STC Test Report

Date: 2016-09-12
No.: DM124918

Applicant:	Monster LLC 3837 Bay Lake Trail, Suite 103, North Las Vegas, NV 89030, USA	
Manufacturer:	Guangzhou Sun Yong Electronics Co., Ltd. No.158, Dayu Road, Dongchong Town, Nansha District, Guangzhou City, China	
Description of Sample(s):	Product:	MONSTER BLUETOOTH HEADPHONES
	Brand Name:	MONSTER
	Model Number:	190686
	FCC ID:	RJE190686
Date Sample(s) Received:	2016-08-23	
Date Tested:	2016-08-30 to 2016-09-09	
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/ π/4-DQPSK/ 8DPSK)	

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

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STC Test Report

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1.0 General Details

1.1 Test Laboratory

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

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

Product:	MONSTER BLUETOOTH HEADPHONES
Manufacturer:	Guangzhou Sun Yong Electronics Co., Ltd. No.158, Dayu Road, Dongchong Town, Nansha District, Guangzhou City, China
Brand Name:	MONSTER
Model Number:	190686
Rating:	5.0Vd.c. (Powered by USB port) / 3.7Vd.c Li-ion rechargeable battery

1.2.1 Description of EUT Operation

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

1.3 Date of Order

2016-08-23

1.4 Submitted Sample(s):

1 Sample

1.5 Test Duration

2016-08-30 to 2016-09-09

1.6 Country of Origin

China

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1.7 RF Module Details

Module Model Number:	K549AH
Module FCC ID:	
Module Transmission Type:	Bluetooth V4.1
Modulation:	FHSS (GFSK / π/4-DQPSK/ 8DPSK)
Data Rates:	1MBps: GFSK 2 MBps: π/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:	Dielectric Chip Antenna
Antenna Gain:	2.0dBi

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2.0 Technical Details

2.1 Investigations Requested

Perform Electromagnetic Interference measurements in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2015 Regulations and ANSI C63.10: 2013 for FCC Certification.

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)	ANSI C63.10: 2013	N/A	☒	☐	☐
Radiated Spurious Emissions	FCC 47CFR 15.209	ANSI C63.10: 2013	N/A	☒	☐	☐
AC Mains Conducted Emissions	FCC 47CFR 15.207	ANSI C63.10: 2013	N/A	☒	☐	☐
Number of Hopping Frequency	FCC 47CFR 15.247 (b)(1)	ANSI C63.10: 2013	N/A	☒	☐	☐
20dB Bandwidth	FCC 47CFR 15.247(a)(2)	ANSI C63.10: 2013	N/A	☒	☐	☐
Hopping Channel Separation	FCC 47CFR 15.247(a)(1)	ANSI C63.10: 2013	N/A	☒	☐	☐
Band-edge measurement (Radiated)	FCC 47CFR 15.247(d)	ANSI C63.10: 2013	N/A	☒	☐	☐
Pseudorandom Hopping Algorithm	FCC 47CFR 15.247(a)(1)	N/A	N/A	☒	☐	☐
Time of Occupancy (Dwell Time)	FCC 47CFR 15.247(a)(1)(iii)	ANSI C63.10: 2013	N/A	☒	☐	☐
Antenna requirement	FCC 47CFR 15.203	N/A	N/A	☒	☐	☐

Note: N/A – Not Applicable

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2.3 Table for Test Modes

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate in the table below is the worst case rate with respect to the specific test item.
Investigation has been done on all the possible configurations for searching the worst cases.
The device was realized by test software.
The following table is a list of the test modes shown in this test report.

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

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3.0 Test Results

3.1 Emission

3.1.1 Maximum Peak Conducted Output Power

Test Requirement:	FCC 47CFR 15.247(b)(1)
Test Method:	ANSI C63.10: 2013
Test Date:	2016-08-30
Mode of Operation:	Tx mode

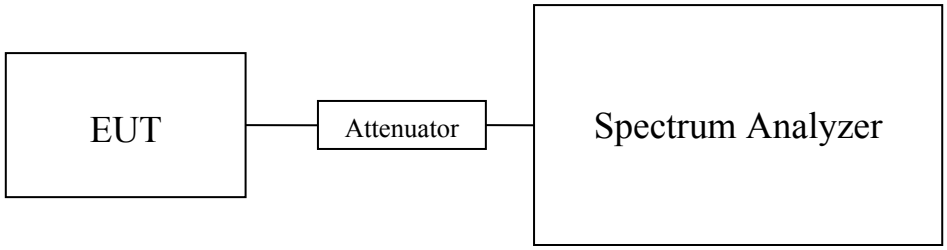
Test Method:

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

The maximum peak output power shall not exceeded 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	0.002612

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2441	0.003756

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.003556

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

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2402	0.001507

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2441	0.002415

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.002244

The maximum peak output power shall not exceeded 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	0.001706

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2441	0.002636

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.002443

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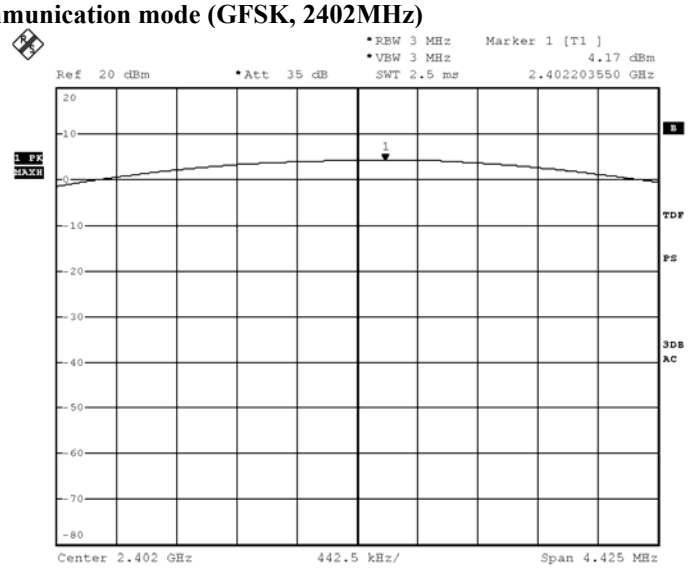
Test plot of Maximum Peak Conducted Output Power：
Bluetooth Communication mode (GFSK, 2402MHz)



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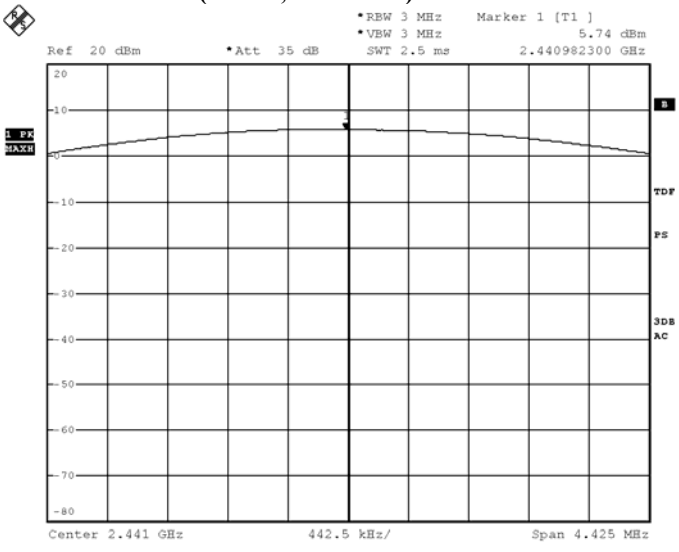
Date: 30.AUG.2016 10:41:49

Bluetooth Communication mode (GFSK, 2441MHz)



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Date: 30.AUG.2016 10:42:06

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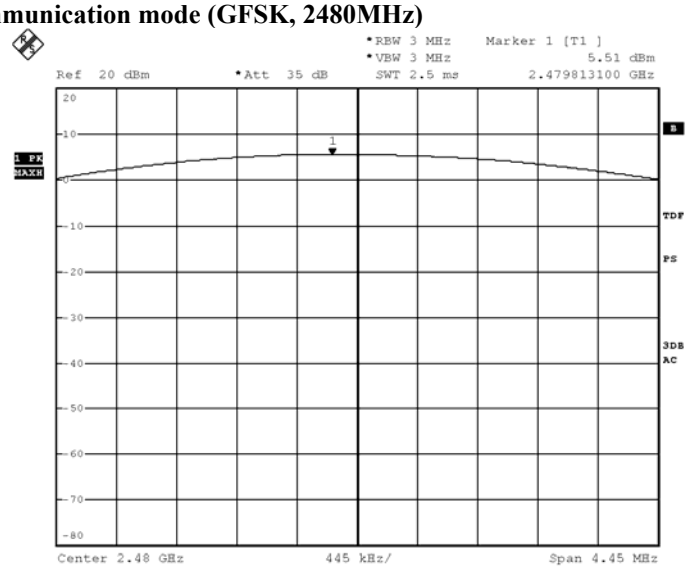
Bluetooth Communication mode (GFSK, 2480MHz)



