



STC Test Report

Date: 2016-10-31

Page 1 of 87

No.: DM124408

Applicant:

Guangdong LEIYON Intelligence Technology Corp.
BBK Road of Wusha, Changan Town, Dongguan City,
Guangdong Province, China

Manufacturer:

Guangdong LEIYON Intelligence Technology Corp.
BBK Road of Wusha, Changan Town, Dongguan City,
Guangdong Province, China

Description of Sample(s):

Product: Karaoke System
Brand Name: LEIYON
Model Number: LY-K01
FCC ID: 2AJA3LYK01

Date Sample(s) Received: 2016-07-13

Date Tested: 2016-07-21 to 2016-10-26

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)


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

STC (Dongguan) Company Limited

68 Fumin Nan Road, Dalang, Dongguan, China. (Zip Code : 523 770)
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STC Test Report

Date: 2016-10-31

No.: DM124408

Page 2 of 87

CONTENT:

Cover	Page 1 of 87
Content	Page 2 of 87
<u>1.0 General Details</u>	
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
<u>2.0 Technical Details</u>	
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
<u>3.0 Test Results</u>	
3.1 Emission	Page 7 –80 of 87
<u>Appendix A</u>	
List of Measurement Equipment	Page 81 of 87
<u>Appendix B</u>	
Photographs	Page 82-87 of 87

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STC Test Report

Date: 2016-10-31

Page 3 of 87

No.: DM124408

1.0 General Details

1.1 Test Laboratory

STC (Dongguan) Company Limited
EMC Laboratory
68 Fumin Nan Road, Dalang, Dongguan, Guangdong, China
Telephone: (86 769) 81119888
Fax: (86 769) 81116222

1.2 Equipment Under Test [EUT]

Description of Sample(s)

Product: Karaoke System
Manufacturer: Guangdong LEIYON Intelligence Technology Corp.
BBK Road of Wusha, Changan Town, Dongguan City,
Guangdong Province, China
Brand Name: LEIYON
Model Number: LY-K01
Rating: Input: 100-240V a.c. 50/60Hz 1.0A;
Output: 15V d.c. 2.4A.

The AC/DC adaptor was provided by the applicant with following details:

Brand name: N/A; Model no.: YeS36W-1500240U

1.2.1 Description of EUT Operation

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

1.3 Date of Order

2016-07-13

1.4 Submitted Sample(s):

1 Sample

1.5 Test Duration

2016-07-21 to 2016-10-26

1.6 Country of Origin

China

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STC Test Report

Date: 2016-10-31

Page 4 of 87

No.: DM124408

1.7 RF Module Details

Module Model Number:	F-6188
Module FCC ID:	
Module Transmission Type:	Bluetooth V3.0
Modulation:	FHSS (GFSK / $\pi/4$ -DQPSK/ 8DPSK)
Data Rates:	1Mbps: GFSK 2 MBps: $\pi/4$ -DQPSK 3 MBps: 8DPSK
Frequency Range:	2400-2483.5MHz
Carrier Frequencies:	2402MHz – 2480MHz

Module Specification (specification provided by manufacturer)

1.8 Antenna Details

Antenna Type:	Monopole antenna
Antenna Gain:	0dBi

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STC Test Report

Date: 2016-10-31

Page 5 of 87

No.: DM124408

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		
			Pass	Fail	N/A
Maximum Peak Conducted Output Power	FCC 47CFR 15.247(b)(1)	ANSI C63.10: 2013	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Radiated Spurious Emissions	FCC 47CFR 15.209	ANSI C63.10: 2013	N/A	<input checked="" 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"/>
Number of Hopping Frequency	FCC 47CFR 15.247 (b)(1)	ANSI C63.10: 2013	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>
20dB Bandwidth	FCC 47CFR 15.247(a)(2)	ANSI C63.10: 2013	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Hopping Channel Separation	FCC 47CFR 15.247(a)(1)	ANSI C63.10: 2013	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Band-edge measurement (Radiated)	FCC 47CFR 15.247(d)	ANSI C63.10: 2013	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Pseudorandom Hopping Algorithm	FCC 47CFR 15.247(a)(1)	N/A	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Time of Occupancy (Dwell Time)	FCC 47CFR 15.247(a)(1)(iii)	ANSI C63.10: 2013	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Antenna requirement	FCC 47CFR 15.203	N/A	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>
RF Exposure	FCC 47CFR 15.247(i)	N/A	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Note: N/A – Not Applicable

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STC Test Report

Date: 2016-10-31

Page 6 of 87

No.: DM124408

2.3 Table for Test Modes

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate in the table below is the worst case rate with respect to the specific test item.

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

The device was realized by test software.

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

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

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STC Test Report

Date: 2016-10-31

Page 7 of 87

No.: DM124408

3.0 Test Results

3.1 Emission

3.1.1 Maximum Peak Conducted Output Power

Test Requirement: FCC 47CFR 15.247(b)(1)
Test Method: ANSI C63.10: 2013
Test Date: 2016-07-26
Mode of Operation: Tx mode

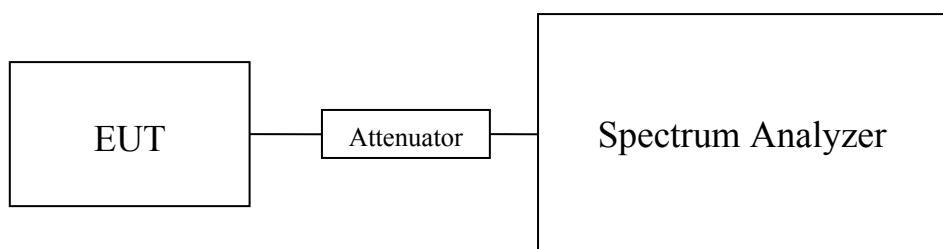
Test Method:

A temporary antenna connector was soldered to the RF output. The RF output of the EUT was connected to the spectrum analyzer. All the attenuation or cable loss will be added to the measured maximum output power. The results are recorded in Watt.

Spectrum Analyzer Setting:

RBW = 3 MHz, VBW= 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: 2016-10-31

Page 8 of 87

No.: DM124408

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

The maximum peak output power shall not exceed the following limits:

For Digital Transmission systems in 2400-2483.5 MHz Band: 1 Watt

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

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2402	0.000414

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2441	0.000475

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.000456

The maximum peak output power shall not exceed the following limits:

For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 Watts

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

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2402	0.000414

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2441	0.000483

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.000475

The maximum peak output power shall not exceed the following limits:

For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 Watts

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

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2402	0.000420

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2441	0.000486

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.000479

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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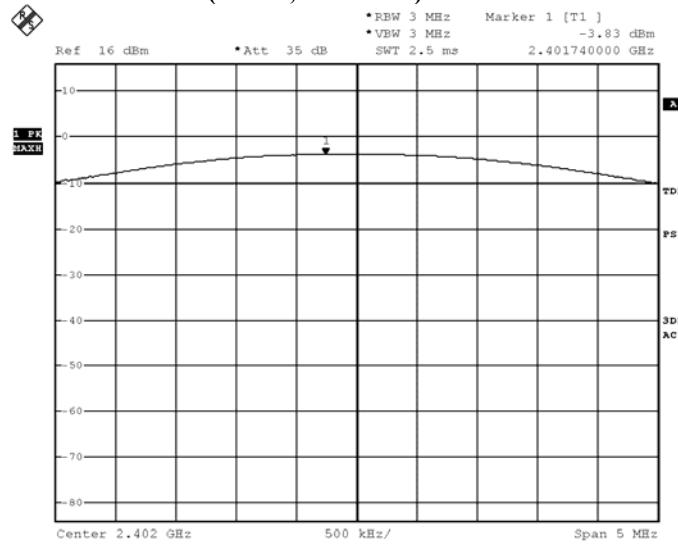
STC Test Report

Date: 2016-10-31

No.: DM124408

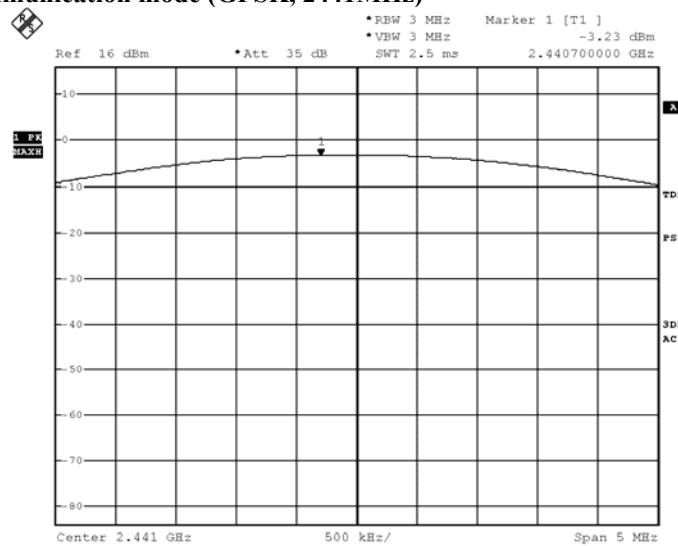
Page 9 of 87

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



BMP
Date: 26.JUL.2016 17:47:34

Bluetooth Communication mode (GFSK, 2441MHz)



BMP
Date: 26.JUL.2016 17:48:09

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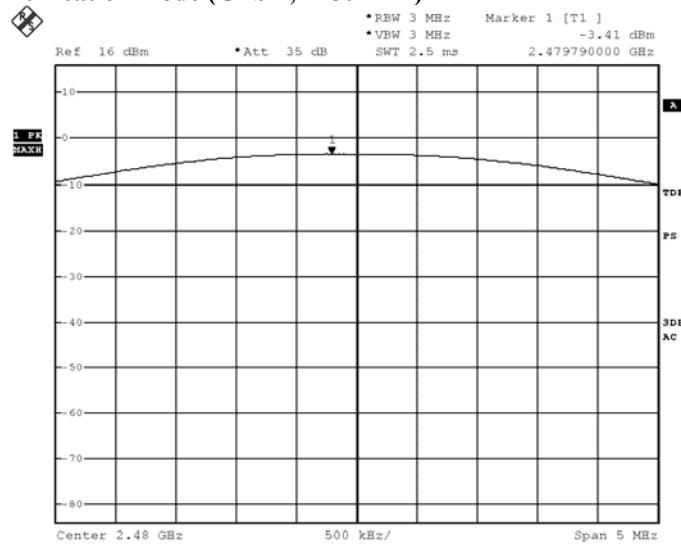
STC Test Report

Date: 2016-10-31

Page 10 of 87

No.: DM124408

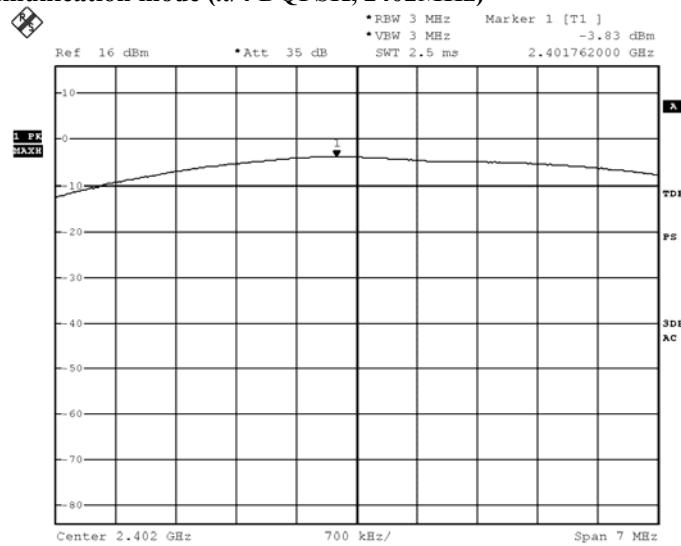
Bluetooth Communication mode (GFSK, 2480MHz)



BMP

Date: 26.JUL.2016 17:48:40

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



BMP

Date: 26.JUL.2016 17:46:50

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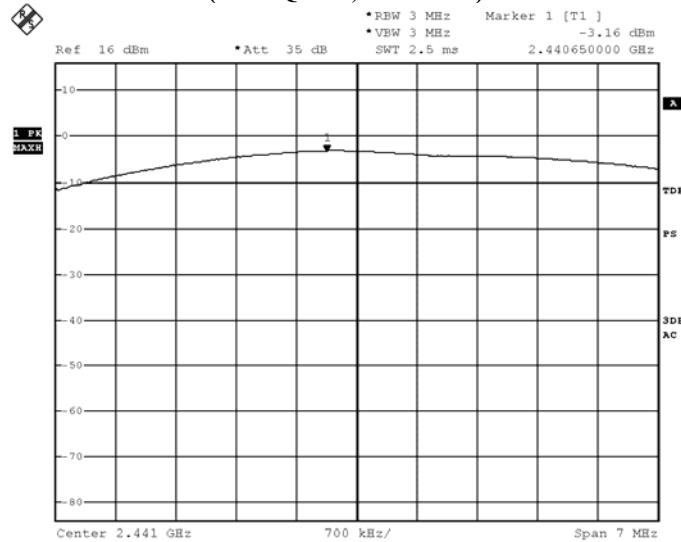
STC Test Report

Date: 2016-10-31

Page 11 of 87

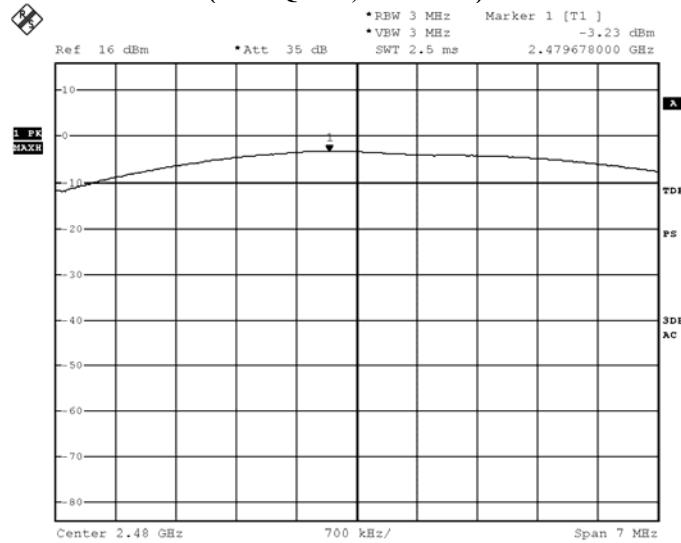
No.: DM124408

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



BMP
Date: 26.JUL.2016 17:16:47

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



BMP
Date: 26.JUL.2016 16:56:15

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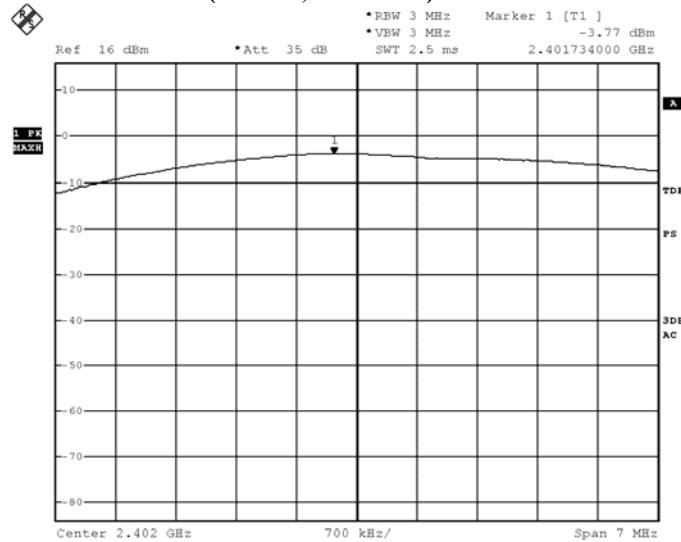
STC Test Report

Date: 2016-10-31

Page 12 of 87

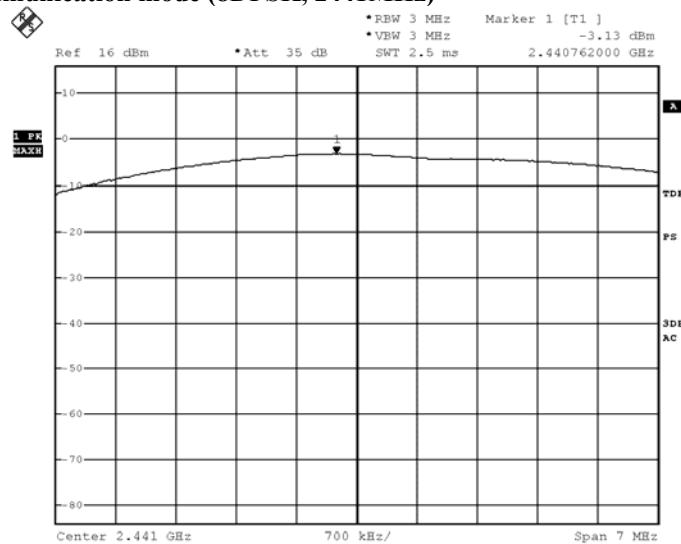
No.: DM124408

Bluetooth Communication mode (8DPSK, 2402MHz)



BMP
Date: 26.JUL.2016 17:35:38

Bluetooth Communication mode (8DPSK, 2441MHz)



BMP
Date: 26.JUL.2016 17:24:00

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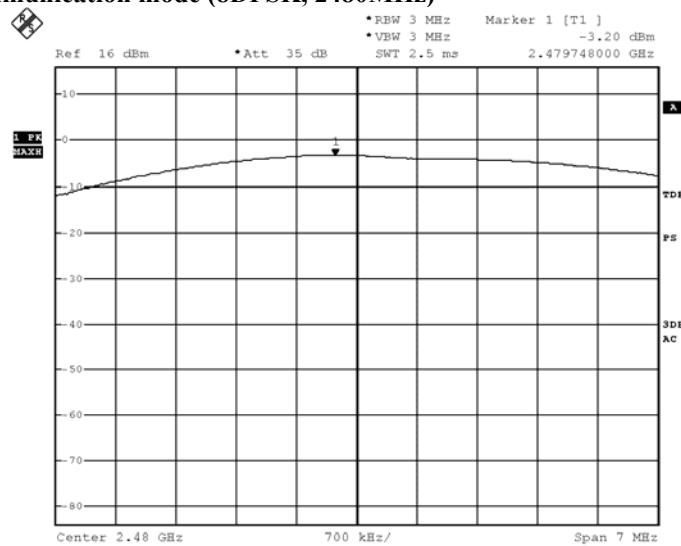
STC Test Report

Date: 2016-10-31

Page 13 of 87

No.: DM124408

Bluetooth Communication mode (8DPSK, 2480MHz)



BMP
Date: 26.JUL.2016 16:48:34

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STC Test Report

Date: 2016-10-31

Page 14 of 87

No.: DM124408

3.1.2 Radiated Spurious Emissions

Test Requirement:	FCC 47CFR 15.209
Test Method:	ANSI C63.10: 2013
Test Date:	2016-07-26
Mode of Operation:	Tx mode / Bluetooth Communication 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 STC (Dongguan) Company Ltd. 68 Fumin Nan Road, Dalang, Dongguan, Guangdong, PRC with a metal ground plane filed with the FCC pursuant to section 2.948 of the FCC rules, with Registration Number: 629686.

