 2016-04-05

Page 57 of 87

No.: MH192510

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

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
Highest Fundamental (2480) - 2483.5	53.22



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**Date: 2016-04-05**

**Page 58 of 87**

**No.: MH192510**

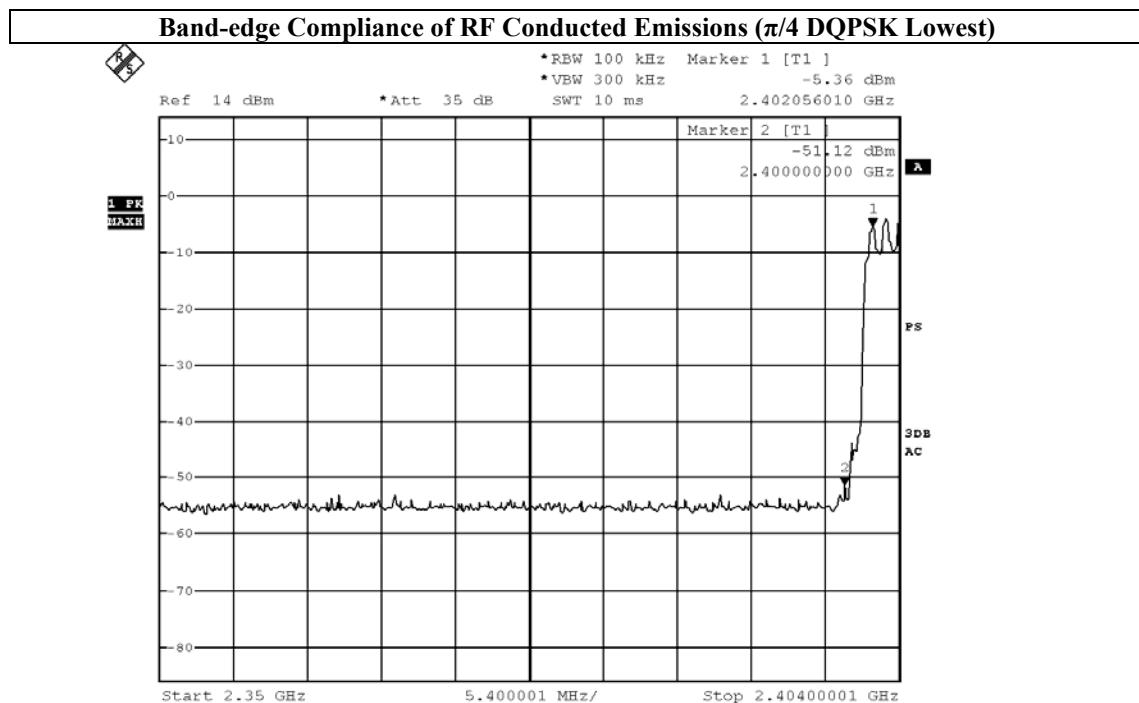
### **Band-edge Compliance of RF Conducted Emissions Measurement:**

#### **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.

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

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	45.76



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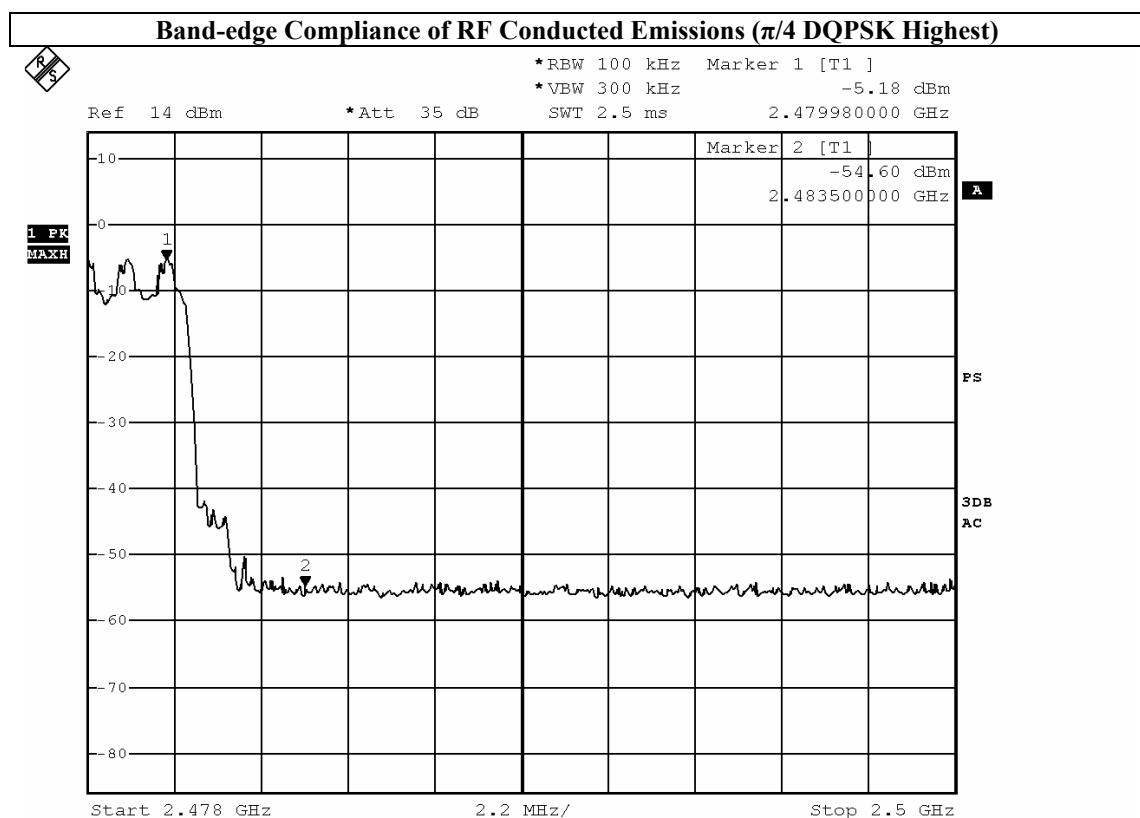
Date: 2016-04-05

Page 59 of 87

No.: MH192510

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

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
Highest Fundamental (2480) - 2483.5	49.42



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**Date: 2016-04-05**

**Page 60 of 87**

**No.: MH192510**

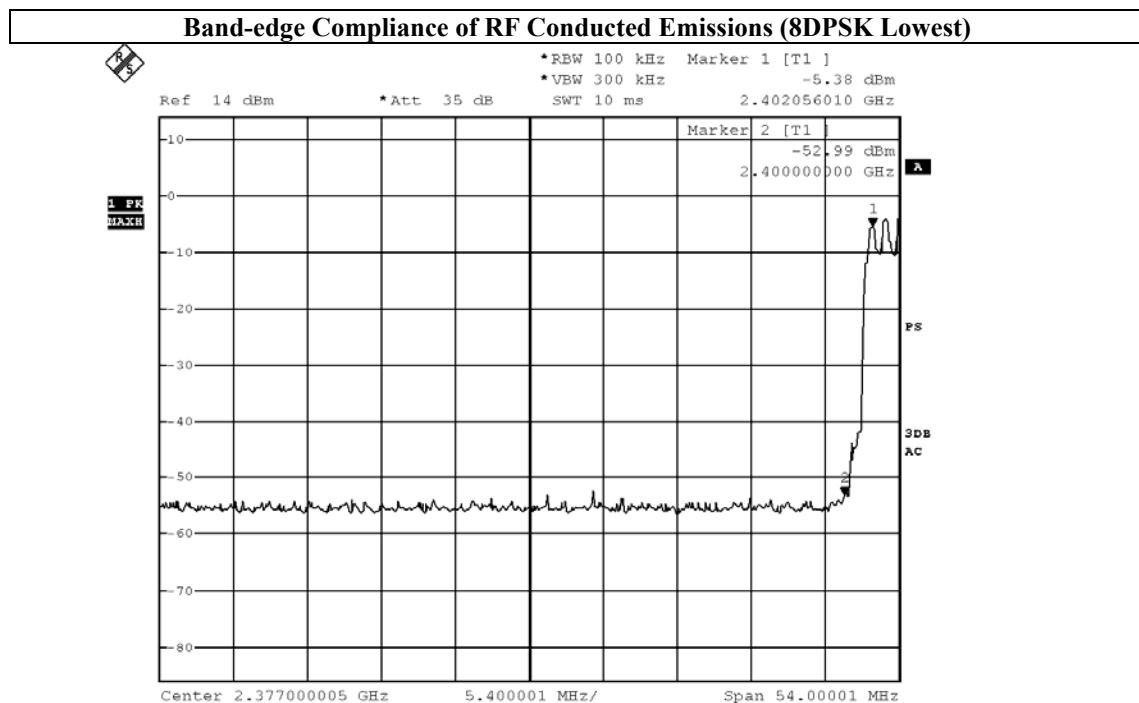
### **Band-edge Compliance of RF Conducted Emissions Measurement:**