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STC Test Report

Date: 2016-10-31

Page 15 of 87

No.: DM124408

Spectrum Analyzer Setting:

9KHz – 30MHz (Pk & Av)

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

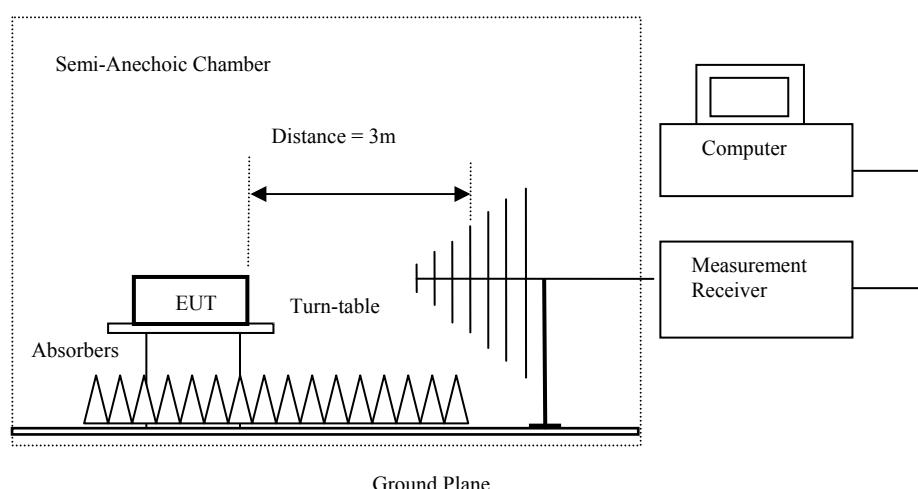
30MHz – 1GHz (QP)

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

Above 1GHz (Pk & Av)

RBW: 1MHz
VBW: 1MHz
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: 2016-10-31

Page 16 of 87

No.: DM124408

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

Frequency Range [MHz]	Quasi-Peak Limits [μ 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 Tx mode (2402.0 MHz) (GFSK mode) (9kHz – 30MHz): Pass

Field Strength of Spurious Emissions						
Peak Value						
Frequency MHz	Measured Level dB μ V	Correction Factor dB/m	Field Strength dB μ 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 (2402.0 MHz) (GFSK mode) (Above 1GHz): Pass

Field Strength of Spurious Emissions						
Peak Value						
Frequency MHz	Measured Level @3m dB μ V	Correction Factor dB/m	Field Strength dB μ V/m	Limit @3m dB μ V/m	Margin dB μ V/m	E-Field Polarity
4804.0	18.4	41.5	59.9	74.0	14.1	Vertical
4804.0	13.8	42.4	56.2	74.0	17.8	Horizontal
7206.0	13.1	45.1	58.2	74.0	15.8	Vertical
7206.0	8.2	46.2	54.4	74.0	19.6	Horizontal
9608.0	7.7	48.0	55.7	74.0	18.3	Vertical
9608.0	4.5	48.8	53.3	74.0	20.7	Horizontal
12010.0	3.7	51.8	55.5	74.0	18.5	Vertical
12010.0	0.7	52.4	53.1	74.0	20.9	Horizontal

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STC Test Report

Date: 2016-10-31

Page 17 of 87

No.: DM124408

Result of Tx mode (2402.0 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
4804.0	3.2	41.5	44.7	54.0	9.3	Vertical
4804.0	-1.4	42.4	41.0	54.0	13.0	Horizontal
7206.0	-2.2	45.1	42.9	54.0	11.1	Vertical
7206.0	-6.9	46.2	39.3	54.0	14.7	Horizontal
9608.0	-7.5	48.0	40.5	54.0	13.5	Vertical
9608.0	-10.7	48.8	38.1	54.0	15.9	Horizontal
12010.0	-11.7	51.8	40.1	54.0	13.9	Vertical
12010.0	-14.4	52.4	38.0	54.0	16.0	Horizontal

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

Field Strength of Spurious Emissions						
Peak Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4882.0	16.3	41.6	57.9	74.0	16.1	Vertical
4882.0	12.8	42.5	55.3	74.0	18.7	Horizontal
7323.0	3.2	53.2	56.4	74.0	17.6	Vertical
7323.0	7.2	46.3	53.5	74.0	20.5	Horizontal
9764.0	7.6	48.1	55.7	74.0	18.3	Vertical
9764.0	5.4	48.9	54.3	74.0	19.7	Horizontal
12205.0	3.7	51.6	55.3	74.0	18.7	Vertical
12205.0	1.6	52.5	54.1	74.0	19.9	Horizontal

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STC Test Report

Date: 2016-10-31

Page 18 of 87

No.: DM124408

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

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4882.0	1.1	41.6	42.7	54.0	11.3	Vertical
4882.0	-2.4	42.5	40.1	54.0	13.9	Horizontal
7323.0	-4.1	45.2	41.1	54.0	12.9	Vertical
7323.0	-7.9	46.3	38.4	54.0	15.6	Horizontal
9764.0	-7.5	48.1	40.6	54.0	13.4	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	-13.5	52.5	39.0	54.0	15.0	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	17.3	41.4	58.7	74.0	15.3	Vertical
4960.0	13.5	42.7	56.2	74.0	17.8	Horizontal
7440.0	10.7	45.6	56.3	74.0	17.7	Vertical
7440.0	6.7	46.5	53.2	74.0	20.8	Horizontal
9920.0	6.9	48.6	55.5	74.0	18.5	Vertical
9920.0	4.0	49.7	53.7	74.0	20.3	Horizontal
12400.0	3.1	51.7	54.8	74.0	19.2	Vertical
12400.0	0.6	52.7	53.3	74.0	20.7	Horizontal

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STC Test Report

Date: 2016-10-31

Page 19 of 87

No.: DM124408

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	2.2	41.4	43.6	54.0	10.4	Vertical
4960.0	-1.7	42.7	41.0	54.0	13.0	Horizontal
7440.0	-4.6	45.6	41.0	54.0	13.0	Vertical
7440.0	-8.5	46.5	38.0	54.0	16.0	Horizontal
9920.0	-8.2	48.6	40.4	54.0	13.6	Vertical
9920.0	-11.2	49.7	38.5	54.0	15.5	Horizontal
12400.0	-12.2	51.7	39.5	54.0	14.5	Vertical
12400.0	-14.6	52.7	38.1	54.0	15.9	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 dB μ V	Correction Factor dB/m	Field Strength dB μ V/m	Limit @3m dB μ V/m	Margin dB μ V/m	E-Field Polarity
4804.0	17.4	41.5	58.9	74.0	15.1	Vertical
4804.0	14.0	42.4	56.4	74.0	17.6	Horizontal
7206.0	12.9	45.1	58.0	74.0	16.0	Vertical
7206.0	8.0	46.2	54.2	74.0	19.8	Horizontal
9608.0	8	48.0	56.0	74.0	18.0	Vertical
9608.0	5.3	48.8	54.1	74.0	19.9	Horizontal
12010.0	4.0	51.8	55.8	74.0	18.2	Vertical
12010.0	0.9	52.4	53.3	74.0	20.7	Horizontal

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STC Test Report

Date: 2016-10-31

Page 20 of 87

No.: DM124408

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	2.3	41.5	43.8	54.0	10.2	Vertical
4804.0	-1.3	42.4	41.1	54.0	12.9	Horizontal
7206.0	-2.4	45.1	42.7	54.0	11.3	Vertical
7206.0	-7.1	46.2	39.1	54.0	14.9	Horizontal
9608.0	-7.1	48.0	40.9	54.0	13.1	Vertical
9608.0	-9.9	48.8	38.9	54.0	15.1	Horizontal
12010.0	-11.3	51.8	40.5	54.0	13.5	Vertical
12010.0	-14.2	52.4	38.2	54.0	15.8	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 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	16.4	41.6	58.0	74.0	16.0	Vertical
4882.0	13.0	42.5	55.5	74.0	18.5	Horizontal
7323.0	3.1	53.2	56.3	74.0	17.7	Vertical
7323.0	7.9	46.3	54.2	74.0	19.8	Horizontal
9764.0	7.4	48.1	55.5	74.0	18.5	Vertical
9764.0	4.5	48.9	53.4	74.0	20.6	Horizontal
12205.0	3.2	51.6	54.8	74.0	19.2	Vertical
12205.0	0.8	52.5	53.3	74.0	20.7	Horizontal

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STC Test Report

Date: 2016-10-31

Page 21 of 87

No.: DM124408

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	1.3	41.6	42.9	54.0	11.1	Vertical
4882.0	-2.2	42.5	40.3	54.0	13.7	Horizontal
7323.0	-4.2	45.2	41.0	54.0	13.0	Vertical
7323.0	-7.3	46.3	39.0	54.0	15.0	Horizontal
9764.0	-7.7	48.1	40.4	54.0	13.6	Vertical
9764.0	-10.7	48.9	38.2	54.0	15.8	Horizontal
12205.0	-11.9	51.6	39.7	54.0	14.3	Vertical
12205.0	-14.4	52.5	38.1	54.0	15.9	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	16.7	41.4	58.1	74.0	15.9	Vertical
4960.0	13.1	42.7	55.8	74.0	18.2	Horizontal
7440.0	10.5	45.6	56.1	74.0	17.9	Vertical
7440.0	7.7	46.5	54.2	74.0	19.8	Horizontal
9920.0	7.2	48.6	55.8	74.0	18.2	Vertical
9920.0	4.5	49.7	54.2	74.0	19.8	Horizontal
12400.0	3.7	51.7	55.4	74.0	18.6	Vertical
12400.0	0.5	52.7	53.2	74.0	20.8	Horizontal

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STC Test Report

Date: 2016-10-31

Page 22 of 87

No.: DM124408

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	1.6	41.4	43.0	54.0	11.0	Vertical
4960.0	-2.2	42.7	40.5	54.0	13.5	Horizontal
7440.0	-4.8	45.6	40.8	54.0	13.2	Vertical
7440.0	-7.4	46.5	39.1	54.0	14.9	Horizontal
9920.0	-7.9	48.6	40.7	54.0	13.3	Vertical
9920.0	-10.7	49.7	39.0	54.0	15.0	Horizontal
12400.0	-11.6	51.7	40.1	54.0	13.9	Vertical
12400.0	-14.6	52.7	38.1	54.0	15.9	Horizontal

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

Field Strength of Spurious Emissions						
Peak Value						
Frequency MHz	Measured Level @3m dB μ V	Correction Factor dB/m	Field Strength dB μ V/m	Limit @3m dB μ V/m	Margin dB μ V/m	E-Field Polarity
4804.0	17.6	41.5	59.1	74.0	14.9	Vertical
4804.0	14.1	42.4	56.5	74.0	17.5	Horizontal
7206.0	12.8	45.1	57.9	74.0	16.1	Vertical
7206.0	8.9	46.2	55.1	74.0	18.9	Horizontal
9608.0	8.2	48.0	56.2	74.0	17.8	Vertical
9608.0	4.9	48.8	53.7	74.0	20.3	Horizontal
12010.0	3.7	51.8	55.5	74.0	18.5	Vertical
12010.0	0.9	52.4	53.3	74.0	20.7	Horizontal

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STC Test Report

Date: 2016-10-31

Page 23 of 87

No.: DM124408

Result of Tx mode (2402.0 MHz) (8DPSK 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	2.4	41.5	43.9	54.0	10.1	Vertical
4804.0	-1.1	42.4	41.3	54.0	12.7	Horizontal
7206.0	-2.5	45.1	42.6	54.0	11.4	Vertical
7206.0	-6.2	46.2	40.0	54.0	14.0	Horizontal
9608.0	-7.0	48.0	41.0	54.0	13.0	Vertical
9608.0	-10.3	48.8	38.5	54.0	15.5	Horizontal
12010.0	-11.7	51.8	40.1	54.0	13.9	Vertical
12010.0	-14.2	52.4	38.2	54.0	15.8	Horizontal

Result of Tx mode (2441.0 MHz) (8DPSK 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 (2441.0 MHz) (8DPSK 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	16.7	41.6	58.3	74.0	15.7	Vertical
4882.0	13.6	42.5	56.1	74.0	17.9	Horizontal
7323.0	3.5	53.2	56.7	74.0	17.3	Vertical
7323.0	7.4	46.3	53.7	74.0	20.3	Horizontal
9764.0	8	48.1	56.1	74.0	17.9	Vertical
9764.0	4.8	48.9	53.7	74.0	20.3	Horizontal
12205.0	4.2	51.6	55.8	74.0	18.2	Vertical
12205.0	1.7	52.5	54.2	74.0	19.8	Horizontal

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STC Test Report

Date: 2016-10-31

Page 24 of 87

No.: DM124408

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

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4882.0	1.6	41.6	43.2	54.0	10.8	Vertical
4882.0	-1.6	42.5	40.9	54.0	13.1	Horizontal
7323.0	-3.8	45.2	41.4	54.0	12.6	Vertical
7323.0	-7.7	46.3	38.6	54.0	15.4	Horizontal
9764.0	-7.1	48.1	41.0	54.0	13.0	Vertical
9764.0	-10.4	48.9	38.5	54.0	15.5	Horizontal
12205.0	-11.0	51.6	40.6	54.0	13.4	Vertical
12205.0	-13.5	52.5	39.0	54.0	15.0	Horizontal

Result of Tx mode (2480.0 MHz) (8DPSK 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) (8DPSK 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	16.5	41.4	57.9	74.0	16.1	Vertical
4960.0	12.5	42.7	55.2	74.0	18.8	Horizontal
7440.0	10.5	45.6	56.1	74.0	17.9	Vertical
7440.0	6.9	46.5	53.4	74.0	20.6	Horizontal
9920.0	7.6	48.6	56.2	74.0	17.8	Vertical
9920.0	4.2	49.7	53.9	74.0	20.1	Horizontal
12400.0	3.8	51.7	55.5	74.0	18.5	Vertical
12400.0	0.9	52.7	53.6	74.0	20.4	Horizontal

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STC Test Report

Date: 2016-10-31

Page 25 of 87

No.: DM124408

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

Field Strength of Spurious Emissions						
Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4960.0	1.4	41.4	42.8	54.0	11.2	Vertical
4960.0	-2.7	42.7	40.0	54.0	14.0	Horizontal
7440.0	-4.8	45.6	40.8	54.0	13.2	Vertical
7440.0	-8.2	46.5	38.3	54.0	15.7	Horizontal
9920.0	-7.5	48.6	41.1	54.0	12.9	Vertical
9920.0	-11.1	49.7	38.6	54.0	15.4	Horizontal
12400.0	-11.5	51.7	40.2	54.0	13.8	Vertical
12400.0	-14.2	52.7	38.5	54.0	15.5	Horizontal

Remarks:

* Denotes restricted band of operation.

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

Correction Factor included Antenna Factor and Cable Attenuation.

Calculated measurement uncertainty: (9kHz - 30MHz): 3.3dB

(30MHz - 1GHz): 4.6dB

(1GHz - 26GHz): 4.4dB

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

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STC Test Report

Date: 2016-10-31

Page 26 of 87

No.: DM124408

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 μ V	Correction Factor dB/m	Field Strength dB μ V/m	Limit @3m dB μ V/m	Margin dB μ V/m	E-Field Polarity
2390.0	12.0	36.8	48.8	74.0	25.2	Vertical
2390.0	9.9	36.4	46.3	74.0	27.7	Horizontal

Field Strength of Band-edge Compliance						
Average Value						
Frequency MHz	Measured Level @3m dB μ V	Correction Factor dB/m	Field Strength dB μ V/m	Limit @3m dB μ V/m	Margin dB μ V/m	E-Field Polarity
2390.0	1.6	36.8	38.4	54.0	15.6	Vertical
2390.0	-0.6	36.4	35.8	54.0	18.2	Horizontal

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

Field Strength of Band-edge Compliance						
Peak Value						
Frequency MHz	Measured Level @3m dB μ V	Correction Factor dB/m	Field Strength dB μ V/m	Limit @3m dB μ V/m	Margin dB μ V/m	E-Field Polarity
2483.5	8.4	36.8	45.2	74.0	28.8	Vertical
2483.5	6.7	36.4	43.1	74.0	30.9	Horizontal

Field Strength of Band-edge Compliance						
Average Value						
Frequency MHz	Measured Level @3m dB μ V	Correction Factor dB/m	Field Strength dB μ V/m	Limit @3m dB μ V/m	Margin dB μ V/m	E-Field Polarity
2483.5	-1.8	36.8	35.0	54.0	19.0	Vertical
2483.5	-3.6	36.4	32.8	54.0	21.2	Horizontal

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STC Test Report

Date: 2016-10-31

Page 27 of 87

No.: DM124408

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 μ V	Correction Factor dB/m	Field Strength dB μ V/m	Limit @3m dB μ V/m	Margin dB μ V/m	E-Field Polarity
2390.0	10.8	36.8	47.6	74.0	26.4	Vertical
2390.0	8.3	36.4	44.7	74.0	29.3	Horizontal

Field Strength of Band-edge Compliance						
Average Value						
Frequency MHz	Measured Level @3m dB μ V	Correction Factor dB/m	Field Strength dB μ V/m	Limit @3m dB μ V/m	Margin dB μ V/m	E-Field Polarity
2390.0	0.4	36.8	37.2	54.0	16.8	Vertical
2390.0	-2.2	36.4	34.2	54.0	19.8	Horizontal

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 μ V	Correction Factor dB/m	Field Strength dB μ V/m	Limit @3m dB μ V/m	Margin dB μ V/m	E-Field Polarity
2483.5	9.5	36.8	46.3	74.0	27.7	Vertical
2483.5	7.6	36.4	44.0	74.0	30.0	Horizontal

Field Strength of Band-edge Compliance						
Average Value						
Frequency MHz	Measured Level @3m dB μ V	Correction Factor dB/m	Field Strength dB μ V/m	Limit @3m dB μ V/m	Margin dB μ V/m	E-Field Polarity
2483.5	-0.7	36.8	36.1	54.0	17.9	Vertical
2483.5	-2.6	36.4	33.8	54.0	20.2	Horizontal

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STC Test Report

Date: 2016-10-31

Page 28 of 87

No.: DM124408

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 μ V	Correction Factor dB/m	Field Strength dB μ V/m	Limit @3m dB μ V/m	Margin dB μ V/m	E-Field Polarity
2390.0	11.4	36.8	48.2	74.0	25.8	Vertical
2390.0	8.9	36.4	45.3	74.0	28.7	Horizontal

Field Strength of Band-edge Compliance						
Average Value						
Frequency MHz	Measured Level @3m dB μ V	Correction Factor dB/m	Field Strength dB μ V/m	Limit @3m dB μ V/m	Margin dB μ V/m	E-Field Polarity
2390.0	1.0	36.8	37.8	54.0	16.2	Vertical
2390.0	-1.6	36.4	34.8	54.0	19.2	Horizontal

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

Field Strength of Band-edge Compliance						
Peak Value						
Frequency MHz	Measured Level @3m dB μ V	Correction Factor dB/m	Field Strength dB μ V/m	Limit @3m dB μ V/m	Margin dB μ V/m	E-Field Polarity
2483.5	9.8	36.8	46.6	74.0	27.4	Vertical
2483.5	7.7	36.4	44.1	74.0	29.9	Horizontal

Field Strength of Band-edge Compliance						
Average Value						
Frequency MHz	Measured Level @3m dB μ V	Correction Factor dB/m	Field Strength dB μ V/m	Limit @3m dB μ V/m	Margin dB μ V/m	E-Field Polarity
2483.5	-0.4	36.8	36.4	54.0	17.6	Vertical
2483.5	-2.6	36.4	33.8	54.0	20.2	Horizontal