#### **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.

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

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	47.61



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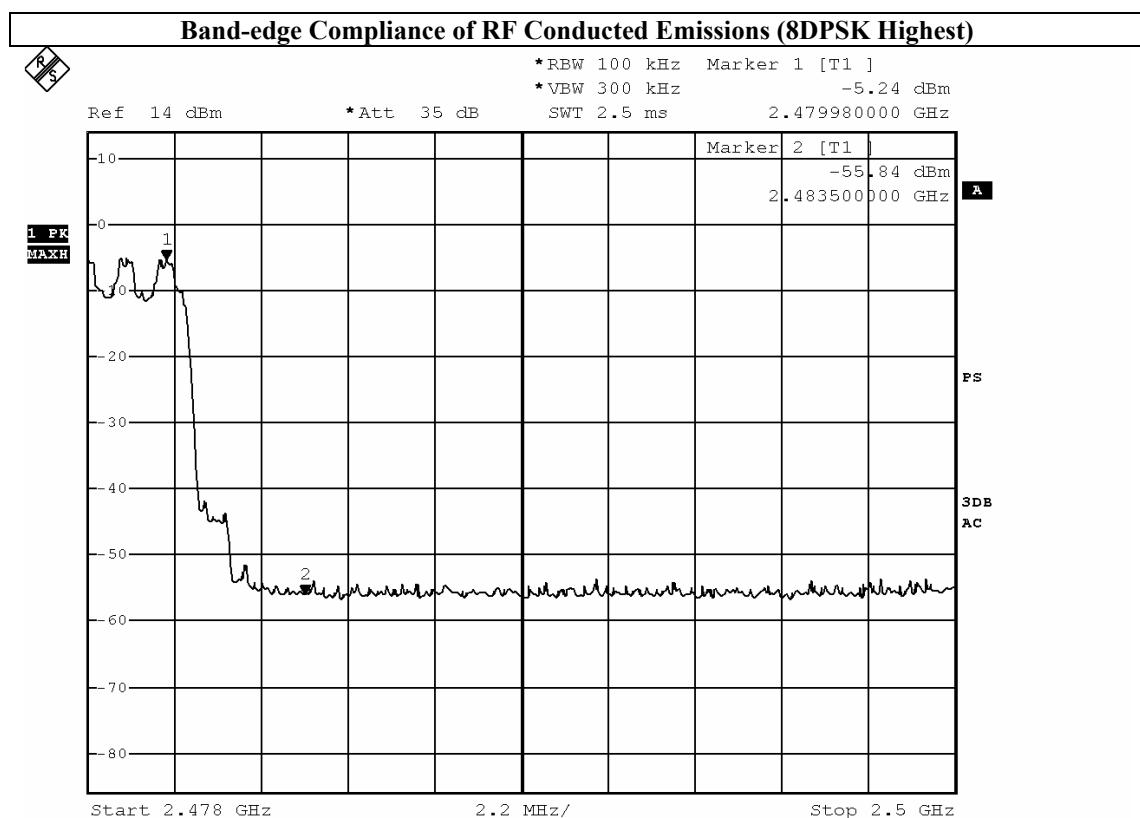
Date: 2016-04-05

Page 61 of 87

No.: MH192510

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

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
Highest Fundamental (2480) - 2483.5	50.6



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## STC Test Report

**Date: 2016-04-05**

**Page 62 of 87**

**No.: MH192510**

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

#### **Limit :**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 5.205(c)).

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

Field Strength of Band-edge Compliance						
Peak Value						
Frequency MHz	Measured Level @3m 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	13.6	36.8	50.4	74.0	23.6	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
2390.0	1.0	36.8	37.8	54.0	16.2	Vertical

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

Field Strength of Band-edge Compliance						
Peak Value						
Frequency MHz	Measured Level @3m dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB $\mu$ V/m	E-Field Polarity
2483.5	28.8	36.8	65.6	74.0	8.4	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
2483.5	5.5	36.8	42.3	54.0	11.7	Vertical

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**Date: 2016-04-05**

**Page 63 of 87**

**No.: MH192510**

### **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 ( $\pi/4$ -DQPSK Lowest)**

Field Strength of Band-edge Compliance						
Peak Value						
Frequency MHz	Measured Level @3m dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB $\mu$ V/m	E-Field Polarity
2400.0	12.0	36.8	48.8	74.0	25.2	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	1.3	36.8	38.1	54.0	15.9	Vertical

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

Field Strength of Band-edge Compliance						
Peak Value						
Frequency MHz	Measured Level @3m dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB $\mu$ V/m	E-Field Polarity
2483.5	27.5	36.8	64.3	74.0	9.7	Vertical

Field Strength of Band-edge Compliance						
Average Value						
Frequency MHz	Measured Level @3m dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB $\mu$ V/m	E-Field Polarity
2483.5	5.5	36.8	42.3	54.0	11.7	Vertical

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## STC Test Report

**Date: 2016-04-05**

**Page 64 of 87**

**No.: MH192510**

### **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 (8DPSK Lowest)**

Field Strength of Band-edge Compliance						
Peak Value						
Frequency MHz	Measured Level @3m dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB $\mu$ V/m	E-Field Polarity
2400.0	11.8	36.8	48.6	74.0	25.4	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	1.3	36.8	38.1	54.0	15.9	Vertical

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

Field Strength of Band-edge Compliance						
Peak Value						
Frequency MHz	Measured Level @3m dB $\mu$ V	Correction Factor dB/m	Field Strength dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB $\mu$ V/m	E-Field Polarity
2483.5	28.4	36.8	65.2	74.0	8.8	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	5.3	36.8	42.1	54.0	11.9	Vertical