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STC Test Report

Date: 2016-10-31

Page 29 of 87

No.: DM124408

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

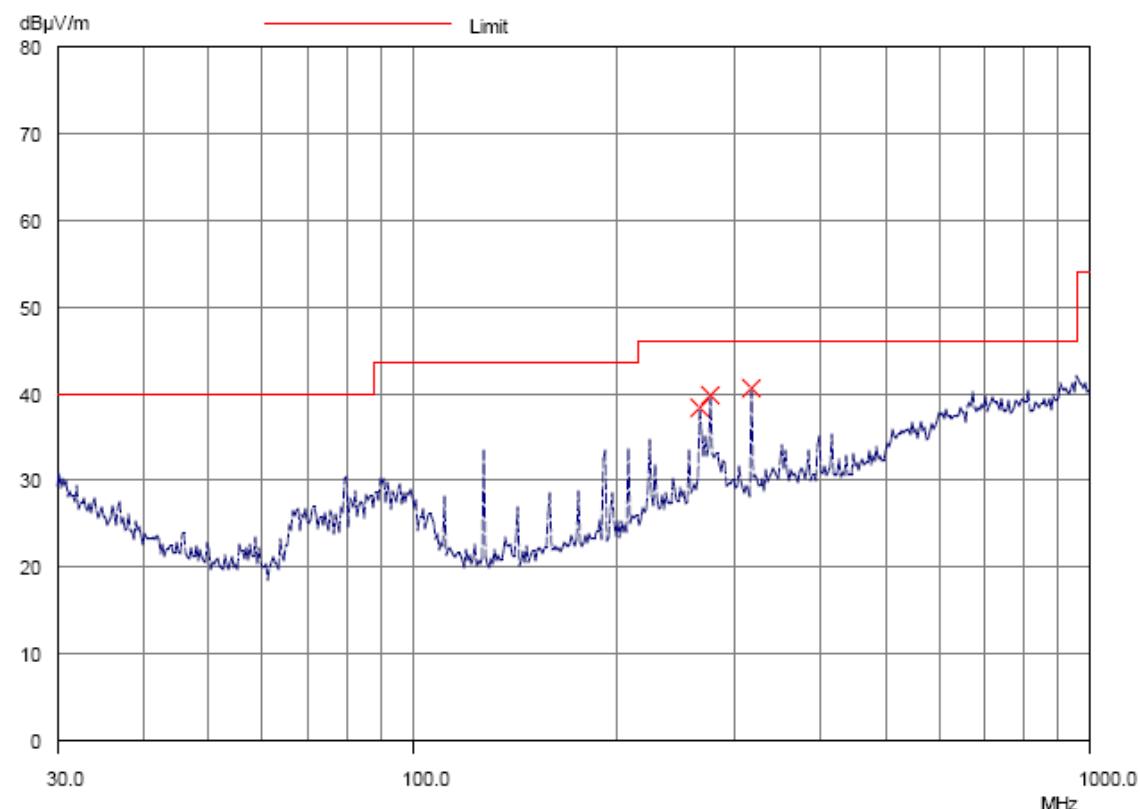
Frequency Range [MHz]	Quasi-Peak Limits [μ V/m]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

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 (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: 2016-10-31

Page 30 of 87

No.: DM124408

Result of Bluetooth Communication mode (2402MHz, GFSK) (30MHz – 1GHz): Pass

Radiated Emissions Quasi-Peak					
Emission Frequency MHz	E-Field Polarity	Level @3m dBμV/m	Limit @3m dBμV/m	Level @3m μV/m	Limit @3m μV/m
264.8	Horizontal	38.1	46.0	80.4	200
275.4	Horizontal	39.4	46.0	93.3	200
315.4	Horizontal	40.3	46.0	103.5	200

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STC Test Report

Date: 2016-10-31

Page 31 of 87

No.: DM124408

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

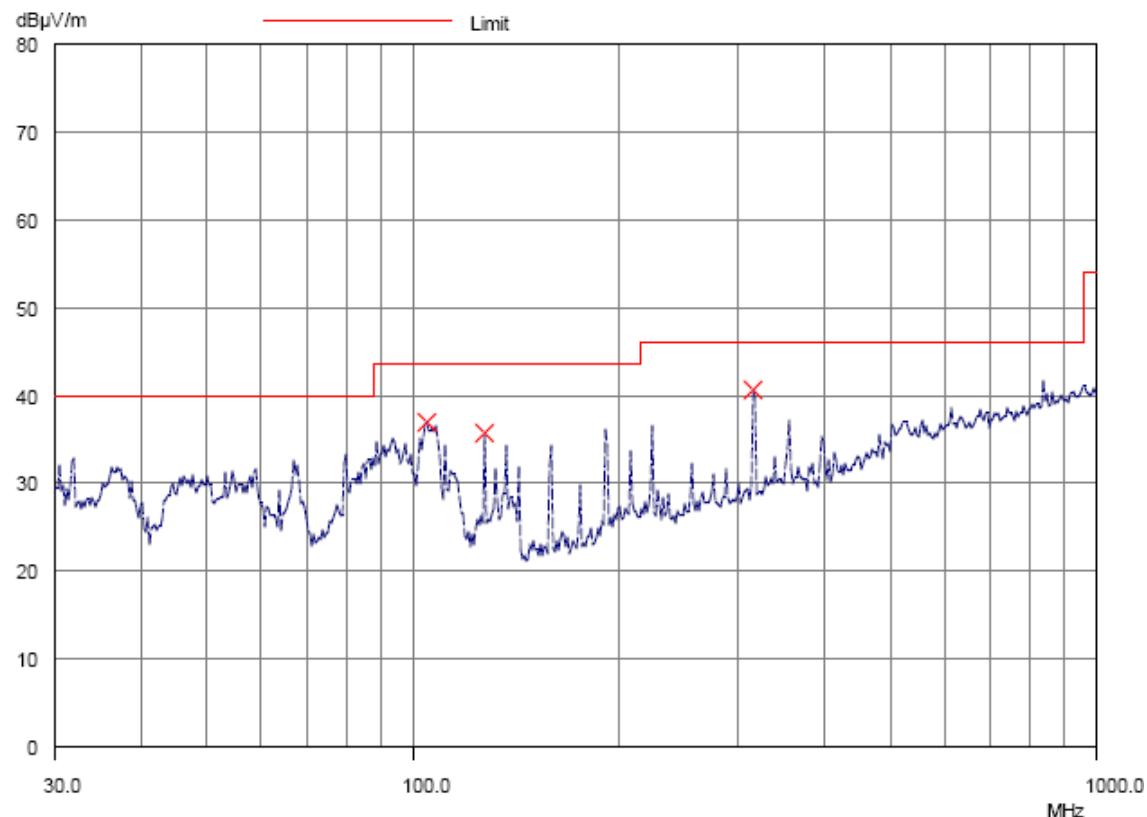
Frequency Range [MHz]	Quasi-Peak Limits [μ V/m]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

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 (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: 2016-10-31

Page 32 of 87

No.: DM124408

Result of Bluetooth Communication mode (2402MHz, GFSK) (30MHz – 1GHz): Pass

Radiated Emissions Quasi-Peak					
Emission Frequency MHz	E-Field Polarity	Level @3m dB μ V/m	Limit @3m dB μ V/m	Level @3m μ V/m	Limit @3m μ V/m
105.4	Vertical	36.8	43.5	69.2	150
127.6	Vertical	35.4	43.5	58.9	150
314.5	Vertical	40.6	46.0	107.2	200

Remarks:

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

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

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STC Test Report

Date: 2016-10-31

Page 33 of 87

No.: DM124408

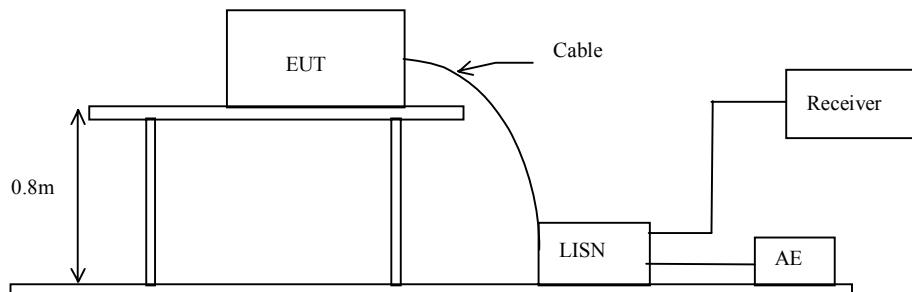
3.1.3 AC Mains Conducted Emissions (0.15MHz to 30MHz)

Test Requirement:	FCC 47CFR 15.207
Test Method:	ANSI C63.10: 2013
Test Date:	2016-09-18
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: 2016-10-31

Page 34 of 87

No.: DM124408

Limit for Conducted Emissions (FCC 47 CFR 15.207):

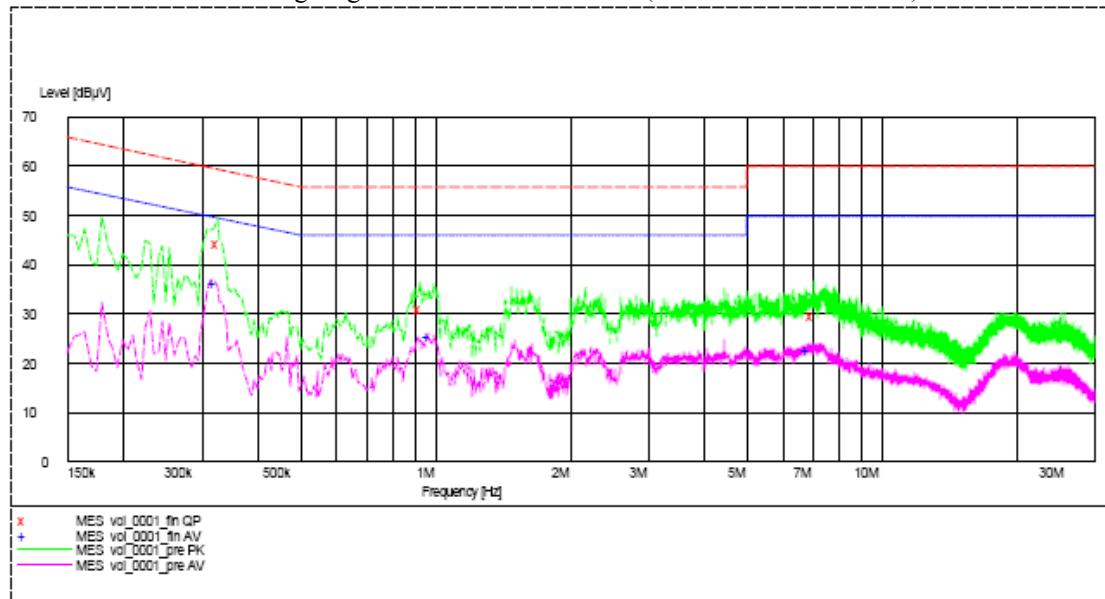
Frequency Range [MHz]	Quasi-Peak Limits [dB μ V]	Average [dB μ V]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

* 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. (The data is the worst cases)



Conductor Live or Neutral	Frequency MHz	Quasi-peak		Average	
		Level dB μ V	Limit dB μ V	Level dB μ V	Limit dB μ V
Live	0.325	44.4	60.0	-*-	-*-
Live	0.925	31.0	56.0	-*-	-*-
Live	7.040	29.6	60.0	-*-	-*-
Live	0.320	-*-	-*-	36.3	50.0
Live	0.965	-*-	-*-	25.6	46.0
Live	6.805	-*-	-*-	22.7	50.0

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STC Test Report

Date: 2016-10-31

Page 35 of 87

No.: DM124408

Limit for Conducted Emissions (FCC 47 CFR 15.207):

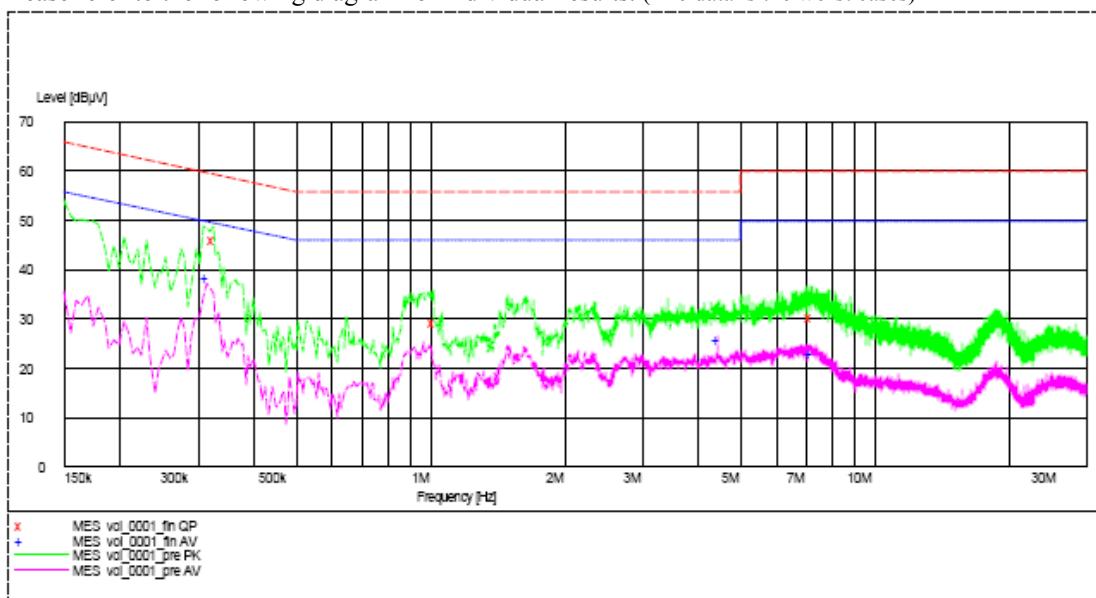
Frequency Range [MHz]	Quasi-Peak Limits [dB μ V]	Average [dB μ V]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

* 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. (The data is the worst cases)



Conductor Live or Neutral	Frequency MHz	Quasi-peak		Average	
		Level dB μ V	Limit dB μ V	Level dB μ V	Limit dB μ V
Neutral	0.325	46.1	60.0	-*-	-*-
Neutral	1.020	29.4	56.0	-*-	-*-
Neutral	7.225	30.4	60.0	-*-	-*-
Neutral	0.315	-*-	-*-	38.5	50.0
Neutral	4.435	-*-	-*-	25.7	46.0
Neutral	7.220	-*-	-*-	23.1	50.0

Remarks:

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

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

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Date: 2016-10-31

Page 36 of 87

No.: DM124408

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:

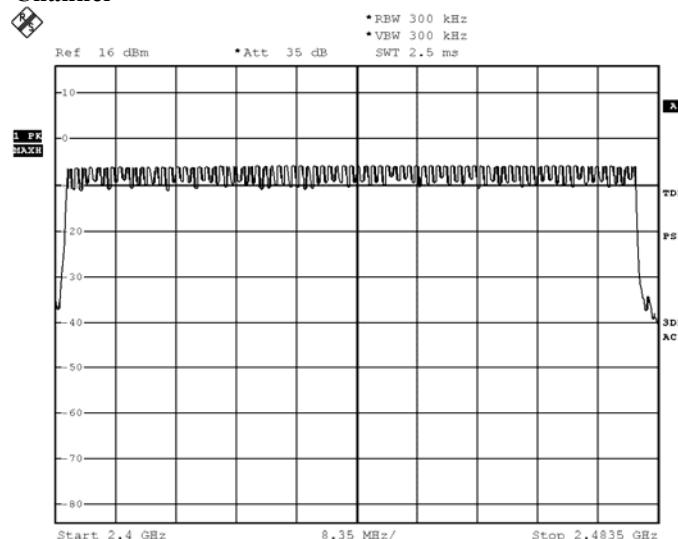
RBW = 1MHz, VBW \geq RBW, Sweep = Auto, Span = the frequency band of operation
Detector = Peak, Trace = Max. hold

Test Setup:

As Test Setup of clause 3.1.1 in this test report.

Measurement Data:

GFSK: 79 of 79 Channel



BMP
Date: 26.JUL.2016 12:44:48

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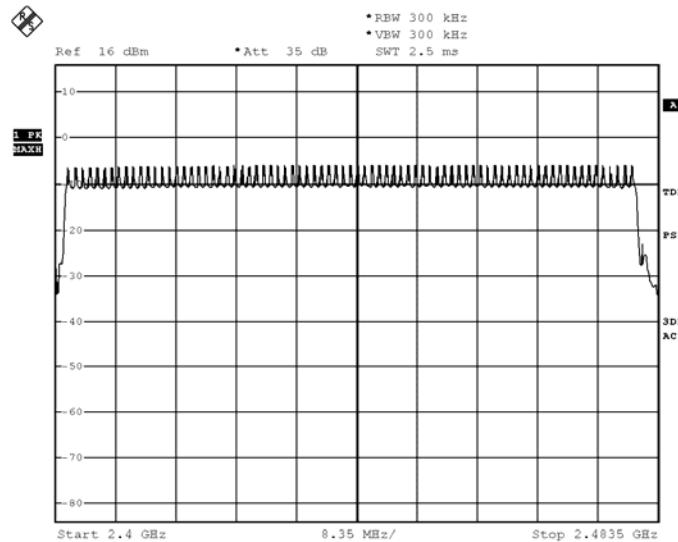
STC Test Report

Date: 2016-10-31

Page 37 of 87

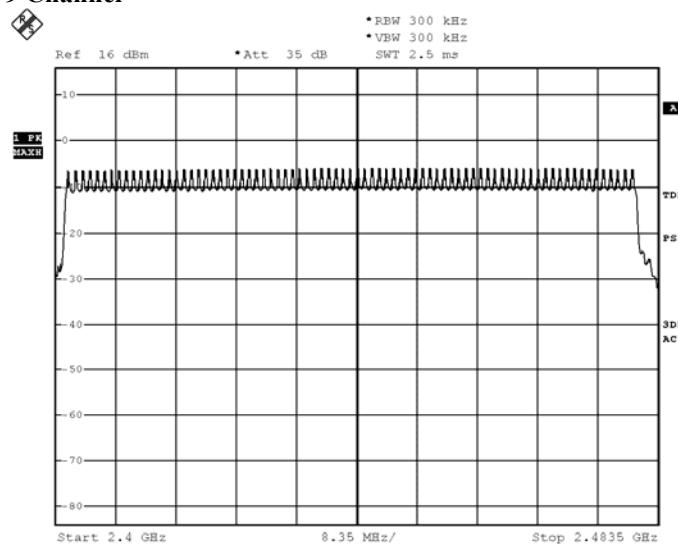
No.: DM124408

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



BMP
Date: 26.JUL.2016 13:01:28

8DPSK: 79 of 79 Channel



BMP
Date: 26.JUL.2016 14:53:36

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STC Test Report

Date: 2016-10-31

Page 38 of 87

No.: DM124408

3.1.5 20dB Bandwidth

Test Requirement:	FCC 47CFR 15.247(a)(1)
Test Method:	ANSI C63.10: 2013
Test Date:	2016-07-26
Mode of Operation:	TX mode

Remark:

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

Test Method:

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

Test Setup:

As Test Setup of clause 3.1.1 in this test report.