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## STC Test Report

**Date: 2016-04-05**

**Page 65 of 87**

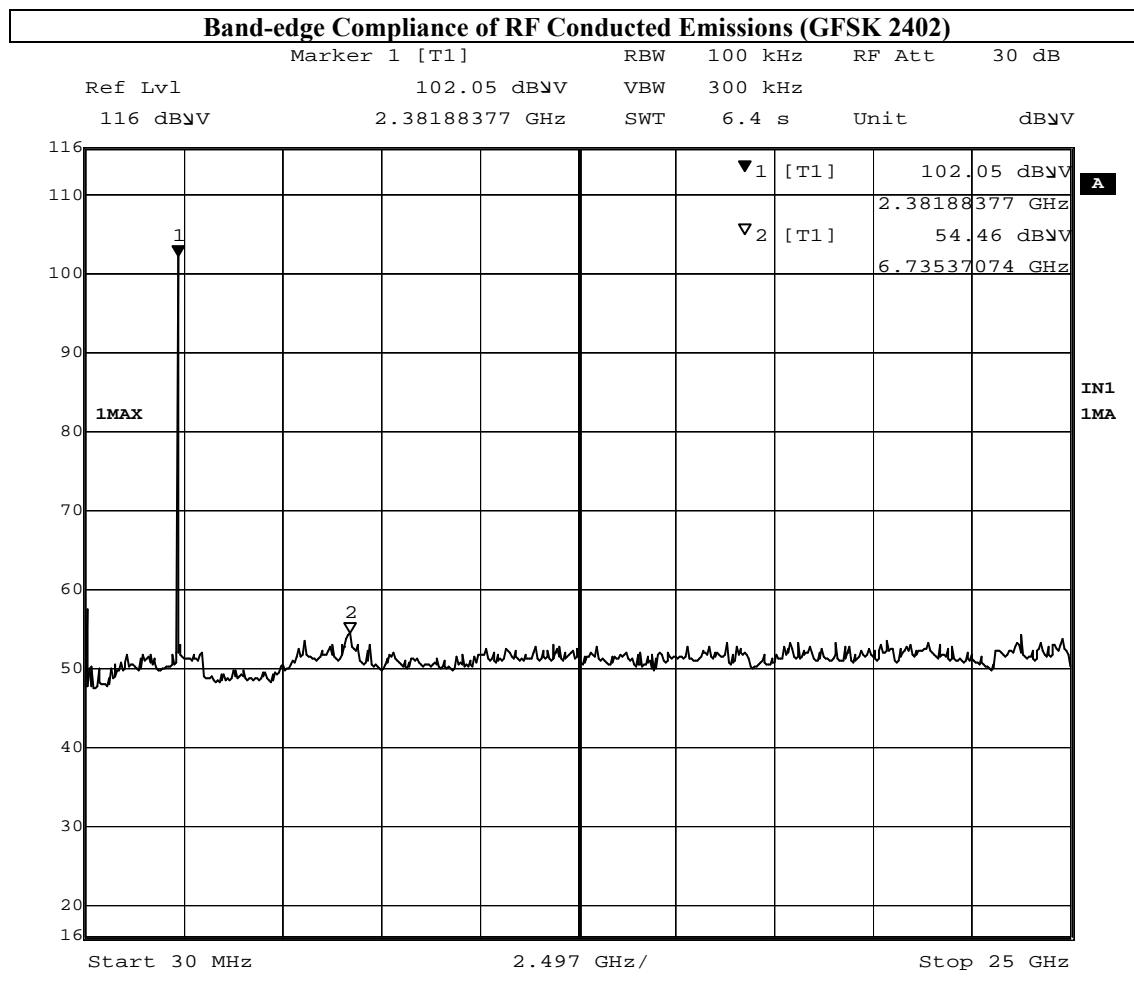
**No.: MH192510**

### **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.

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



Date: 13.MAY.2016 09:16:20

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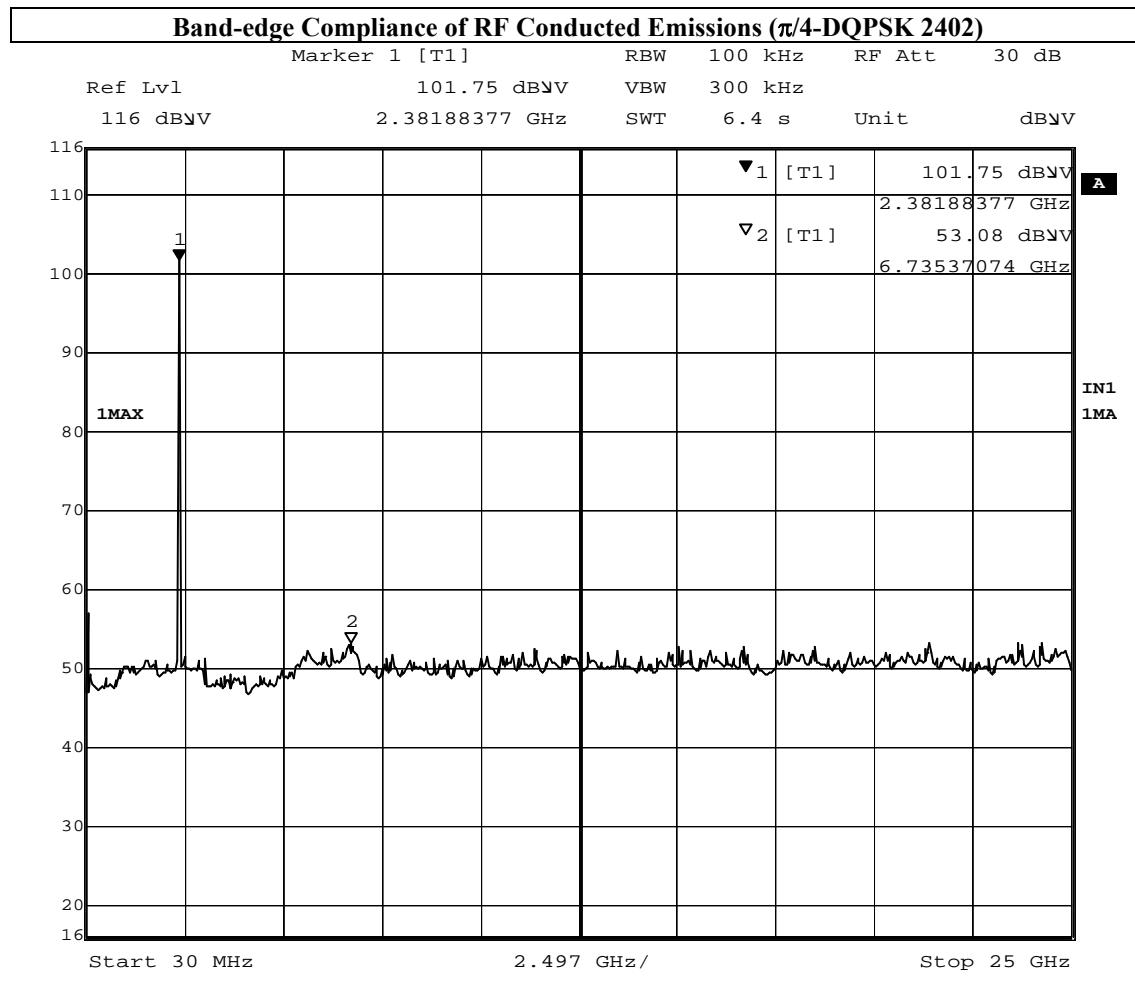