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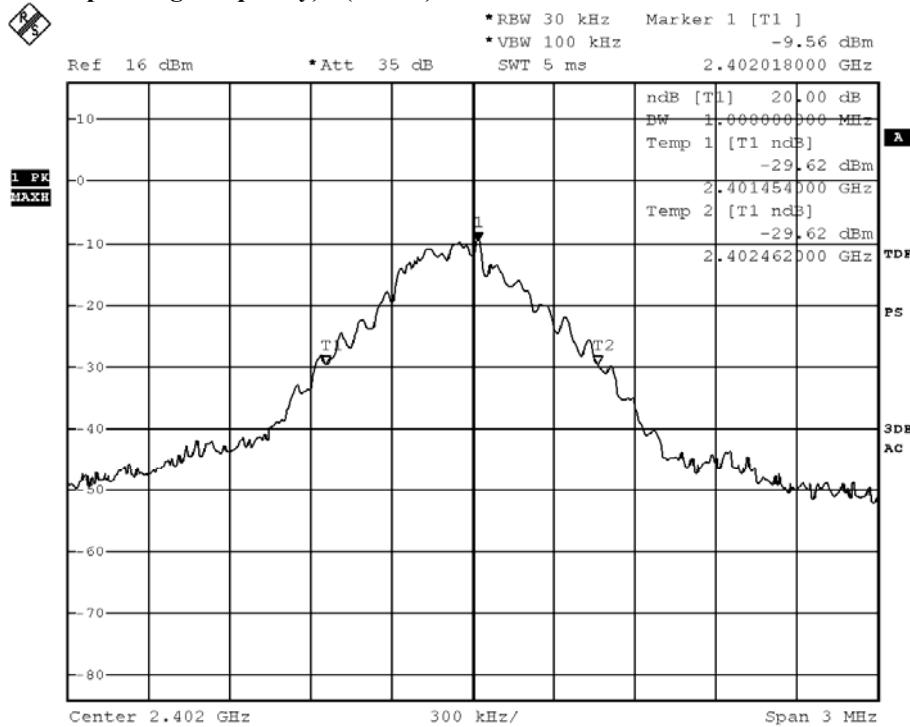
Date: 2016-10-31

Page 39 of 87

No.: DM124408

Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	1.00	Within 2400-2483.5

(Lowest Operating Frequency) - (GFSK)



BMP

Date: 26.JUL.2016 15:32:01

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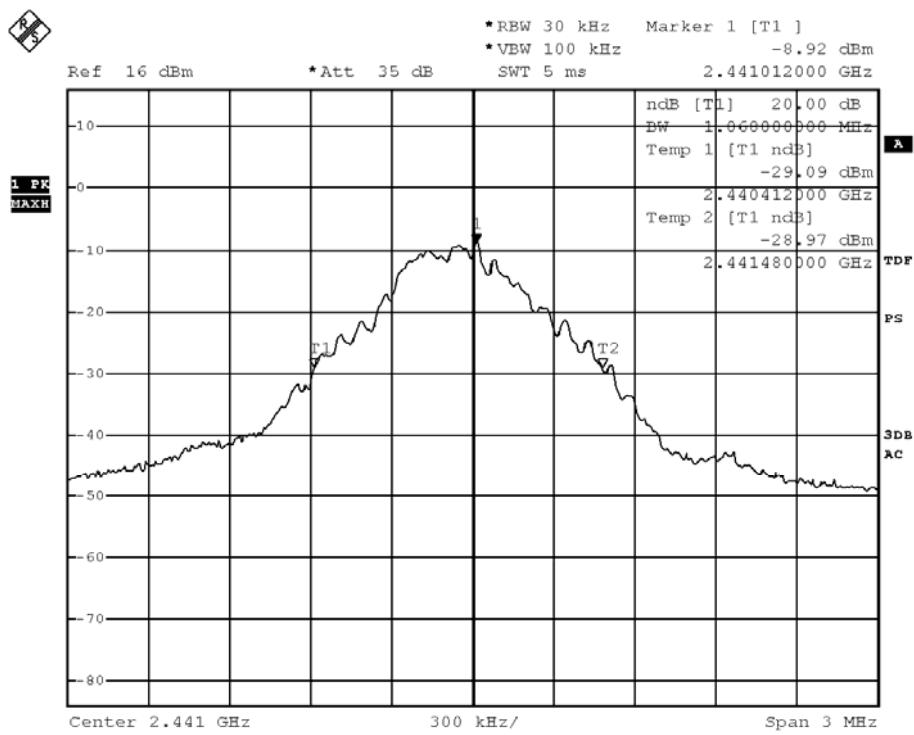
Date: 2016-10-31

Page 40 of 87

No.: DM124408

Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2441	1.06	Within 2400-2483.5

(Middle Operating Frequency) - (GFSK)



BMP

Date: 26.JUL.2016 15:58:42

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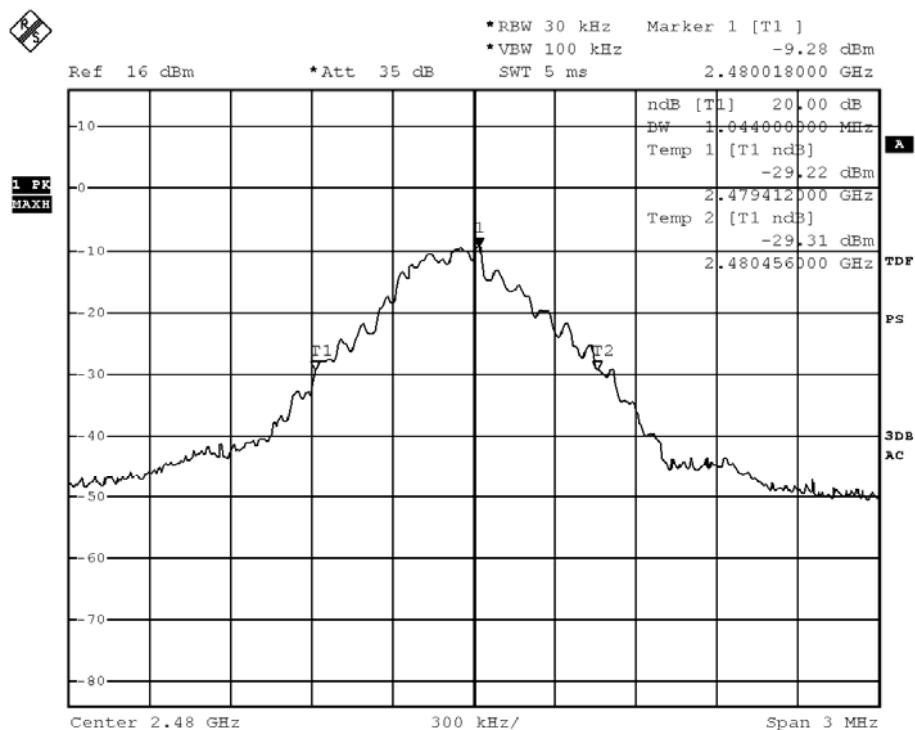
Date: 2016-10-31

Page 41 of 87

No.: DM124408

Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2480	1.044	Within 2400-2483.5

(Highest Operating Frequency) - (GFSK)



BMP

Date: 26.JUL.2016 16:00:32

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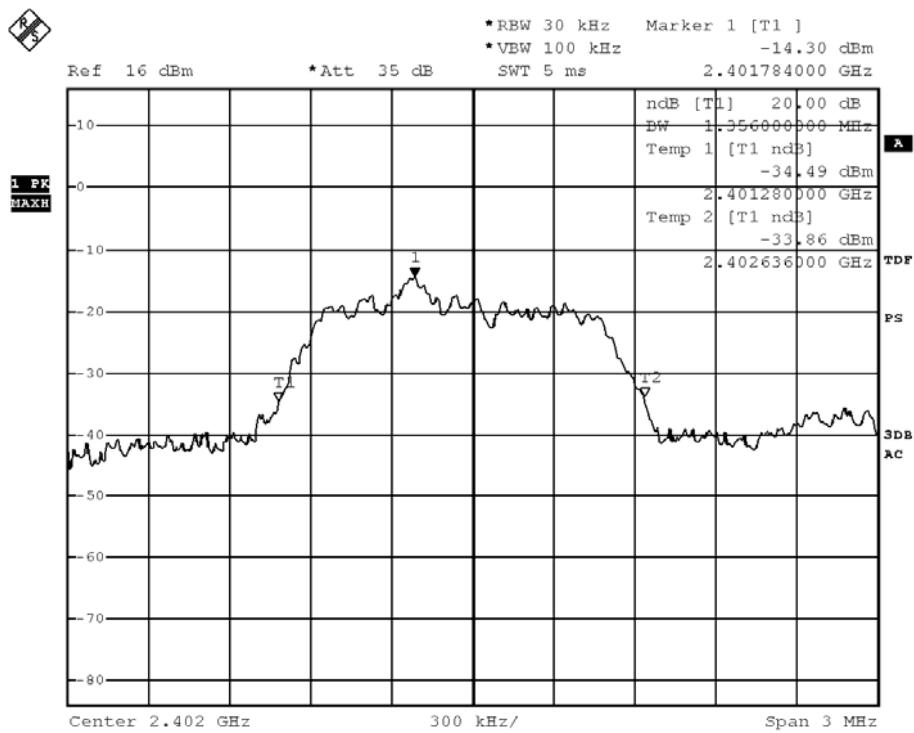
Date: 2016-10-31

Page 42 of 87

No.: DM124408

Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	1.356	Within 2400-2483.5

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



BMP

Date: 26.JUL.2016 15:32:59

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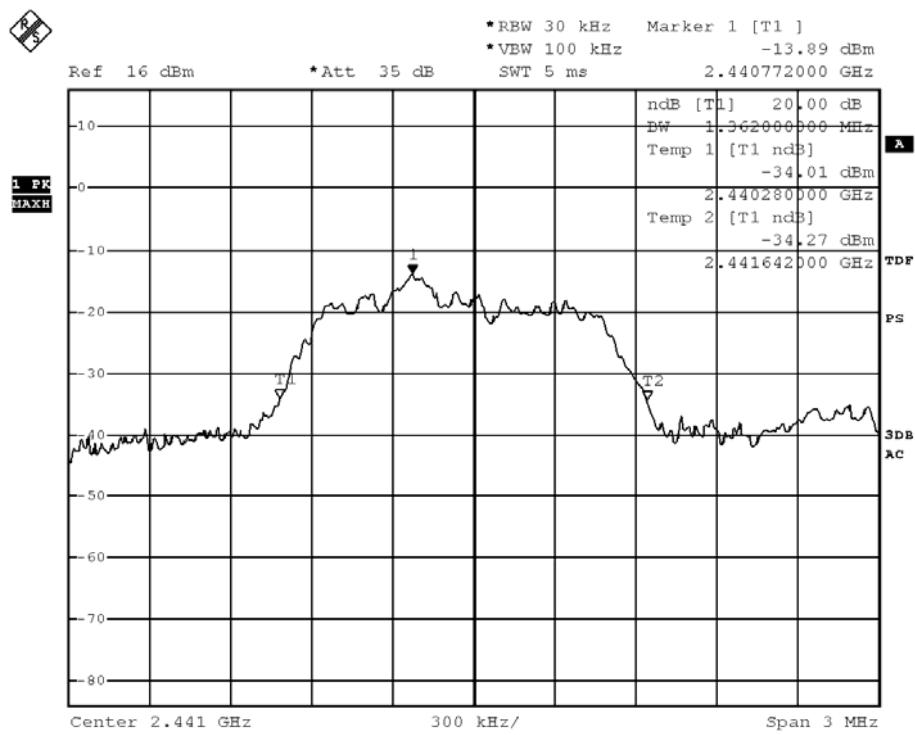
Date: 2016-10-31

Page 43 of 87

No.: DM124408

Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2441	1.362	Within 2400-2483.5

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



BMP

Date: 26.JUL.2016 15:39:07

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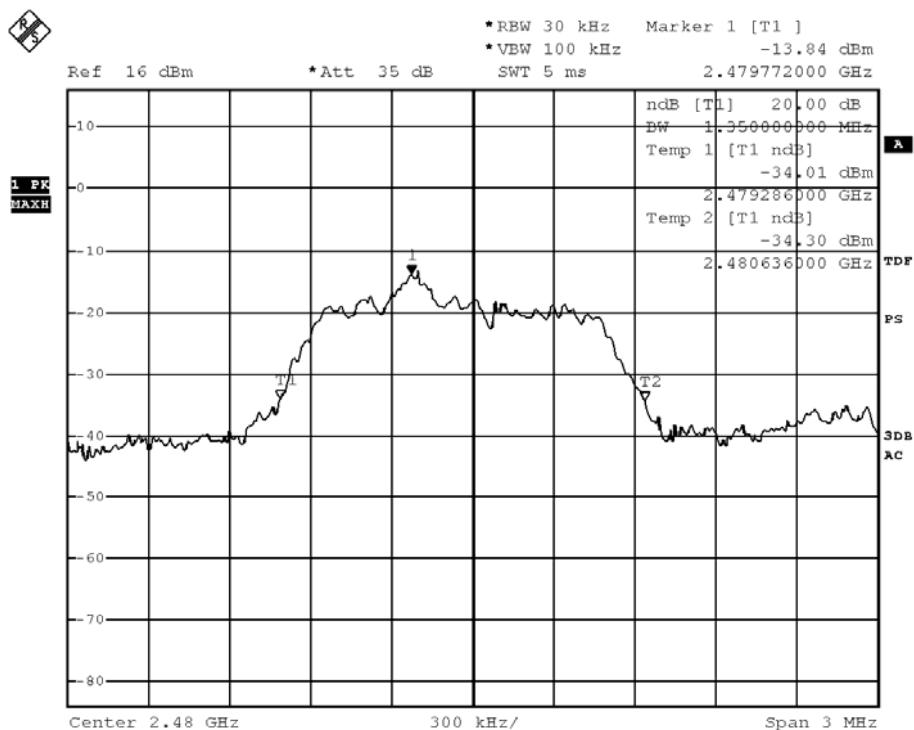
Date: 2016-10-31

Page 44 of 87

No.: DM124408

Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2480	1.350	Within 2400-2483.5

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



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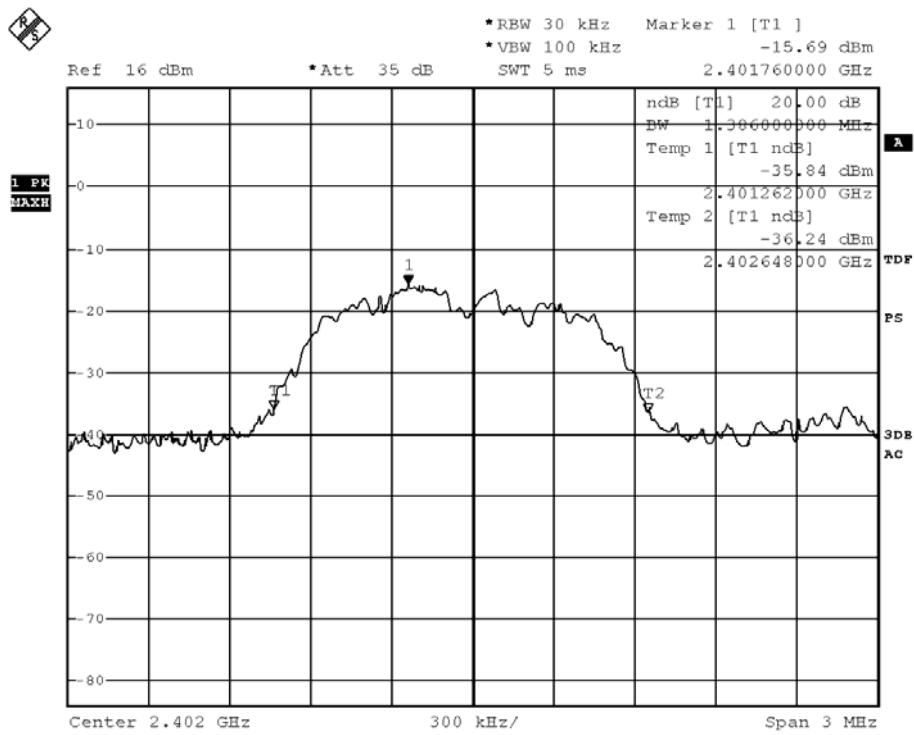
Date: 2016-10-31

Page 45 of 87

No.: DM124408

Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	1.386	Within 2400-2483.5

(Lowest Operating Frequency) - (8DPSK)



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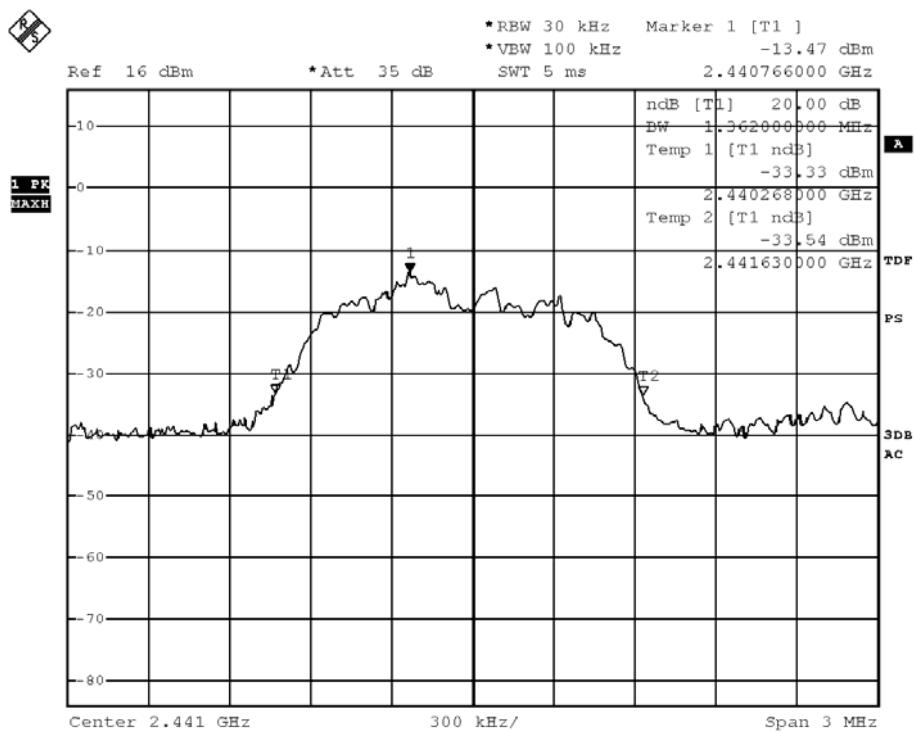
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Page 46 of 87

No.: DM124408

Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2441	1.362	Within 2400-2483.5

(Middle Operating Frequency) - (8DPSK)



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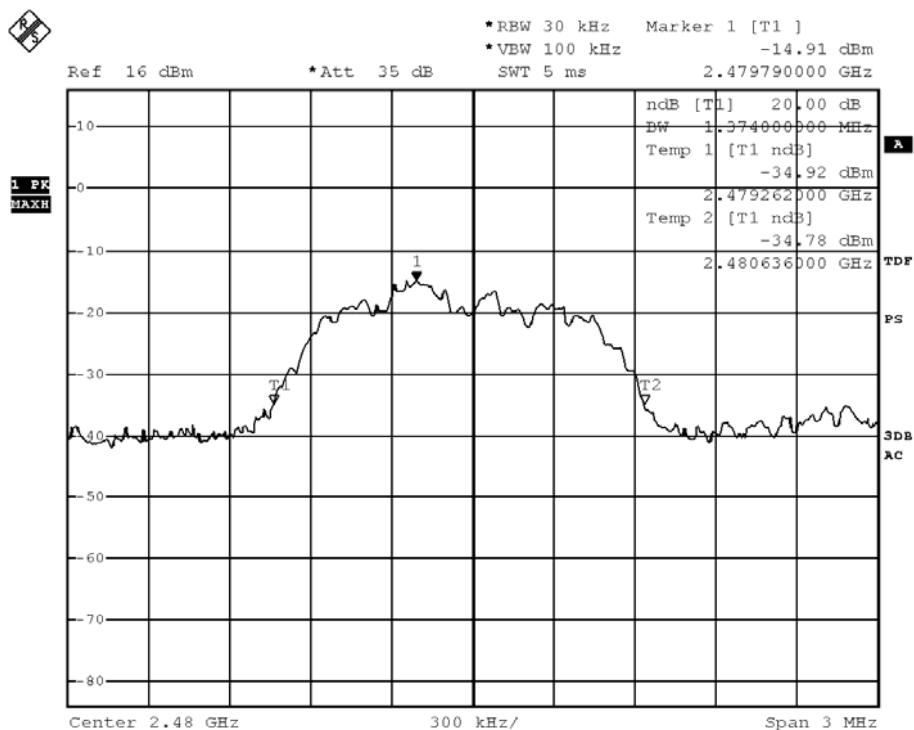
Date: 2016-10-31