## STC Test Report

Date: 2016-04-05

Page 66 of 87

No.: MH192510



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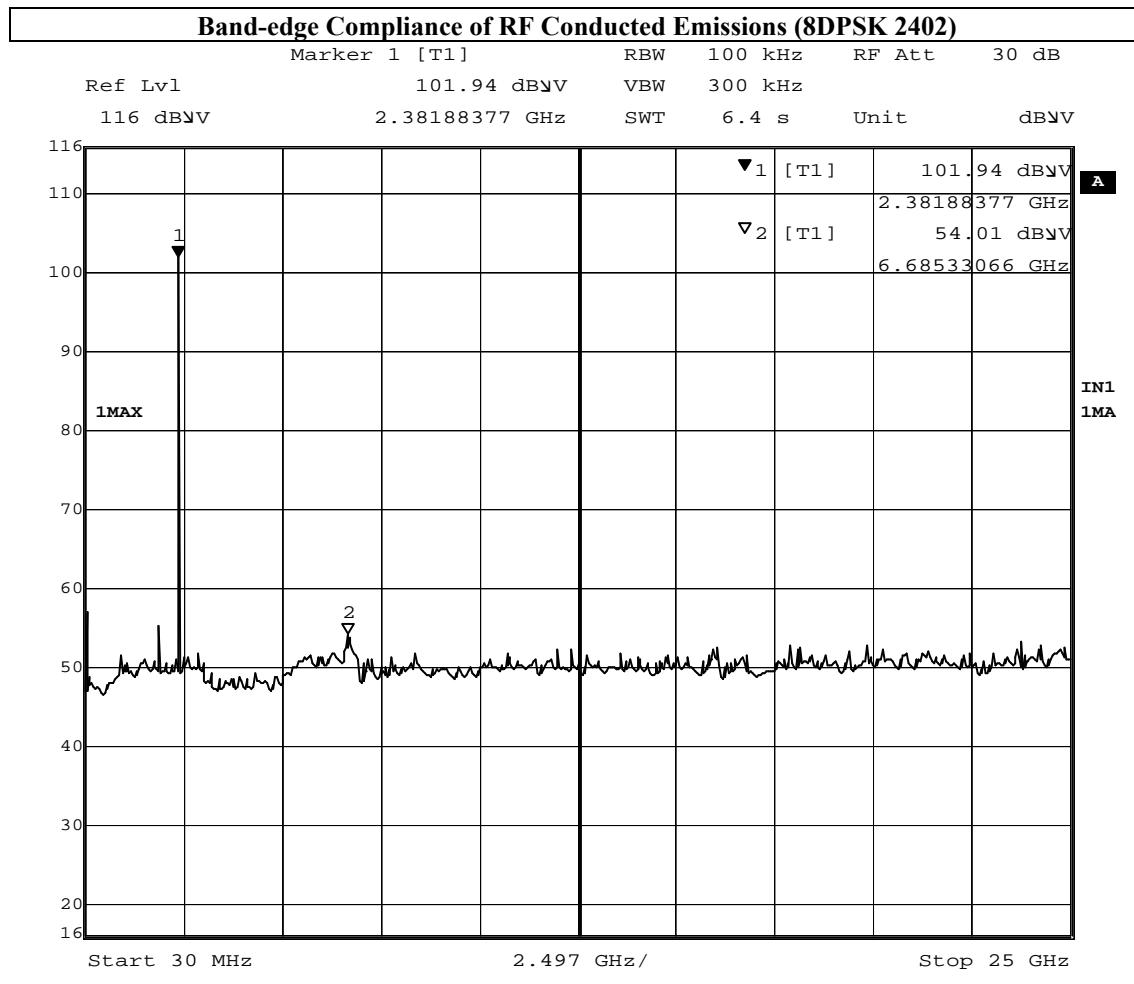


## STC Test Report

Date: 2016-04-05

Page 67 of 87

No.: MH192510



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## STC Test Report

**Date: 2016-04-05**

**Page 68 of 87**

**No.: MH192510**

### **3.1.8 Time of Occupancy (Dwell Time)**

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.

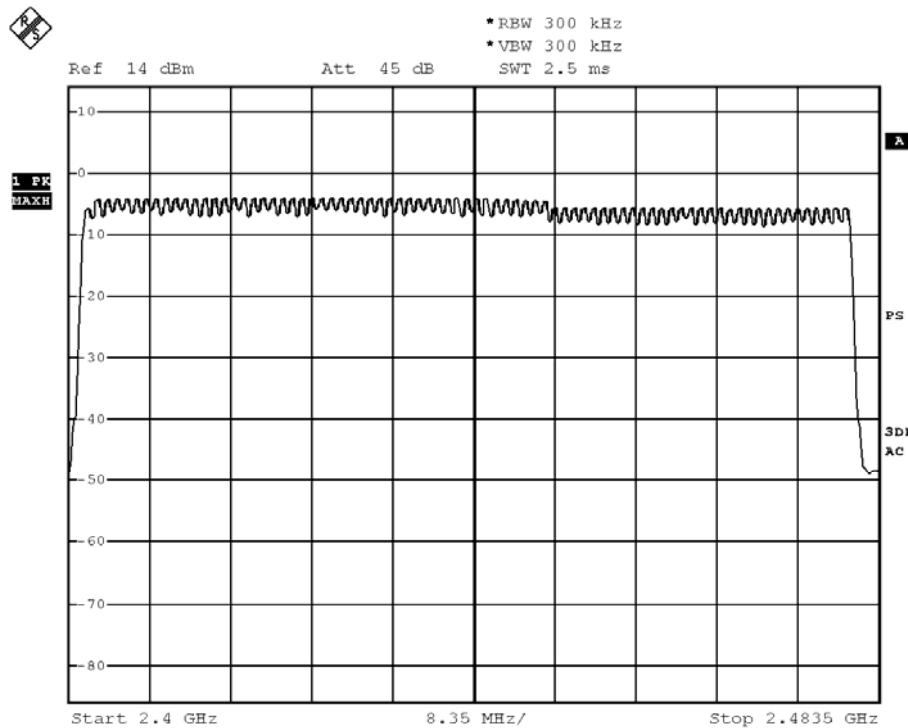
No requirements for Digital Transmission System.

**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**



BMP

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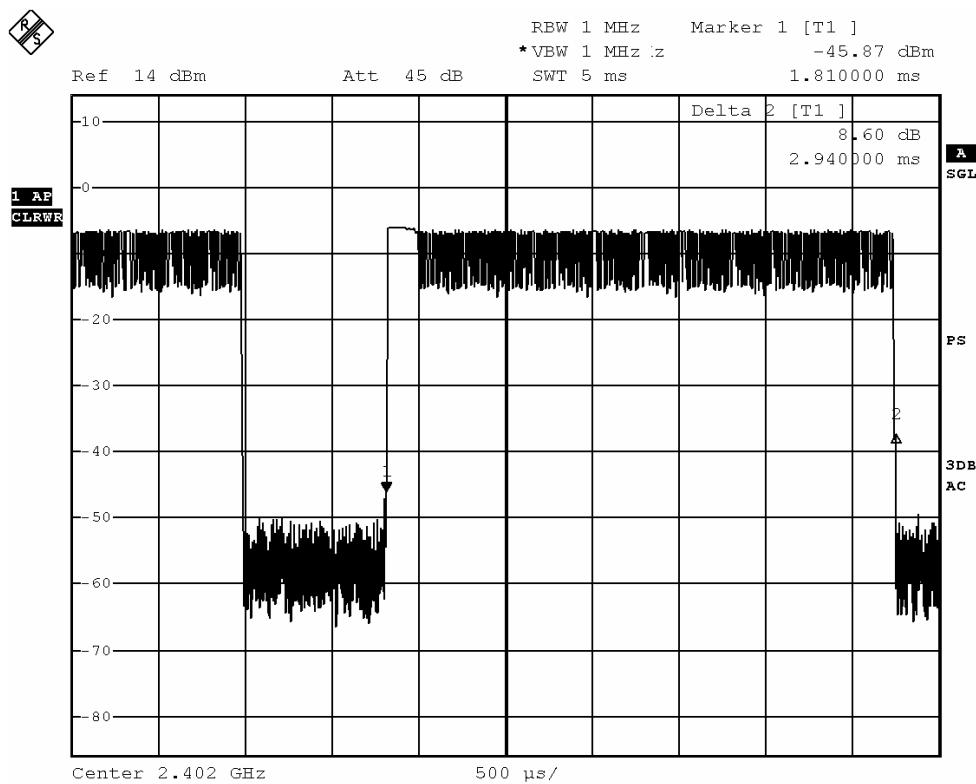
**Page 69 of 87**

**No.: MH192510**

### **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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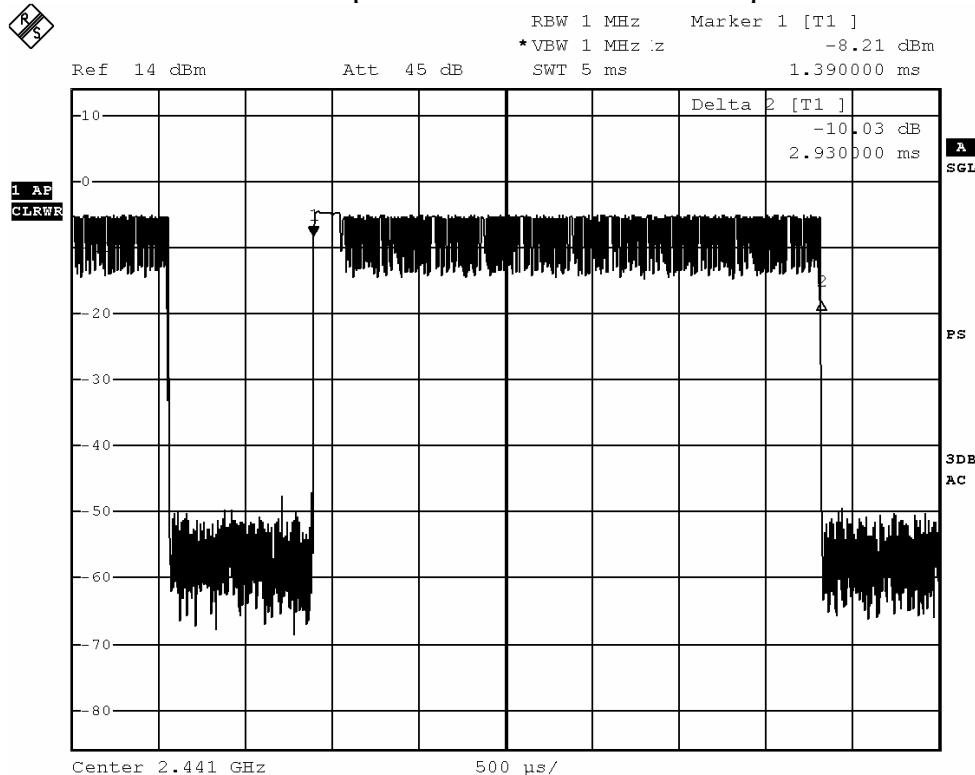
## STC Test Report

Date: 2016-04-05

Page 70 of 87

No.: MH192510

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



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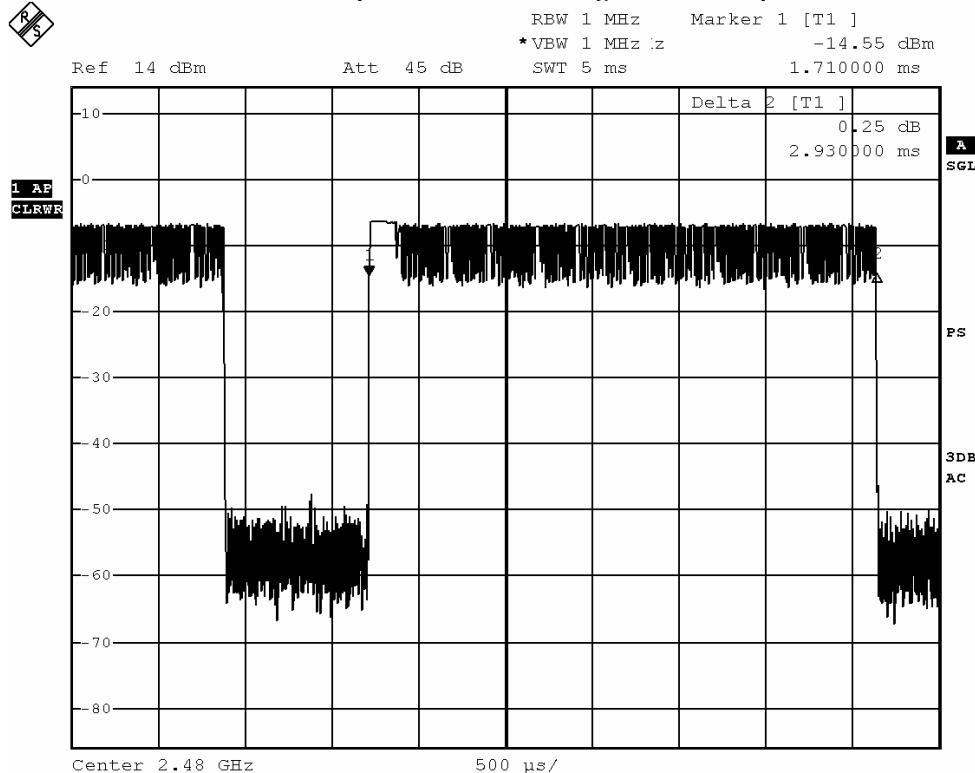
## STC Test Report

Date: 2016-04-05

Page 71 of 87

No.: MH192510

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



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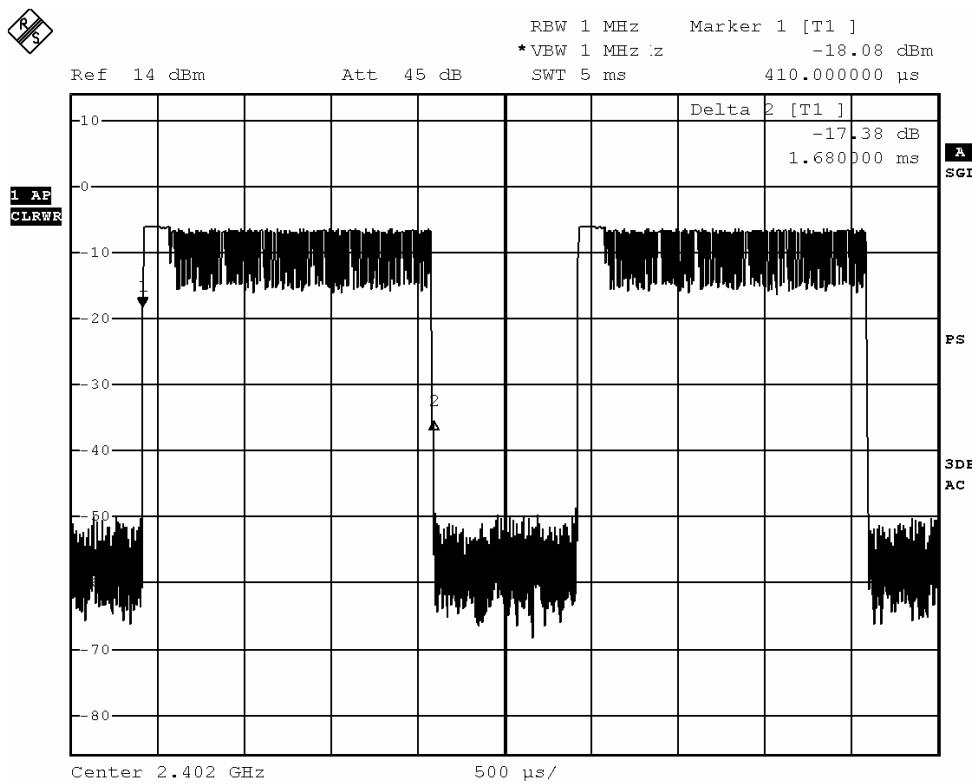
**Page 72 of 87**