Page 47 of 87

No.: DM124408

Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2480	1.374	Within 2400-2483.5

(Highest Operating Frequency) - (8DPSK)



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Date: 2016-10-31

Page 48 of 87

No.: DM124408

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* $2/3 = 1.06\text{MHz} * 2/3 = 706.7\text{ kHz}$ (GFSK)

The measured maximum bandwidth * $2/3 = 1.386\text{MHz} * 2/3 = 924\text{kHz}$ ($\pi/4$ DQPSK, 8DPSK)

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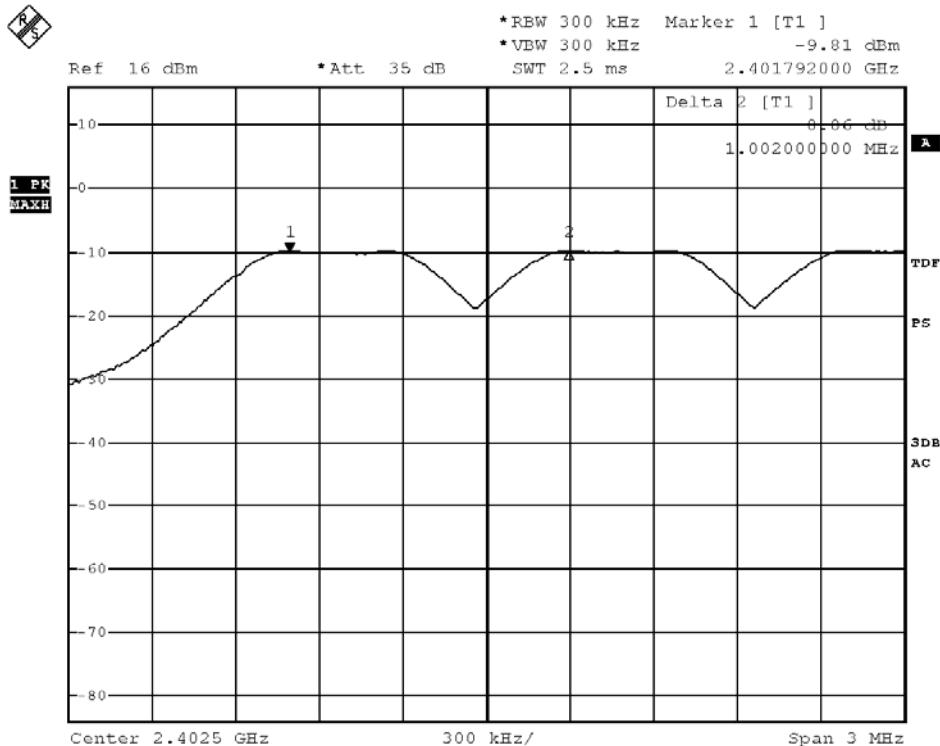
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Date: 2016-10-31

Page 49 of 87

No.: DM124408

Channel separation = 1MHz (>706.7kHz) (Lowest) (GFSK)



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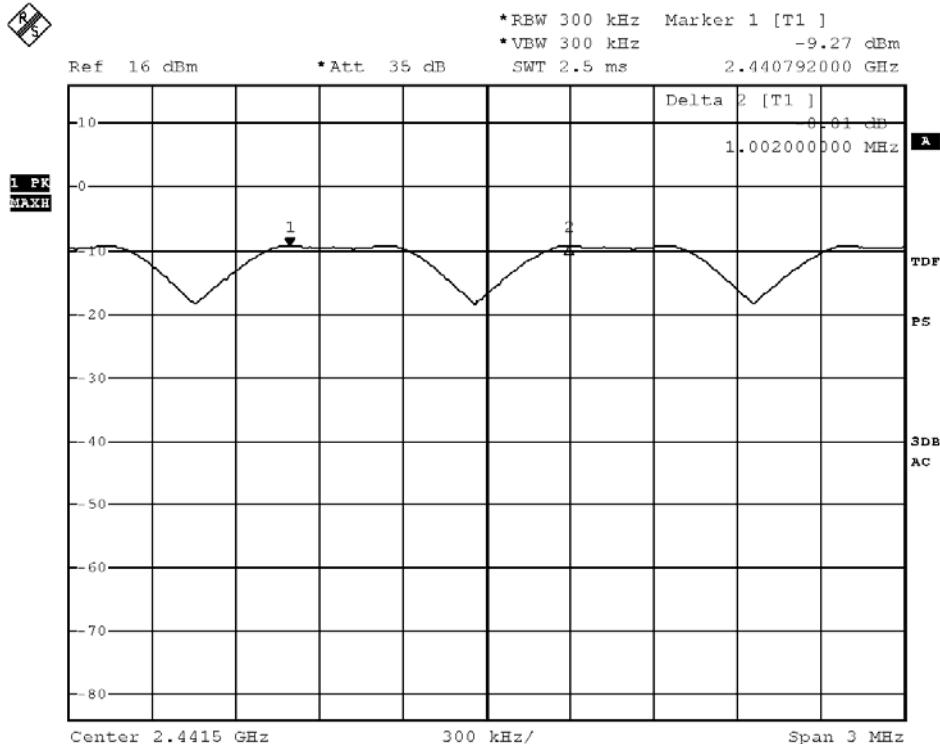
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Page 50 of 87

No.: DM124408

Channel separation = 1MHz (>706.7kHz) (Mid) (GFSK)



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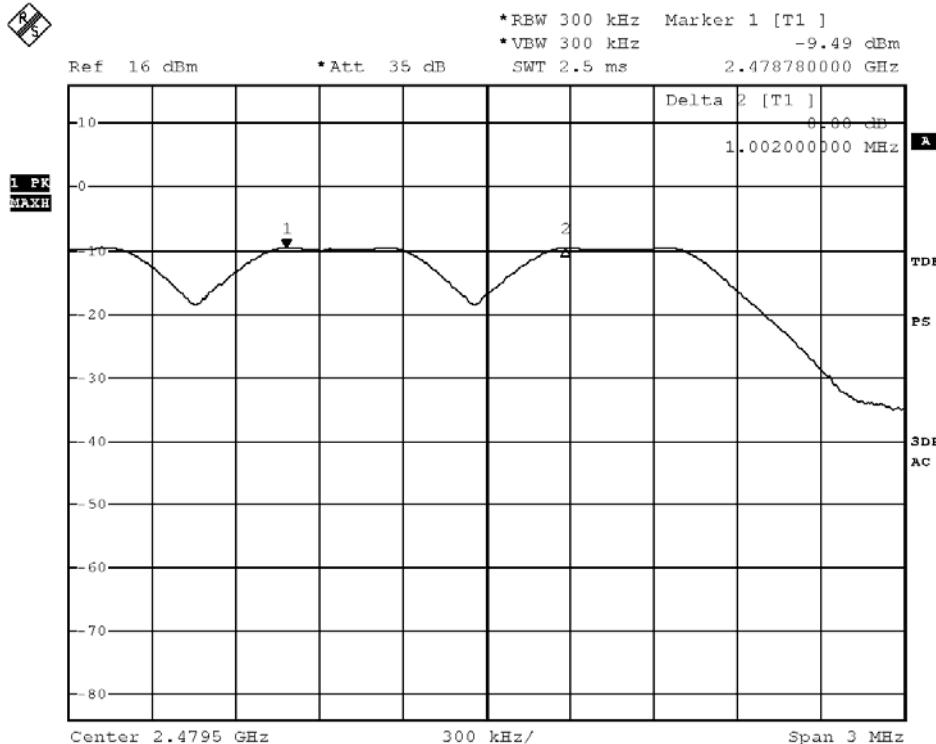
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Page 51 of 87

No.: DM124408

Channel separation = 1MHz (>706.7kHz) (Highest) (GFSK)



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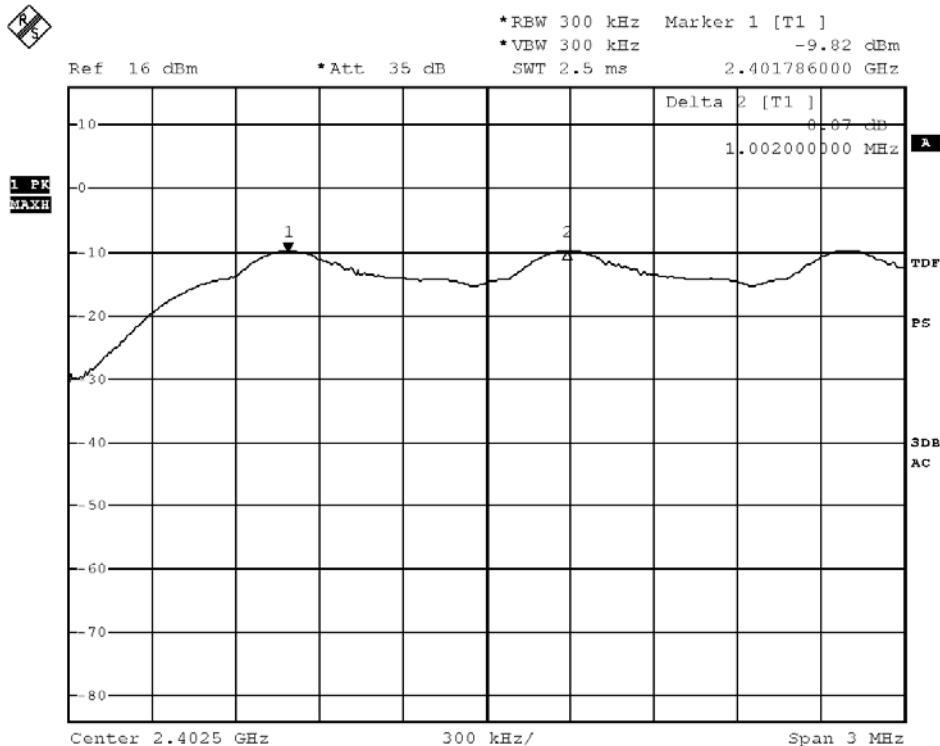
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Page 52 of 87

No.: DM124408

Channel separation = 1MHz (>924kHz) (Lowest) ($\pi/4$ DQPSK)



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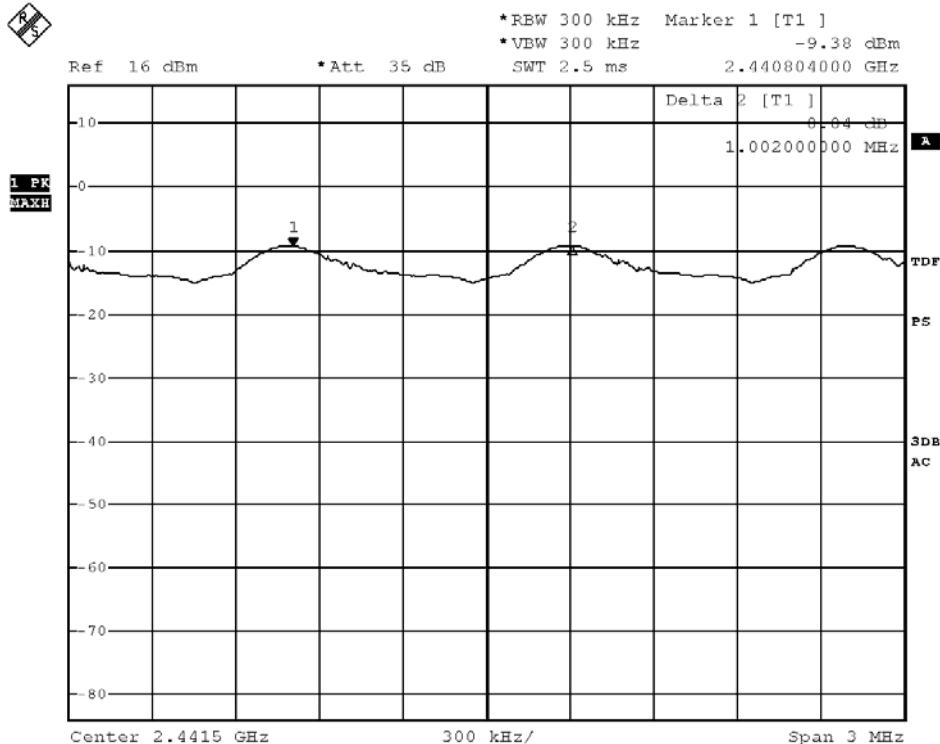
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Date: 2016-10-31

Page 53 of 87

No.: DM124408

Channel separation = 1MHz (>924kHz) (Mid) ($\pi/4$ DQPSK)



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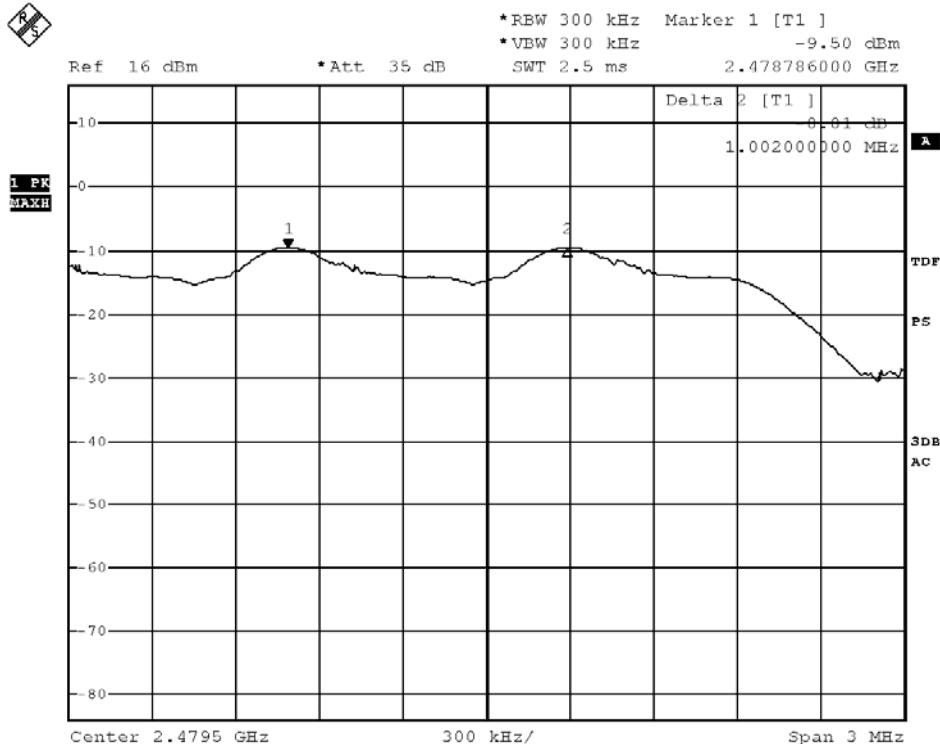
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Page 54 of 87

No.: DM124408

Channel separation = 1MHz (>924kHz) (Highest) ($\pi/4$ DQPSK)



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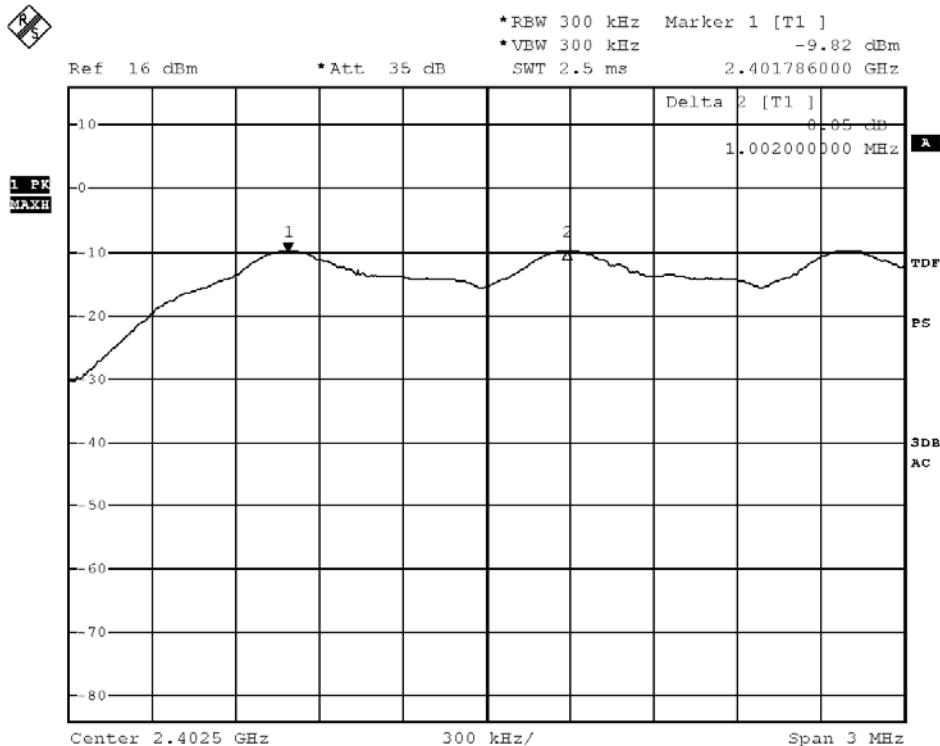
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Date: 2016-10-31

Page 55 of 87

No.: DM124408

Channel separation = 1MHz (>924kHz) (Lowest) (8DPSK)



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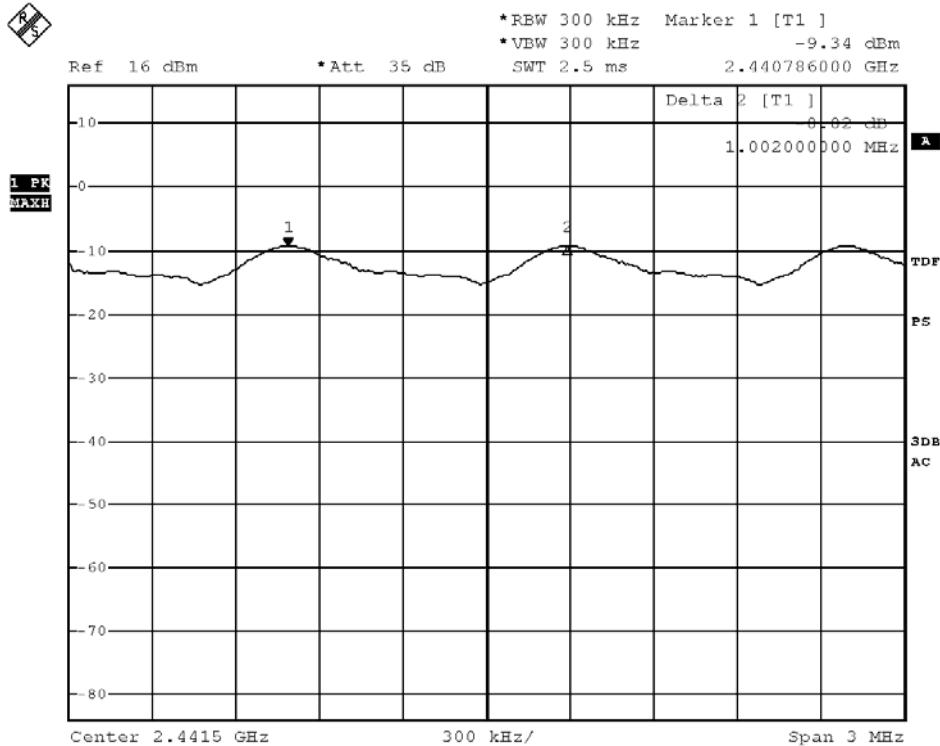
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Page 56 of 87

No.: DM124408

Channel separation = 1MHz (>924kHz) (Mid) (8DPSK)