**No.: MH192510**

### **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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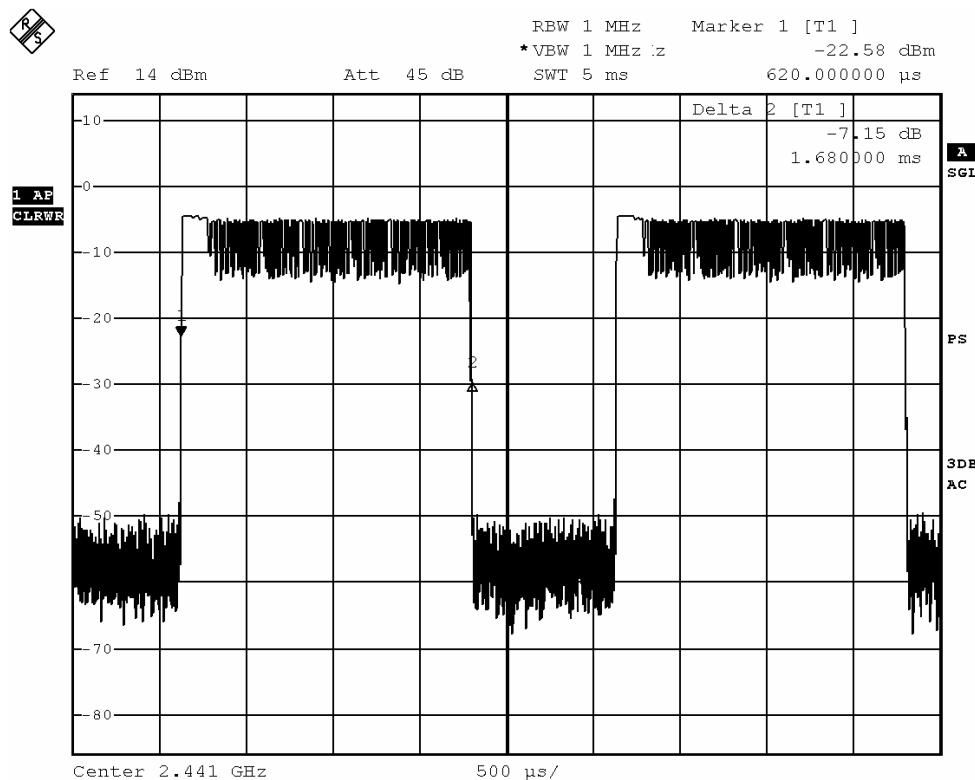
## STC Test Report

**Date: 2016-04-05**

**Page 73 of 87**

**No.: MH192510**

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



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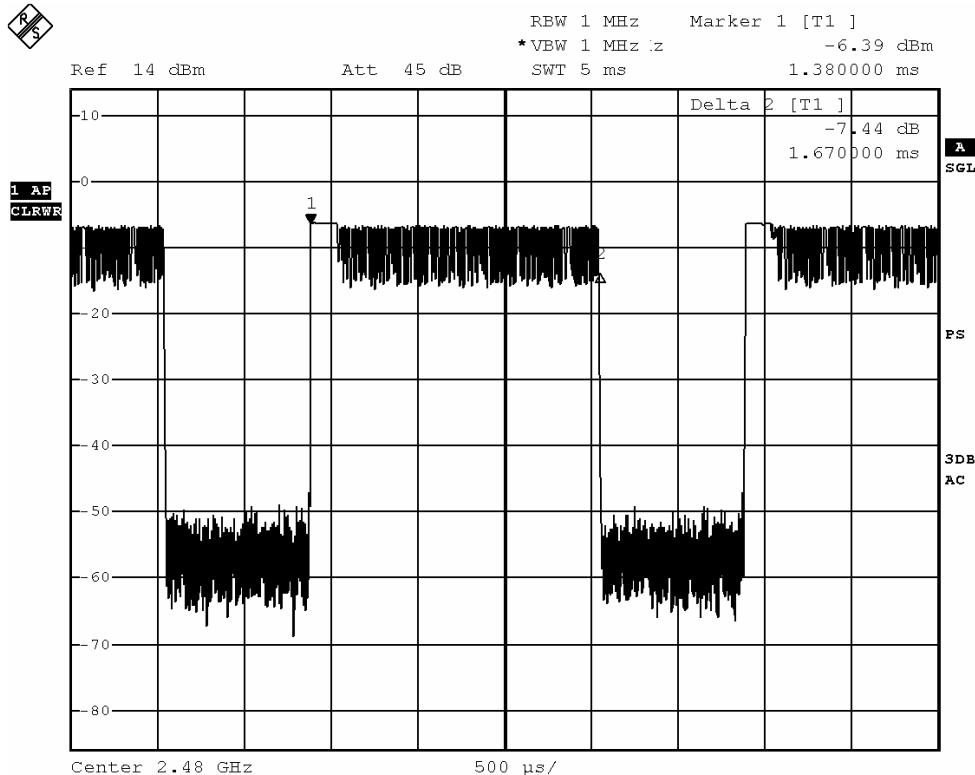
## STC Test Report

Date: 2016-04-05

Page 74 of 87

No.: MH192510

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



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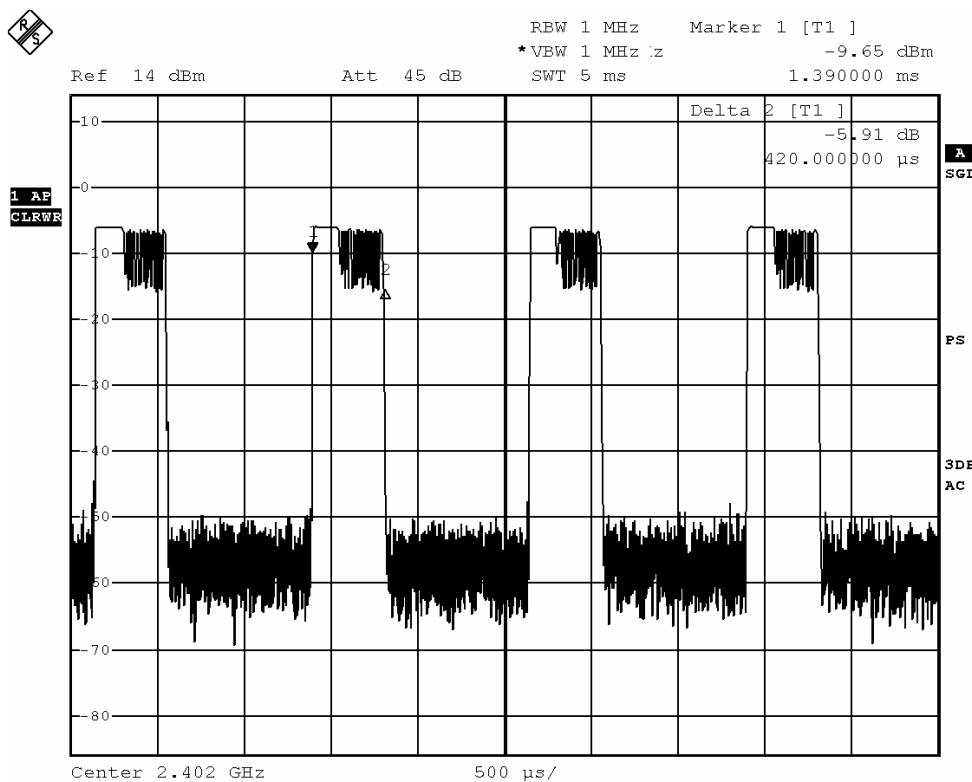
**Page 75 of 87**