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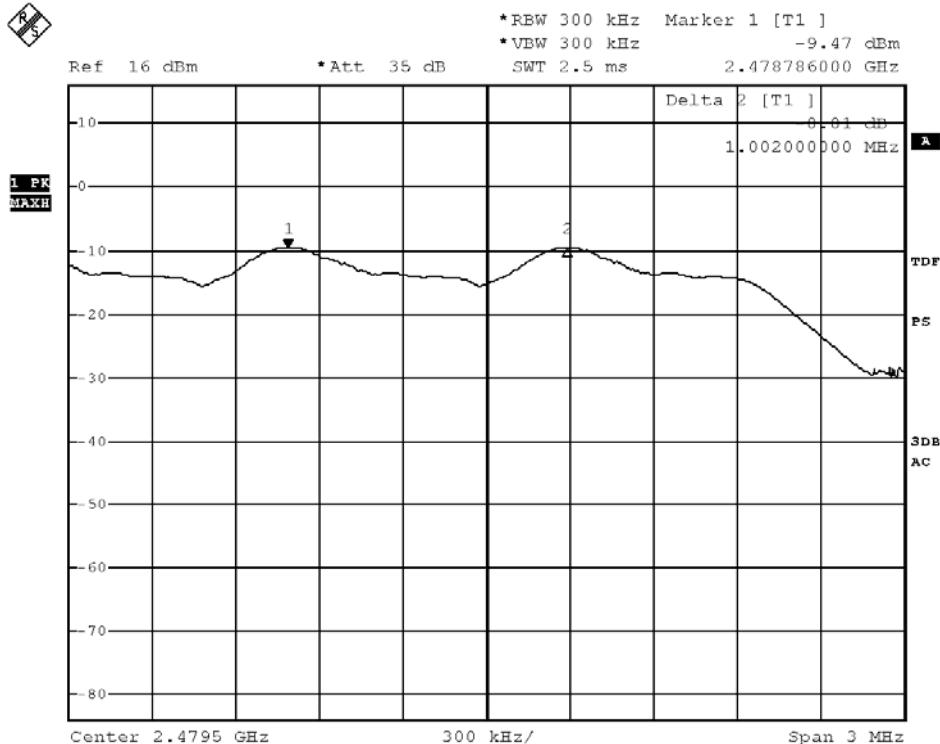
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Page 57 of 87

No.: DM124408

Channel separation = 1MHz (>924kHz) (Highest) (8DPSK)



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Page 58 of 87

No.: DM124408

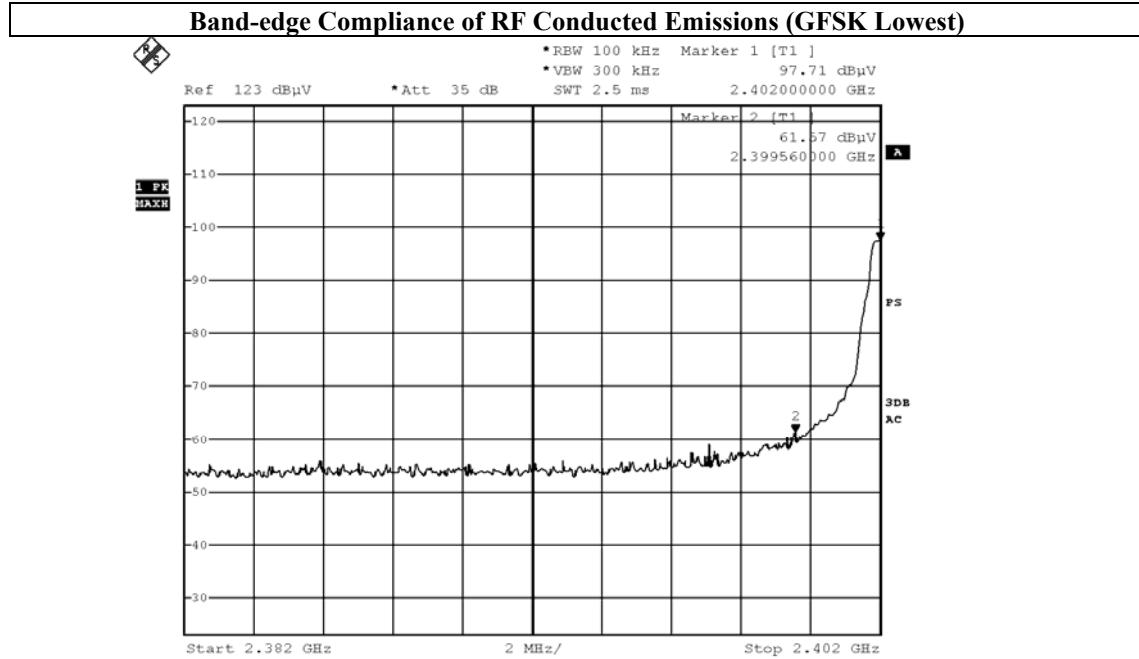
3.1.7 Band-edge Compliance of RF Conducted Emissions Measurement:

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)	36.04



BMP

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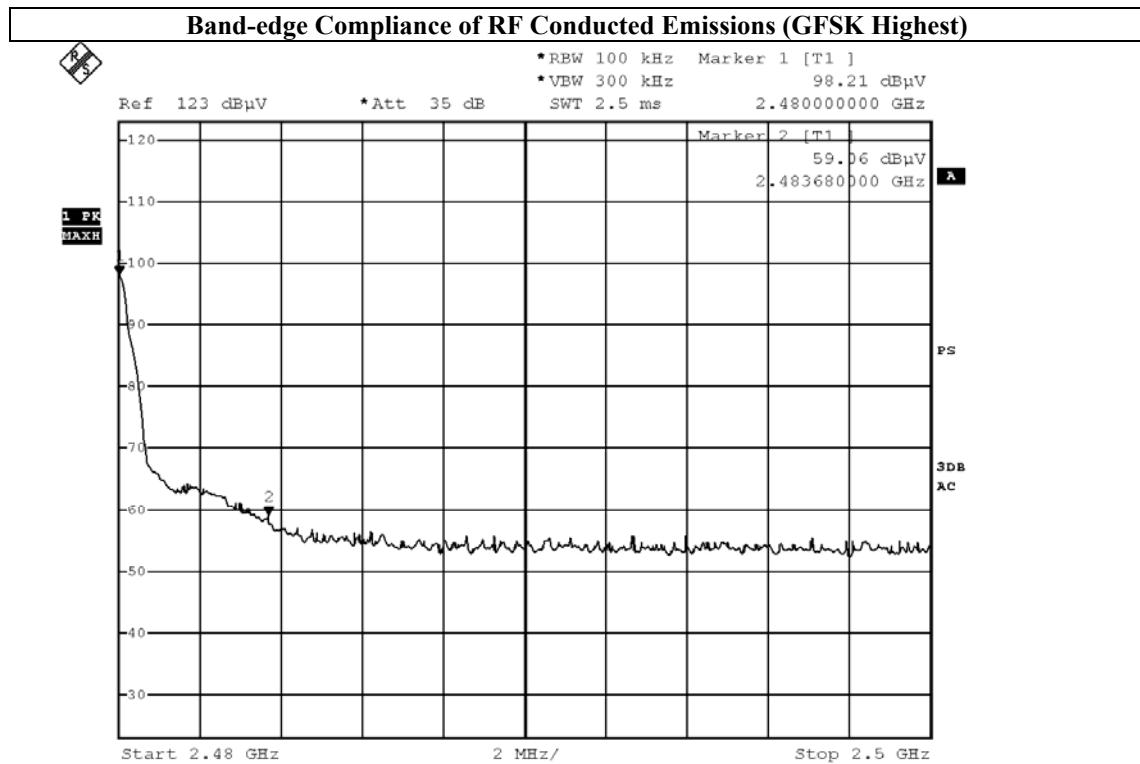
Date: 2016-10-31

Page 59 of 87

No.: DM124408

Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
Highest Fundamental (2480) - 2483.5	38.85



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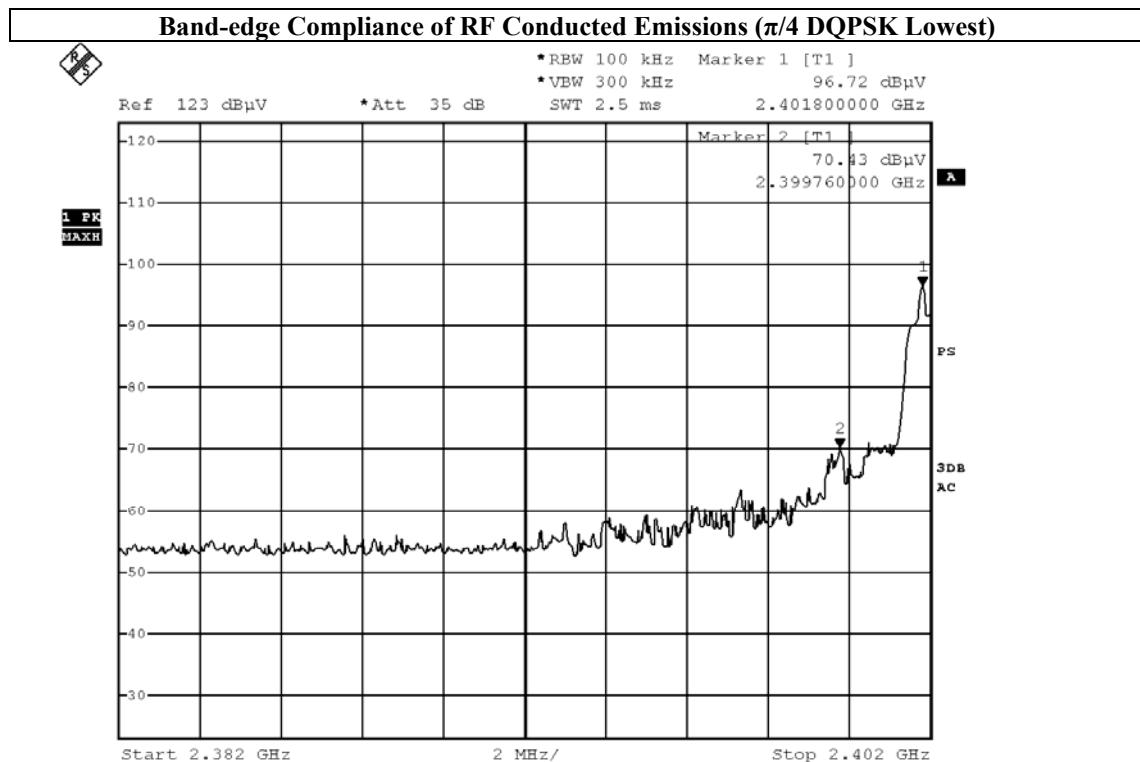
Date: 2016-10-31

Page 60 of 87

No.: DM124408

Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	26.29



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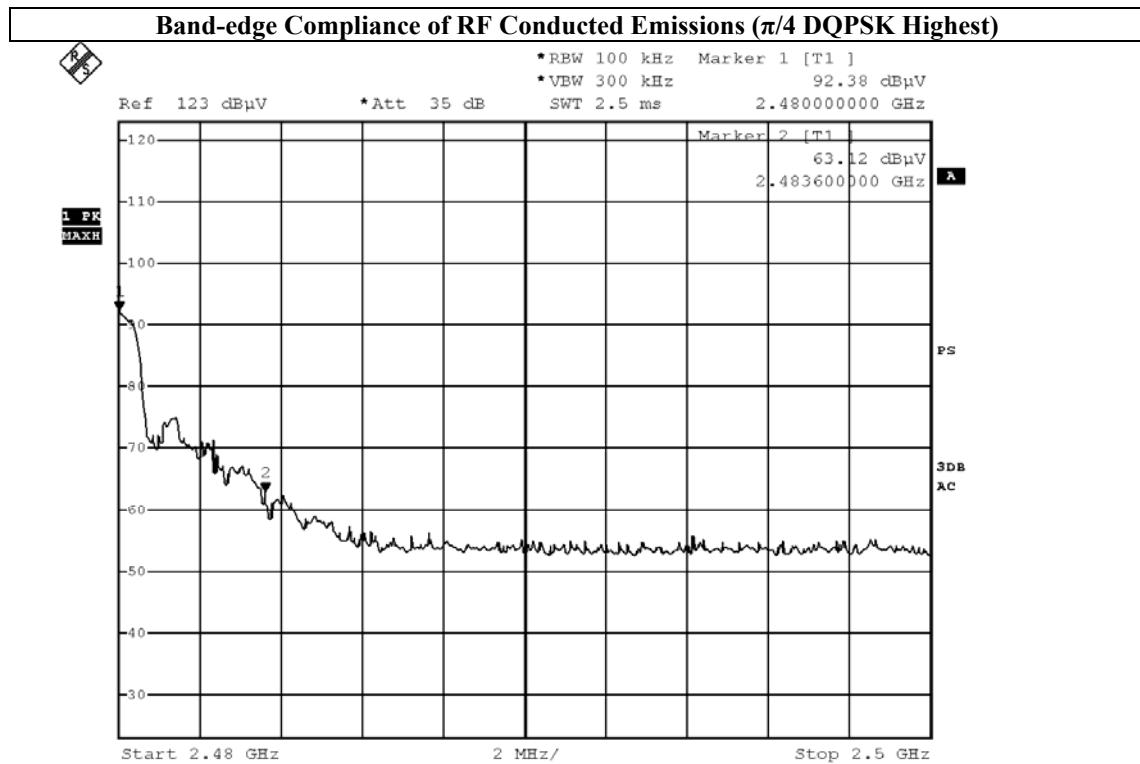
Date: 2016-10-31

Page 61 of 87

No.: DM124408

Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
Highest Fundamental (2480) - 2483.5	29.26



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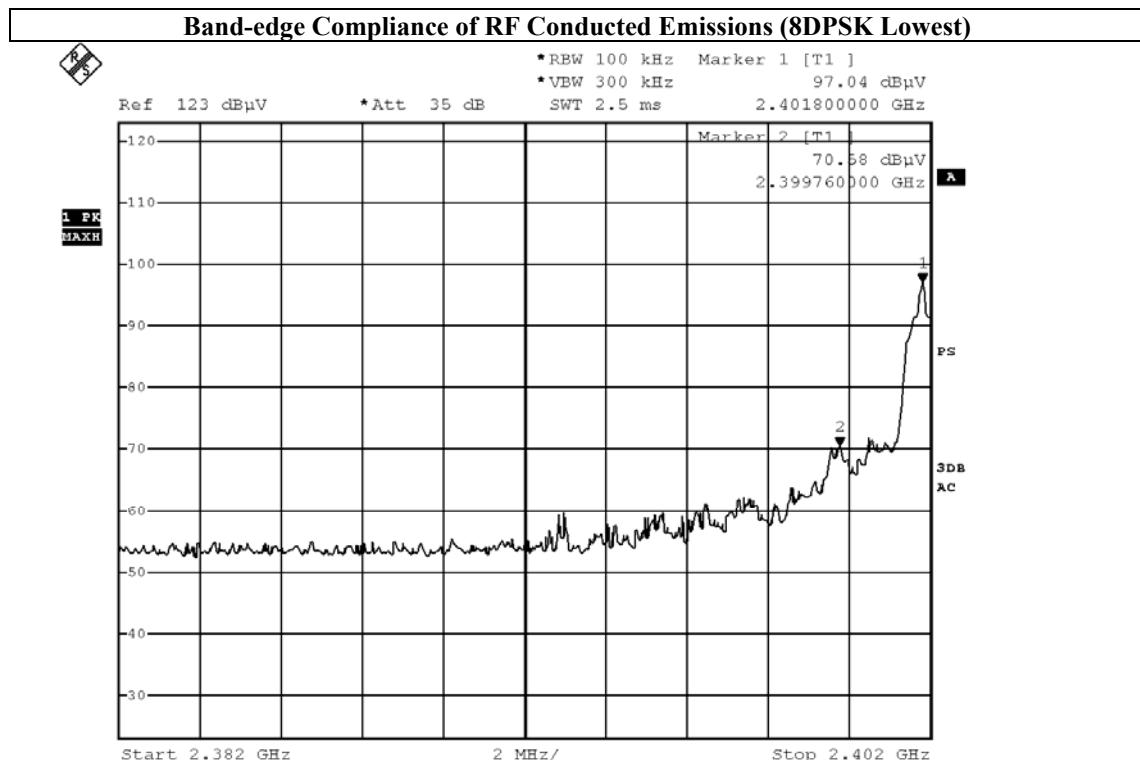
Date: 2016-10-31

Page 62 of 87

No.: DM124408

Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	26.46



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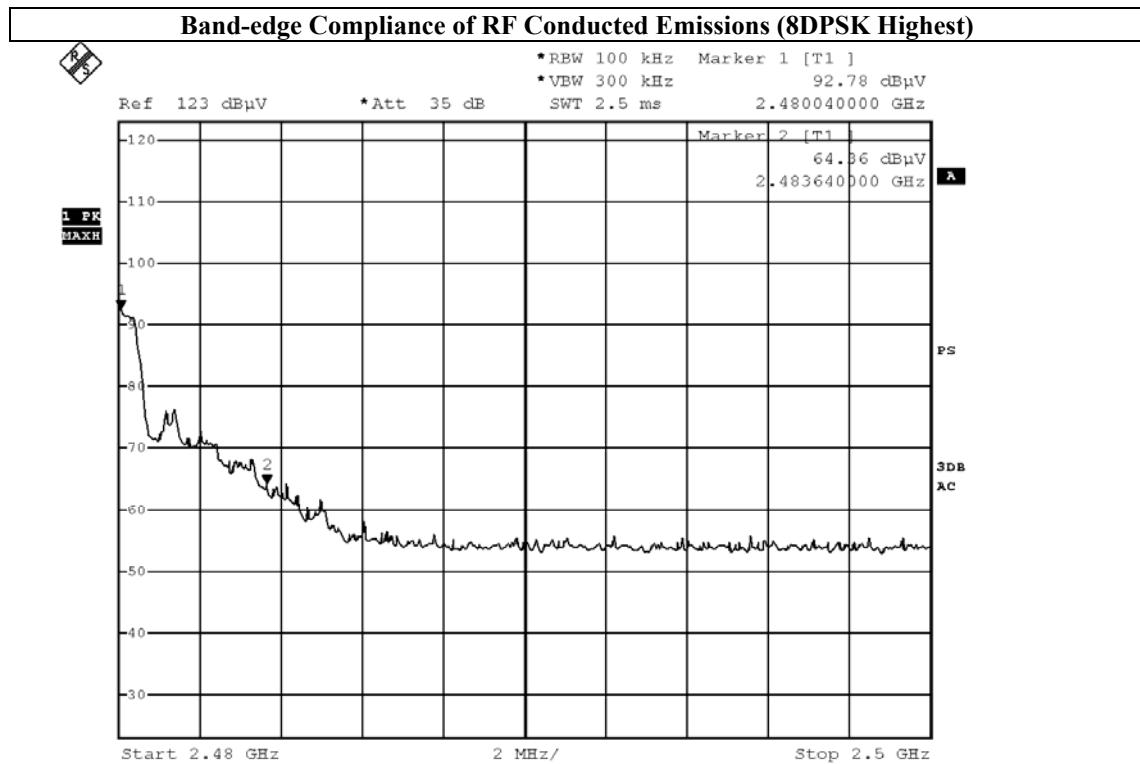
Date: 2016-10-31

Page 63 of 87

No.: DM124408

Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
Highest Fundamental (2480) - 2483.5	28.42