**No.: MH192510**

### **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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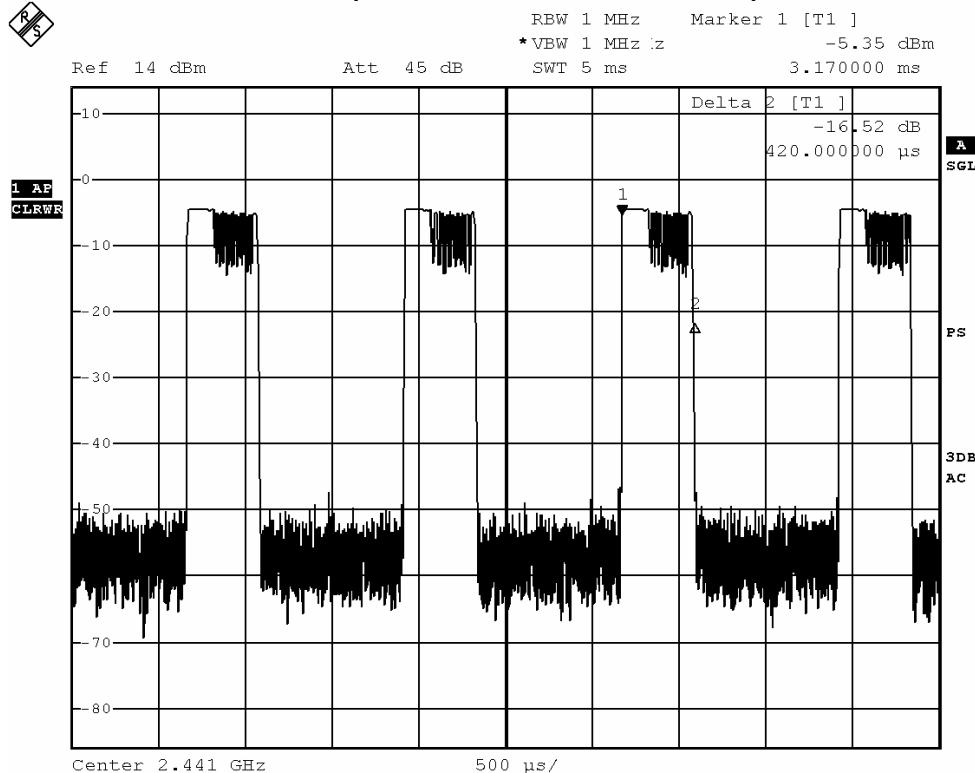
## STC Test Report

Date: 2016-04-05

Page 76 of 87

No.: MH192510

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



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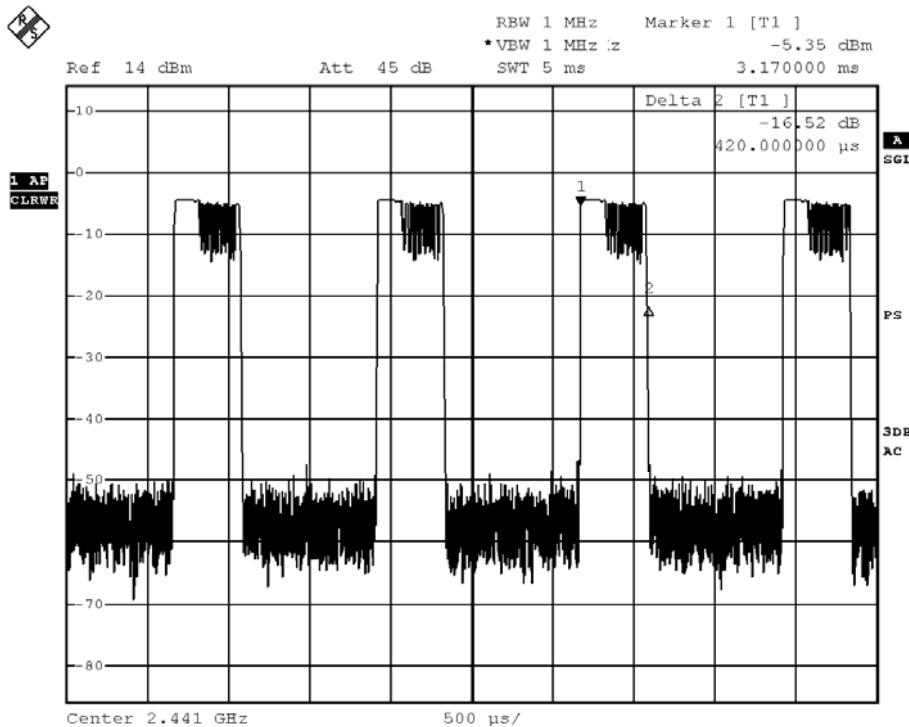
## STC Test Report

Date: 2016-04-05

Page 77 of 87

No.: MH192510

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



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Date: 28.MAR.2016 18:14:48

### 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	2.930	0.313	0.400	Complies
DH5	2480	2.930	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	1.670	0.267	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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## **STC Test Report**

**Date: 2016-04-05**

**Page 78 of 87**

**No.: MH192510**

### **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,  $k = 0, \dots, 78$  (Channel separation = 1MHz)

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**Date: 2016-04-05**

**Page 79 of 87**

**No.: MH192510**

### **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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## **STC Test Report**

**Date: 2016-04-05**

**Page 80 of 87**

**No.: MH192510**

### **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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## **STC Test Report**

**Date: 2016-04-05**

**Page 81 of 87**

**No.: MH192510**

### **3.1.12 RF Exposure**

Test Requirement: FCC 47CFR 15.247(i)

Test Date: 2016-04-04

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 =2.371 mW

$$\begin{aligned} Pd &= PG / 4\pi * R^2 = (2.371 \times 1.58) / 12.566 * (20)^2 \\ &= (3.746) / 12.566 \times 400 = 3.746 / 5026.4 \\ &= 0.000745 \text{mW/cm}^2 \end{aligned}$$

where:

\*Pd = power density in mW/cm<sup>2</sup>

\* G = Antenna numeric gain (1.58); Log G = g/10 ( g = 2dBi ).

\* P = Conducted RF power to antenna (2.371mW).

\* R = Minimum allowable distance.(20 cm)

\*The power density Pd = 0.000745mW/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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## STC Test Report

**Date: 2016-04-05**

**No.: MH192510**

**Page 82 of 87**

### **Appendix A**

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

##### **Radiated Emission**

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EMD062	DOUBLE-RIDGED WAVEGUIDE HORN ANTENNA	ETS-LINDGREN	3117	00075933	2014/11/15	2016/11/15
EMD131	PYRAMIDAL STANDARD GAIN HORN ANTENNA	A-INFOAW	JXTXLB-42- 15-C-KF 01	J20211007210	2015/06/27	2017/06/27
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	--	2015/09/25	2016/09/25
EM320	BICONILOG ANTENNA	ETS-LINDGREN	3142D	00094856	2014/08/06	2016/08/06
EMD124	LOOP ANTENNA	EMCO	6502	00104905	2014/04/28	2016/04/28
EM229	EMI TEST RECEIVER	R&S	ESIB40	100248	2015/06/01	2016/06/01
EM529	MICROWAVE FREQUENCY CABLE	SUHNER	SUCOFLEX 104	238296	2014/07/24	2016/07/24

##### **Line Conducted**

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EM119	LISN	R & S	ESH3-Z5	0831.5518.52	2015/10/22	2016/10/22
EM145	EMI TEST RECEIVER	R & S	ESCS 30	830245/021	2015/06/01	2016/06/01
EM179	IMPULSE LIMITER	ROHDE & SCHWARZ	ESH3-Z2	357- 8810.52/54	2016/01/12	2017/01/12
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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## STC Test Report