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Page 64 of 87

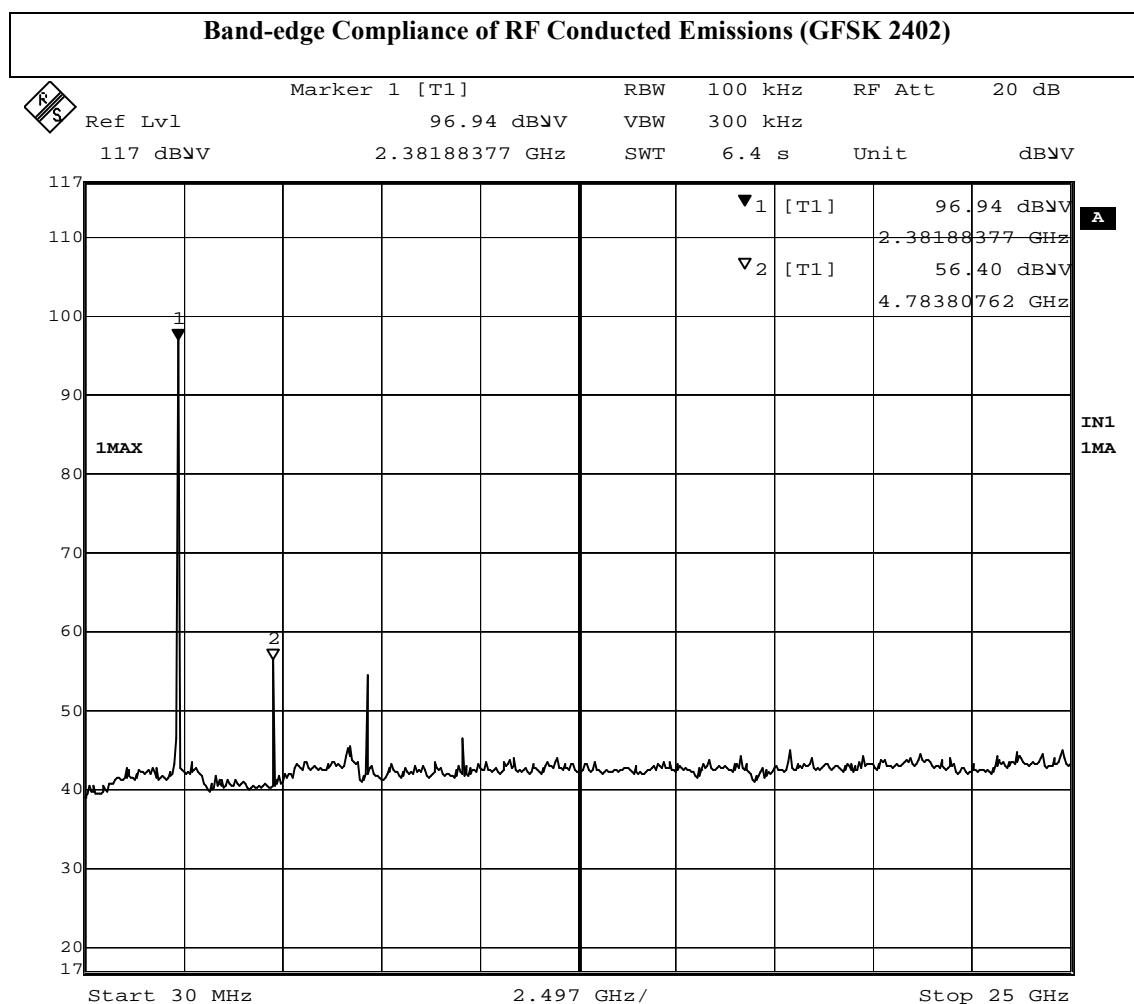
No.: DM124408

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



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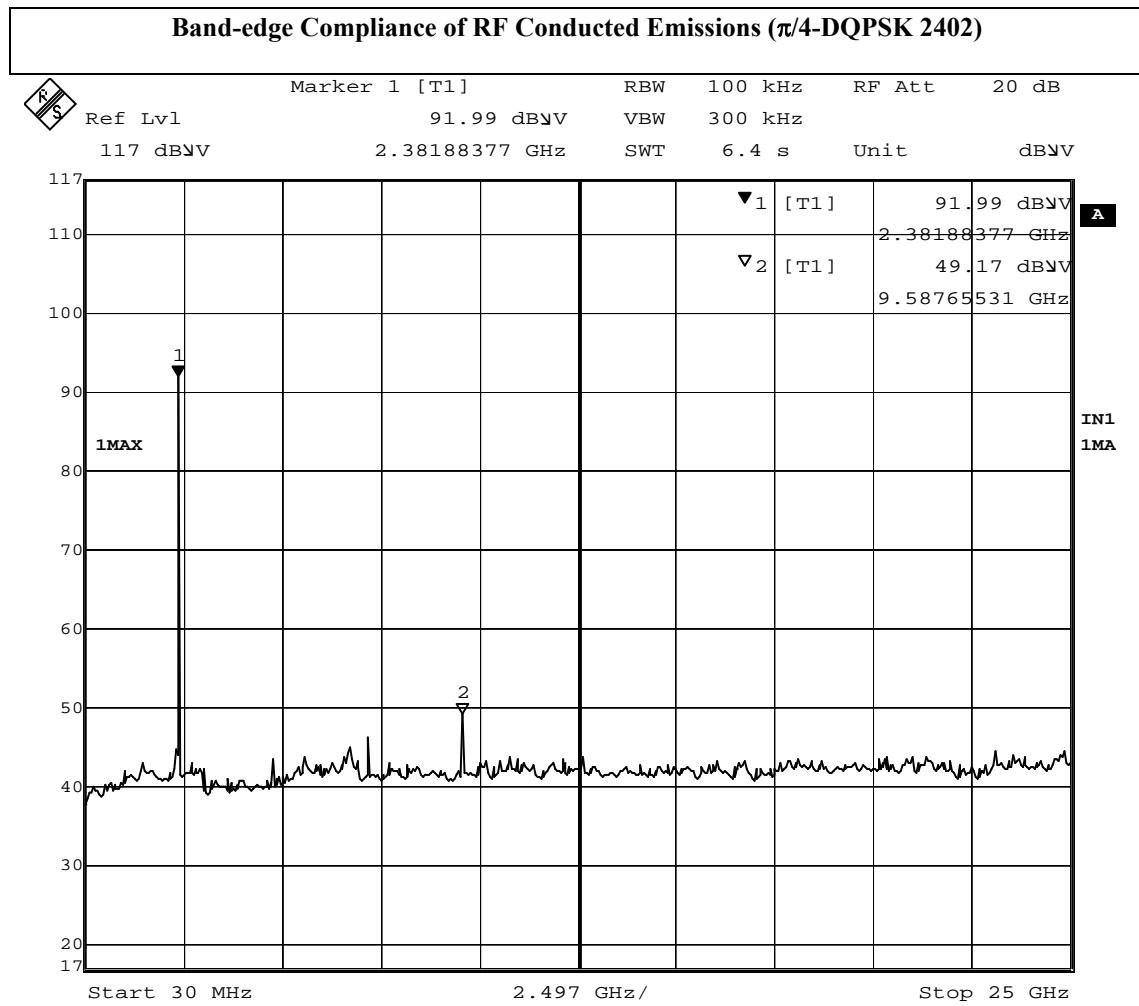


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Date: 2016-10-31

Page 65 of 87

No.: DM124408



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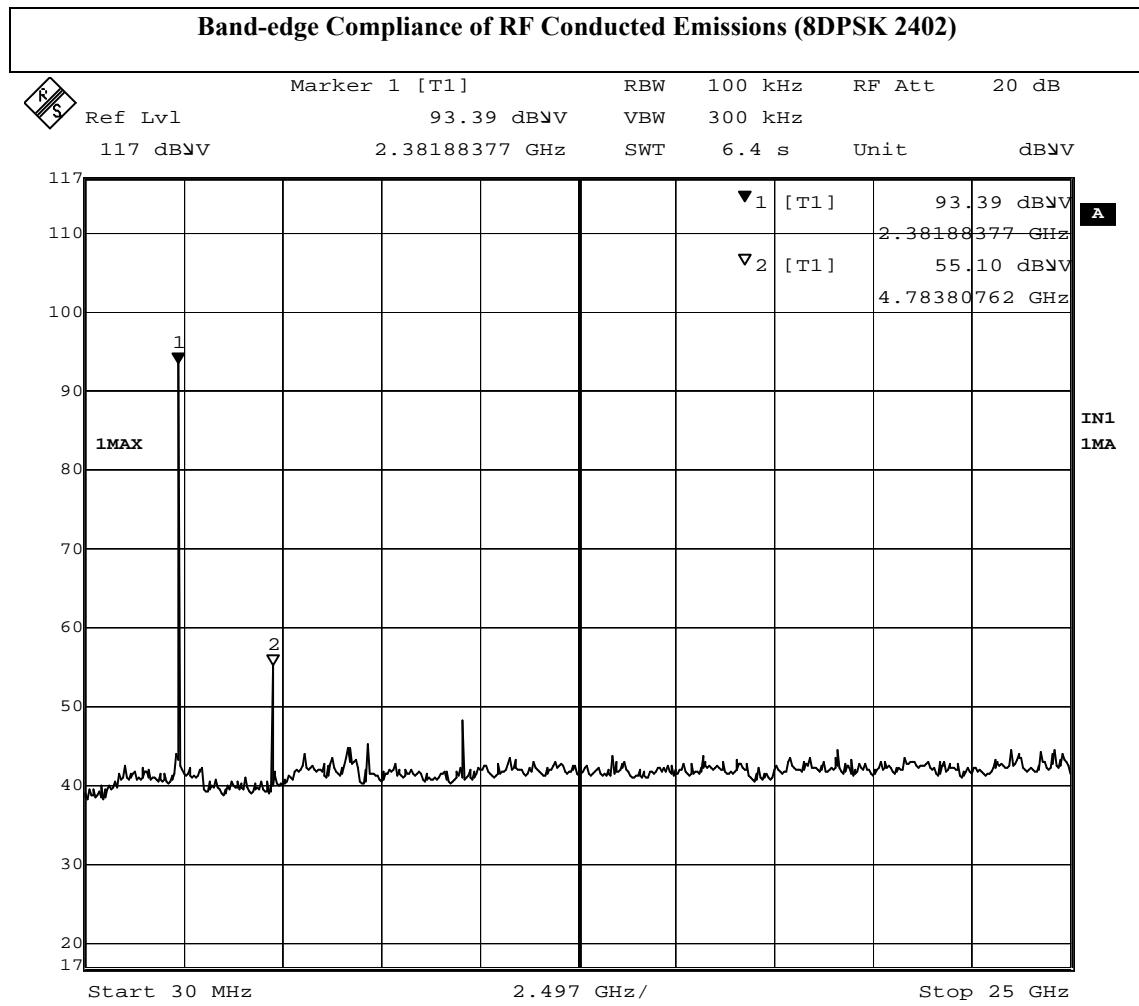


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Page 66 of 87

No.: DM124408



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Page 67 of 87

No.: DM124408

3.1.8 Time of Occupancy (Dwell Time)

Requirements:

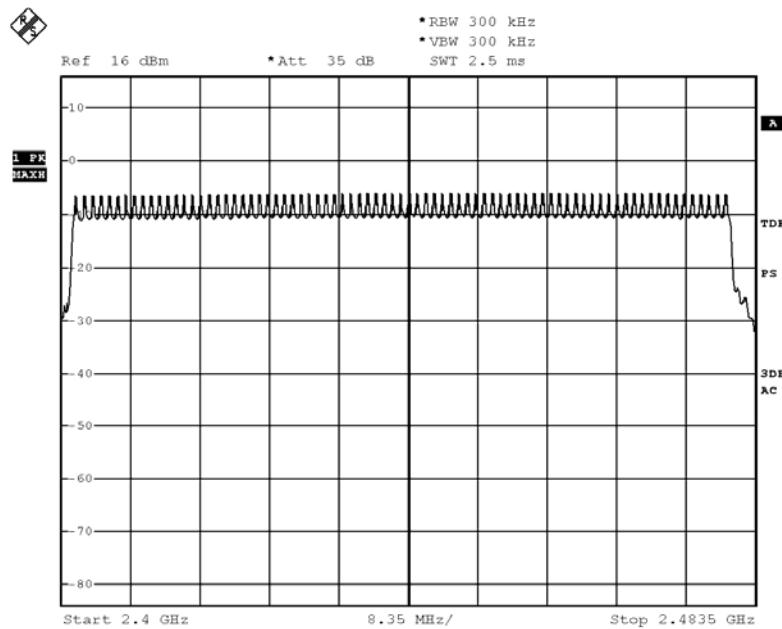
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channel employed.
No requirements for Digital Transmission System.

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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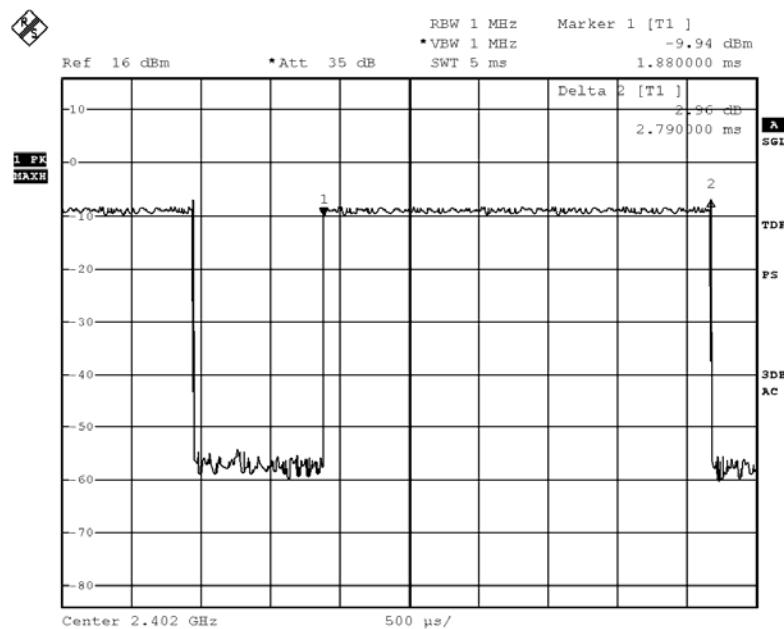
Page 68 of 87

No.: DM124408

DH5 Packet:

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

Fig. A
[Pulse duration of Lowest Channel]



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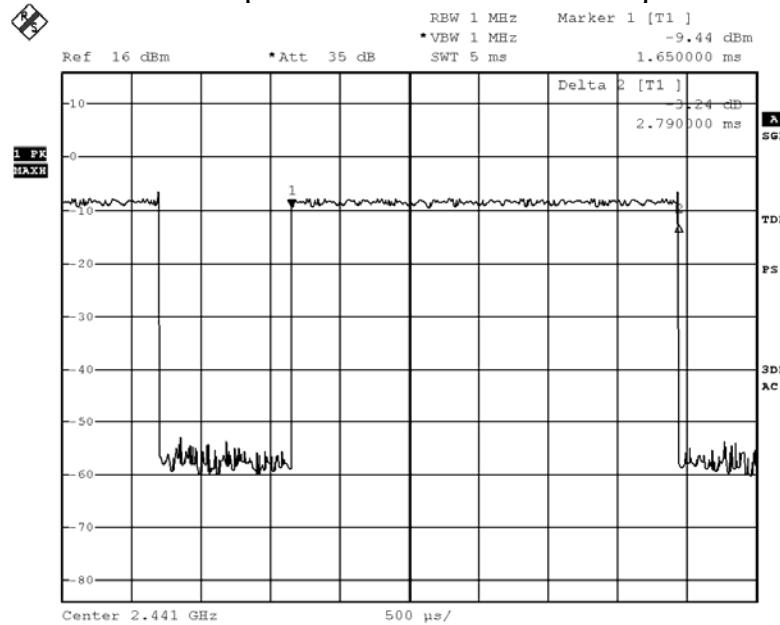
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Page 69 of 87

No.: DM124408

Fig. B
[Pulse duration of Middle Channel]



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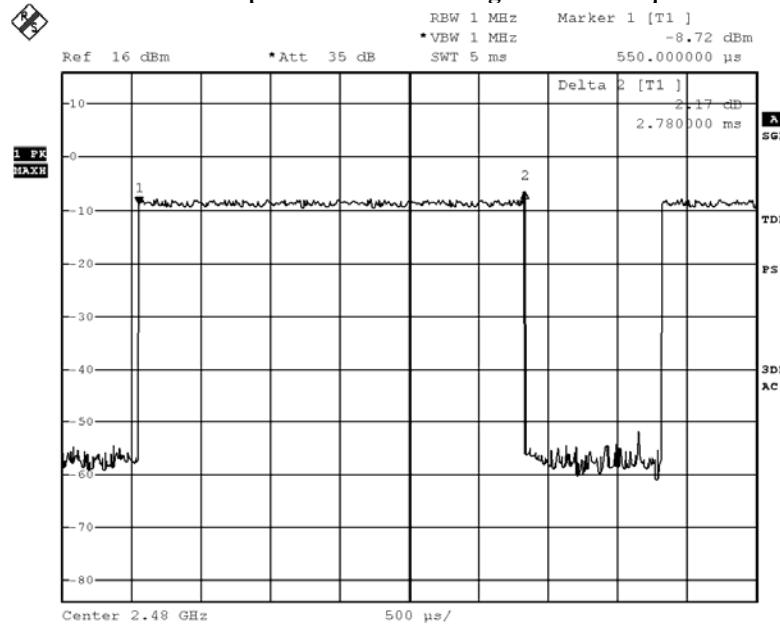
STC Test Report

Date: 2016-10-31

Page 70 of 87

No.: DM124408

Fig. C
[Pulse duration of Highest Channel]



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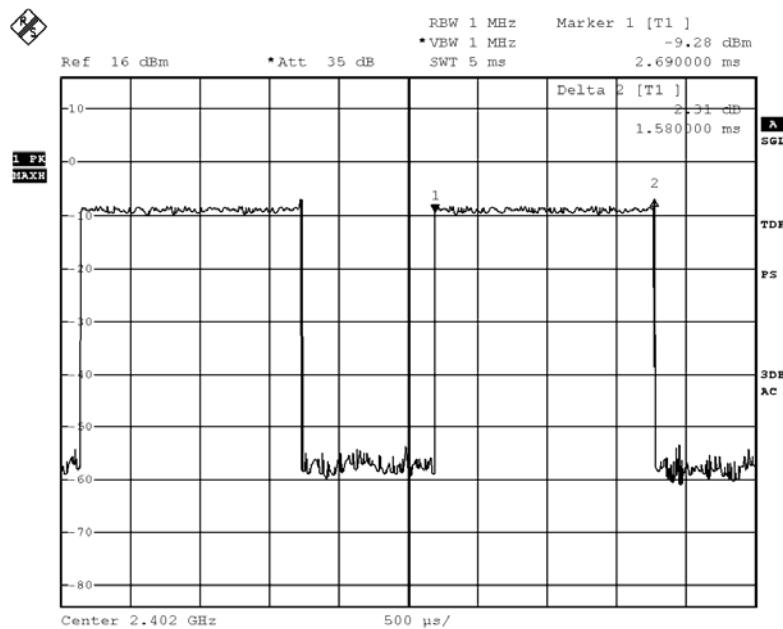
Page 71 of 87

No.: DM124408

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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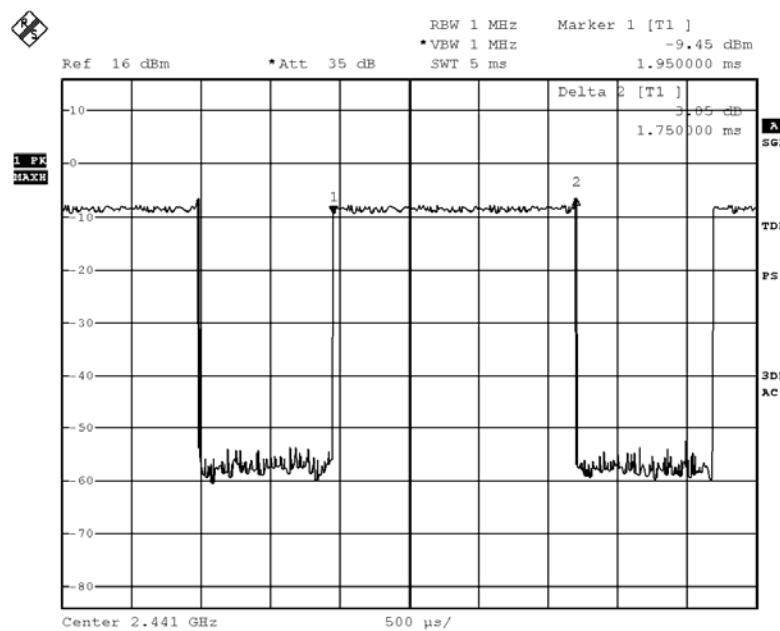
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Date: 2016-10-31

Page 72 of 87

No.: DM124408

Fig. E
[Pulse duration of Middle Channel]



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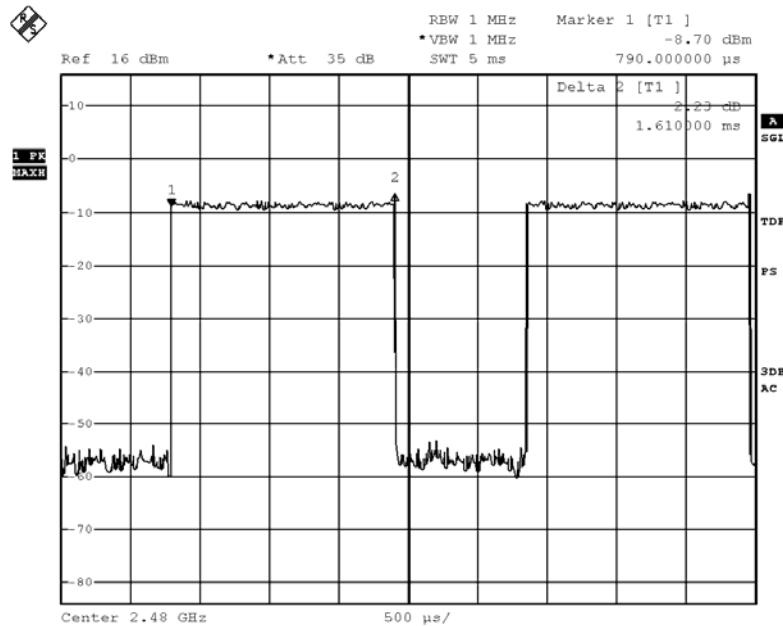
STC Test Report

Date: 2016-10-31

Page 73 of 87

No.: DM124408

Fig. F
[Pulse duration of Highest Channel]



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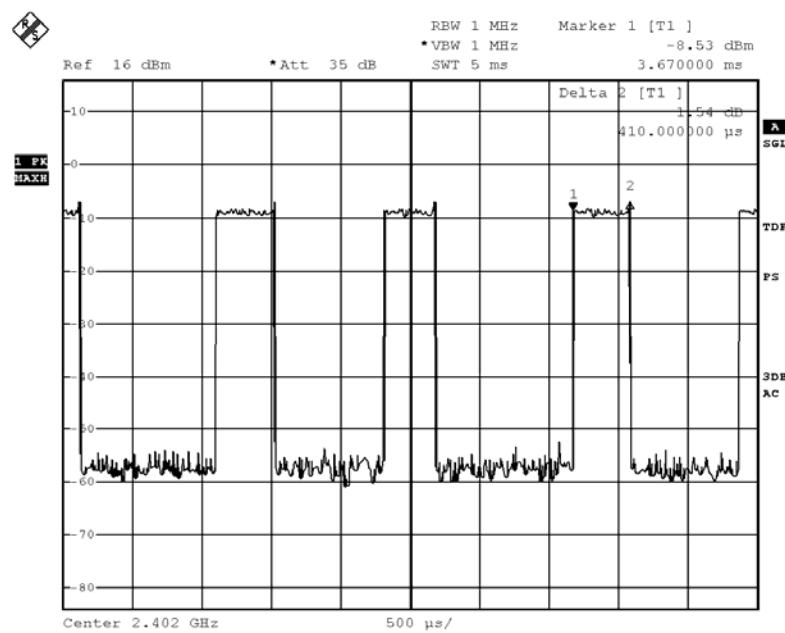
Page 74 of 87

No.: DM124408

DH1 Packet:

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

Fig. G
[Pulse duration of Lowest Channel]



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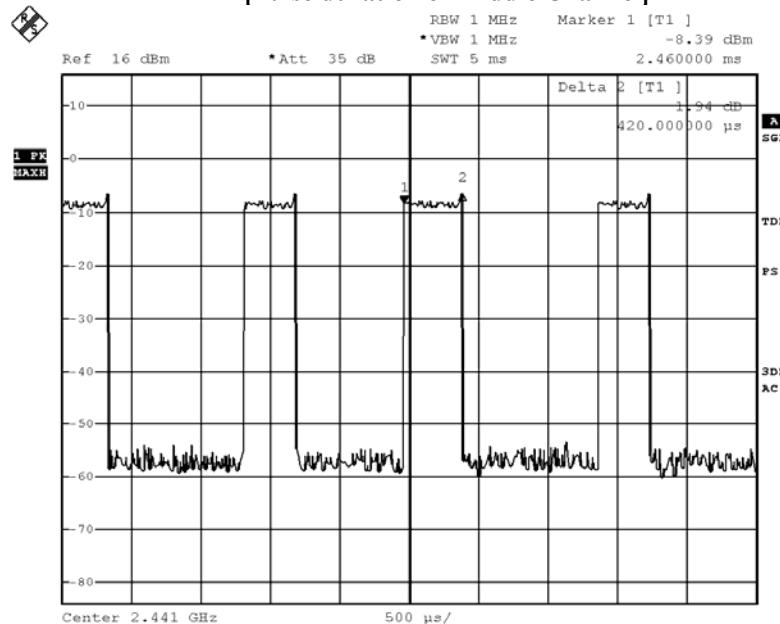
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No.: DM124408

Page 75 of 87

Fig. H

[Pulse duration of Middle Channel]



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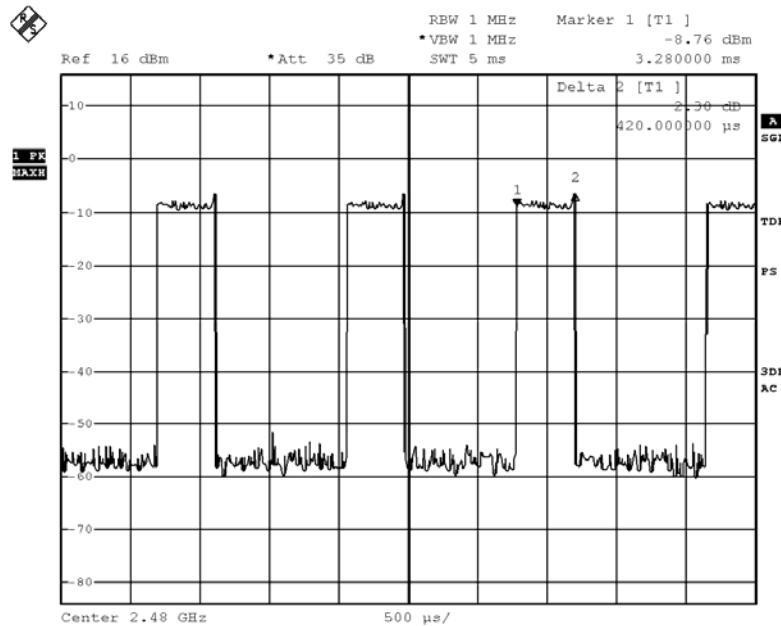
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Date: 2016-10-31

Page 76 of 87

No.: DM124408

Fig. I
[Pulse duration of Highest Channel]



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Time of occupancy (Dwell Time):

Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (s)	Limits (s)	Test Results
DH5	2402	2.79	0.264	0.400	Complies
DH5	2441	2.79	0.264	0.400	Complies
DH5	2480	2.78	0.264	0.400	Complies
DH3	2402	1.58	0.250	0.400	Complies
DH3	2441	1.75	0.277	0.400	Complies
DH3	2480	1.61	0.254	0.400	Complies
DH1	2402	0.41	0.130	0.400	Complies
DH1	2441	0.42	0.133	0.400	Complies
DH1	2480	0.42	0.133	0.400	Complies

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Date: 2016-10-31

Page 77 of 87

No.: DM124408

3.1.9 Channel Centre Frequency

Requirements:

Frequency hopping system in the 2400-2483.5MHz band shall use at least 79 (Channel 1 to 79) non-overlapping channels.

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

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

The operating frequencies of each channel are as follows:

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

Frequency of RF Channel = $2402+k$ MHz, $k = 1, \dots, 79$ (Channel separation = 1MHz)

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Date: 2016-10-31

Page 78 of 87

No.: DM124408

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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Date: 2016-10-31

Page 79 of 87

No.: DM124408

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 monopole antenna. There is no external antenna, the antenna gain = 0dBi. User is unable to remove or change the Antenna.

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Date: 2016-10-31

Page 80 of 87

No.: DM124408

3.1.12 RF Exposure

Test Requirement: FCC 47CFR 15.247(i)

Test Date: 2016-07-28

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 =0.486 mW

The power tune up tolerance is $-3.13 \pm 1.0 \text{ dBm}$

Max. duty factor is 100%

$$\begin{aligned} P_d &= PG / 4\pi R^2 = (0.486 \times 1) / 12.566 \times (20)^2 \\ &= (0.486) / 12.566 \times 400 = 0.486 / 5026.4 \\ &= 0.000097 \text{ mW/cm}^2 \end{aligned}$$

where:

* P_d = power density in mW/cm^2

* G = Antenna numeric gain (1); $\text{Log } G = g/10$ ($g = 0 \text{ dBi}$).

* P = Conducted RF power to antenna (0.486 mW).

* R = Minimum allowable distance.(20 cm)

*The power density $P_d = 0.000097 \text{ mW/cm}^2$ is less than 1 mW/cm^2 (listed MPE limit)

*The SAR evaluation is not needed (this is a desk top device, $R > 20 \text{ cm}$)

* The EUT(antenna) must be 0.2 meters away from the General Population.

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STC Test Report

Date: 2016-10-31

No.: DM124408

Page 81 of 87

Appendix A

List of Measurement Equipment

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EMD004	LISN	ROHDE & SCHWARZ	ESH3-Z5	100102	2016.3.29	2017.3.29
EMD022	EMI Test Receiver	ROHDE & SCHWARZ	ESCS30	100314	2016.3.29	2017.3.29
EMD035	EMI Test Receiver	ROHDE & SCHWARZ	ESCI	100441	2016.3.29	2017.3.29
EMD036	EMI Test Receiver	ROHDE & SCHWARZ	ESIB 26	100388	2016.3.29	2017.3.29
EMD041	TWO-LINE V-NETWORK	ROHDE & SCHWARZ	ENV216	100261	2016.3.29	2017.3.29
EMD061	Biconilog Antenna	ETS.LINDGREN	3142C	00060439	2014.11.29	2016.11.29
EMD062	Double-Ridged Waveguide (1GHz – 18GHz)	ETS.LINDGREN	3117	00075933	2014.11.15	2016.11.15
EMD084	MULTI-DVICE CONTROLLER	ETS.LINDGREN	2090	00060107	N/A	N/A
EMD088	Video Contol Unit	ETS.LINDGREN	Y21953A	2601073	N/A	N/A
EMD093	Monitor	ViewSonic	VA9036	Q8X064201876	N/A	N/A
EMD102	Intelligent Frequency	Ainuo Instrument Co., Ltd	AN97005SS	79707454	N/A	N/A
EMD103	Intelligent Frequency	Ainuo Instrument Co., Ltd	AN97005SS	79707455	N/A	N/A
EMD105	FACT-3 EMC Chamber	ETS.LINDGREN	FACT-3	3803	N/A	N/A
EMD106	Shielding Room #1	ETS.LINDGREN	RFD-100	3802	N/A	N/A
EMD111	Power meter	ROHDE & SCHWARZ	NRVD	102051	2016.3.29	2017.3.29
	100V Insertion Unit	ROHDE & SCHWARZ	URV5-Z4	100464	2016.3.29	2017.3.29
EMD113	Pre-Amplifier	ROHDE & SCHWARZ	N/A	1129588	2016.3.29	2017.3.29
EMD124	Loop Antenna	ETS-Lindgren	6502	00104905	2016.05.23	2017.05.23
EMD131	Standard Gain Horn Antenna (18GHz – 26.5GHz)	Chengdu AINFO Inc.	JXTXLB-42-15-C-KF	J2021100721001	2015.04.09	2017.04.09
RE01	RF cable	N/A	N/A	N/A	2016-9-26	2017-9-26
RE02	RF cable	N/A	N/A	N/A	2016-9-26	2017-9-26

Remarks:-

N/A Not Applicable or Not Available

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Date: 2016-10-31

No.: DM124408

Page 82 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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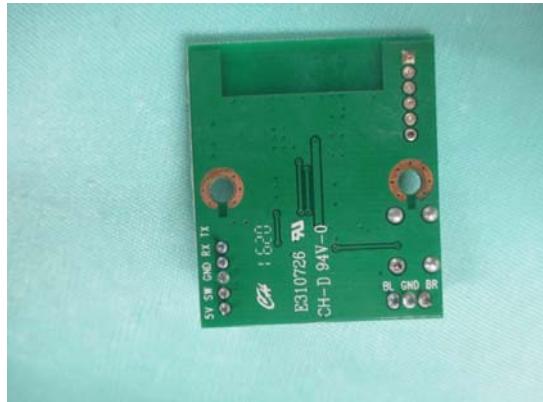
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Page 83 of 87

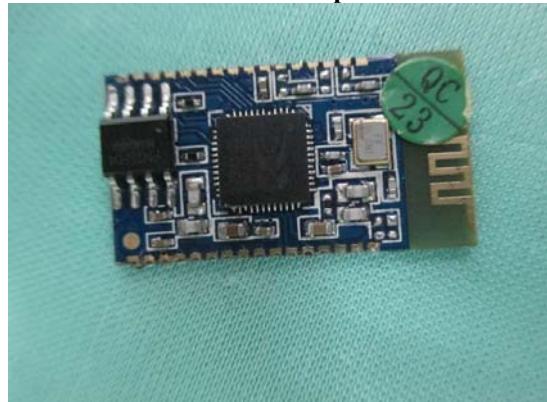
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Photographs of EUT

Inner Circuit Bottom View



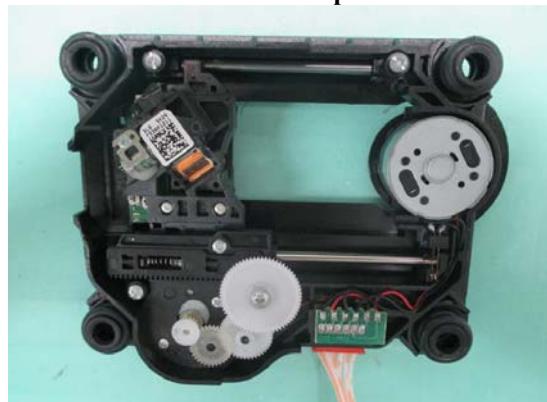
Inner Circuit Top View



Inner Circuit Bottom View



Inner Circuit Top View



Inner Circuit Bottom View



Inner Circuit Top View



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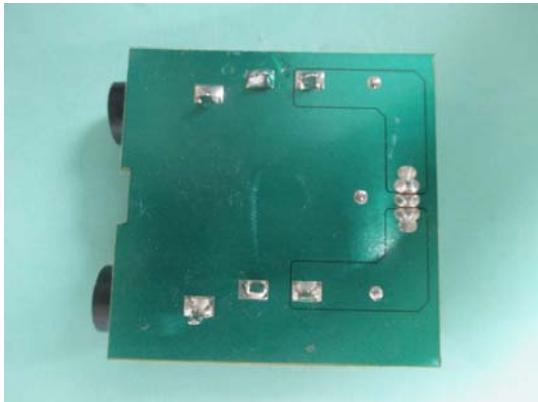
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Page 84 of 87

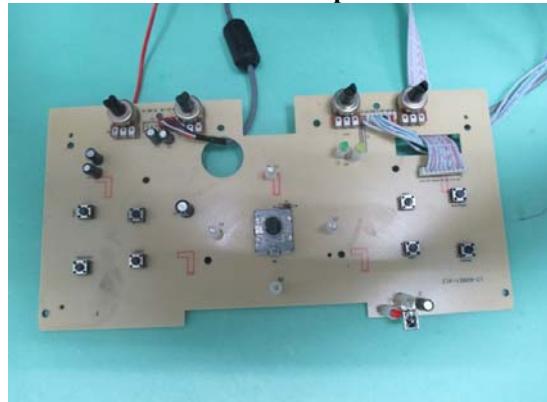
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Photographs of EUT

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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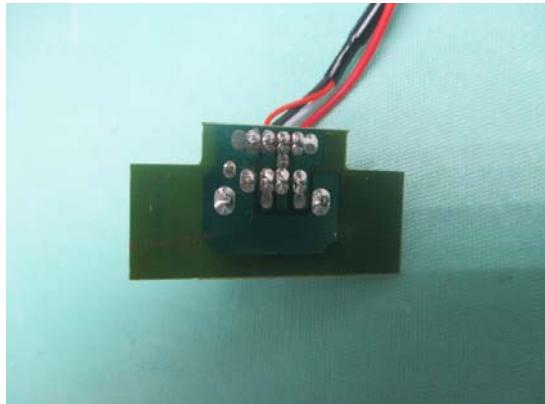
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Page 85 of 87

No.: DM124408

Photographs of EUT

Inner Circuit Bottom View



Battery View of Product



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Page 86 of 87

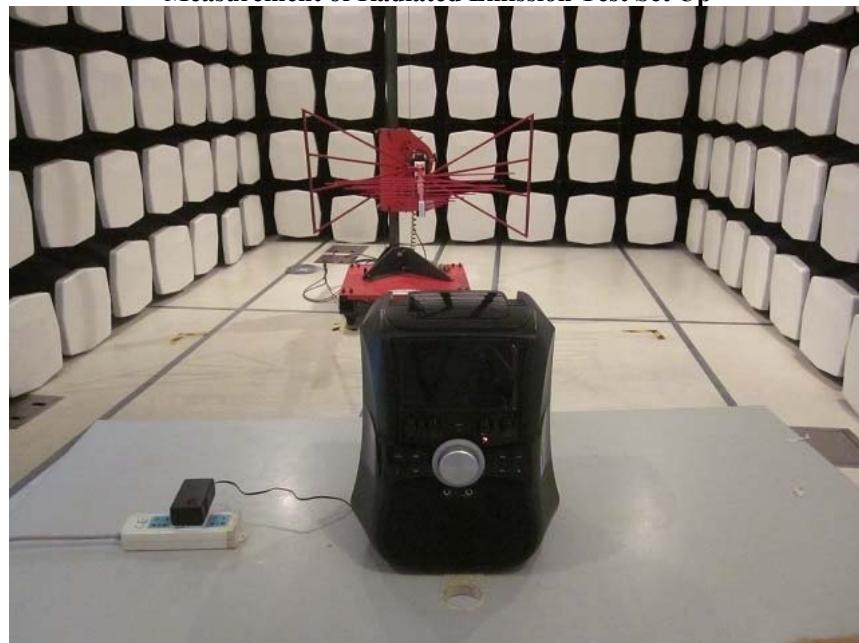
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Photographs of EUT

Measurement of Radiated Emission Test Set Up



Measurement of Radiated Emission Test Set Up



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Date: 2016-10-31

Page 87 of 87

No.: DM124408

Photographs of EUT

Measurement of Radiated Emission Test Set Up



Measurement of Conducted Emission Test Set Up



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