Date: 2016-04-05

No.: MH192510

Page 83 of 87

### Appendix B

#### Photographs of EUT

Front View of the product



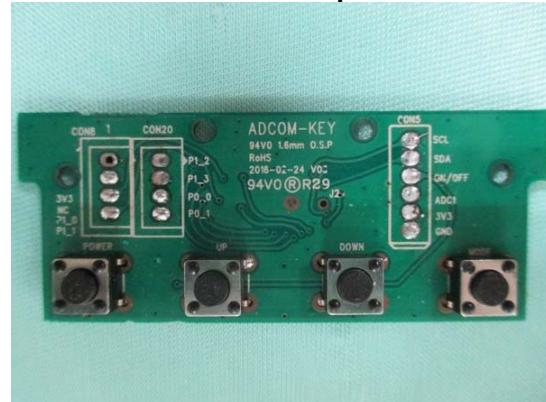
Rear View of the product



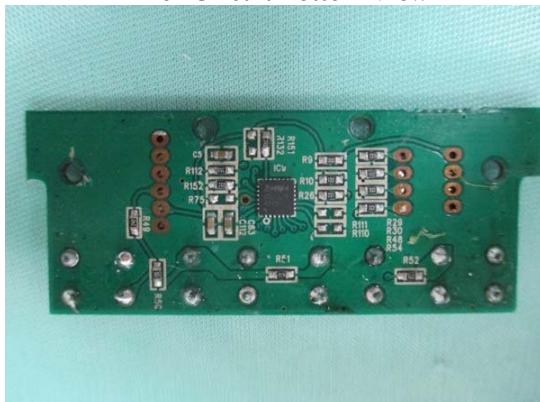
Inside View of the product



Inner Circuit Top View



Inner Circuit Bottom View



Inner Circuit Top View



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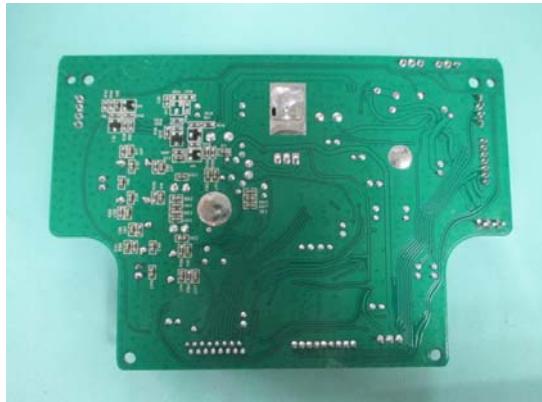
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Page 84 of 87

No.: MH192510

### Photographs of EUT

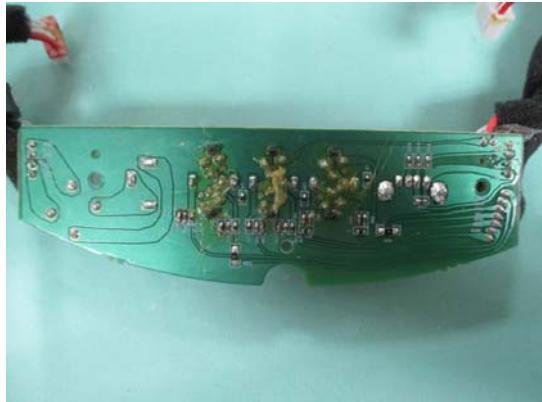
Inner Circuit Bottom View



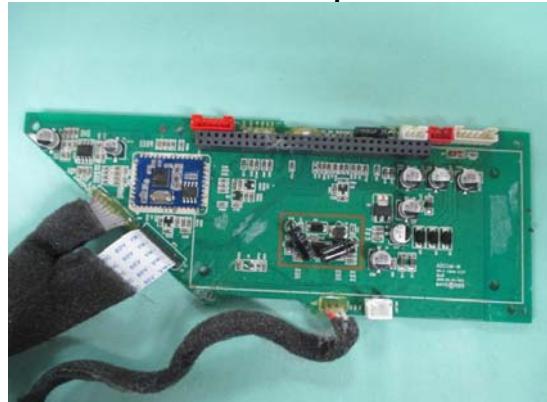
Inner Circuit Top View



Inner Circuit Bottom View



Inner Circuit Top View



Inner Circuit Bottom View



Inner Circuit Top View



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## STC Test Report

Date: 2016-04-05

Page 85 of 87

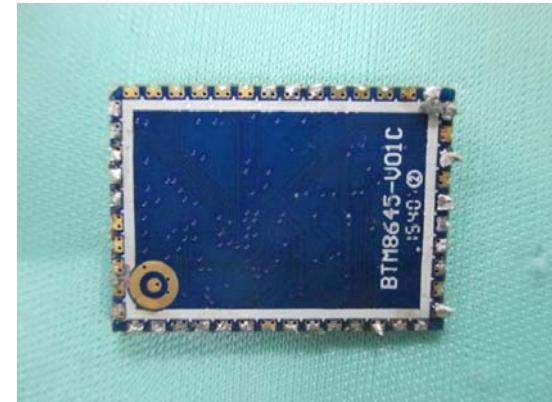
No.: MH192510

### Photographs of EUT

Inner Circuit Top View



Inner Circuit Bottom View



Inner Circuit Top View



Inner Circuit Bottom View



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## STC Test Report

Date: 2016-04-05

Page 86 of 87

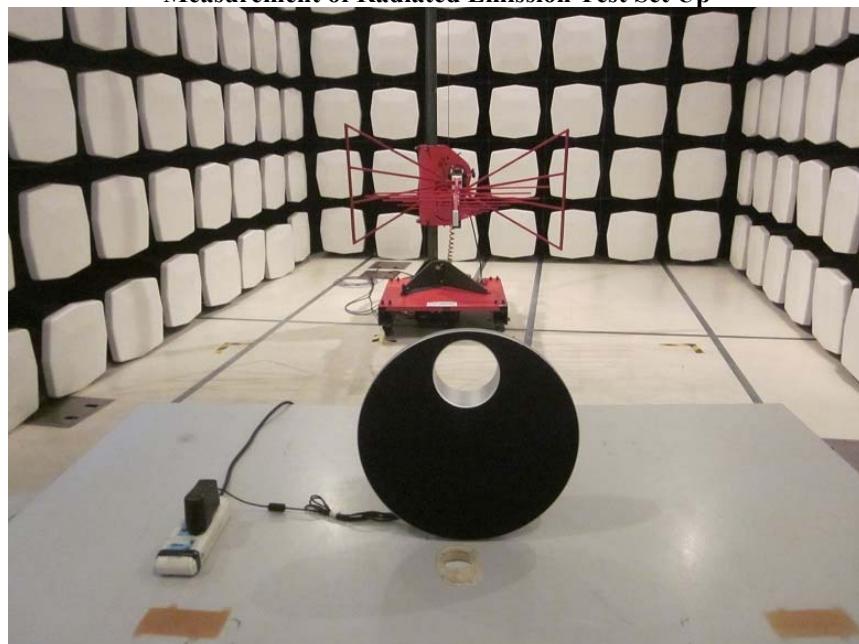
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### Photographs of EUT

Measurement of Radiated Emission Test Set Up



Measurement of Radiated Emission Test Set Up



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## **STC Test Report**

**Date: 2016-04-05**

**Page 87 of 87**

**No.: MH192510**

### **Photographs of EUT**

#### **Measurement of Radiated Emission Test Set Up**



#### **Measurement of Conducted Emission Test Set Up**



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

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