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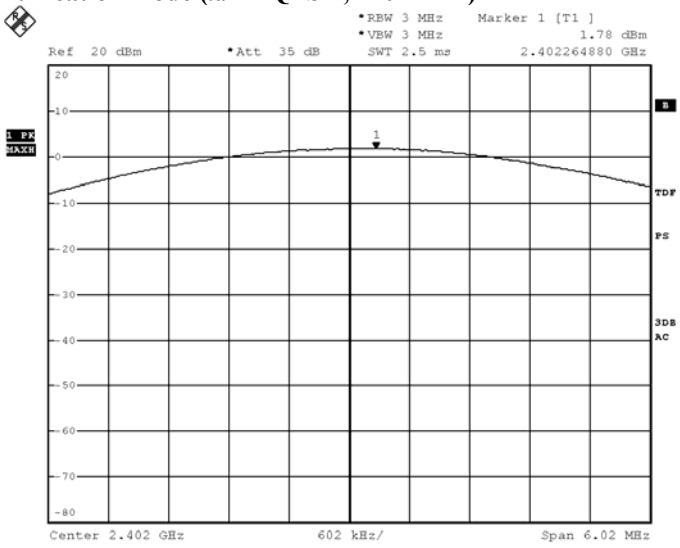
Date: 30.AUG.2016 10:42:42

Bluetooth Communication mode (π/4 DQPSK, 2402MHz)



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Date: 30.AUG.2016 10:44:15

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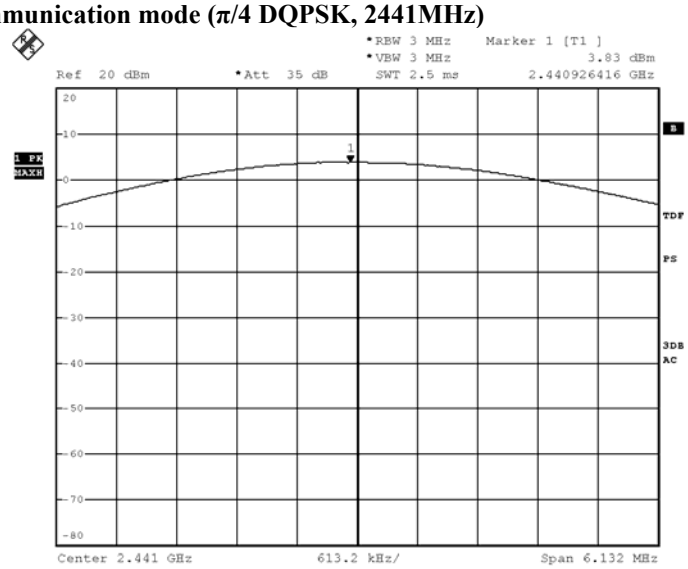
Bluetooth Communication mode (π/4 DQPSK, 2441MHz)



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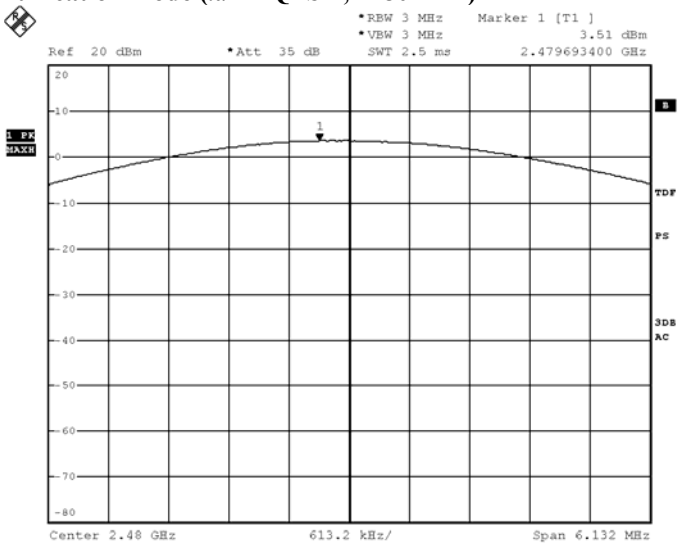
Date: 30.AUG.2016 10:43:48

Bluetooth Communication mode (π/4 DQPSK, 2480MHz)



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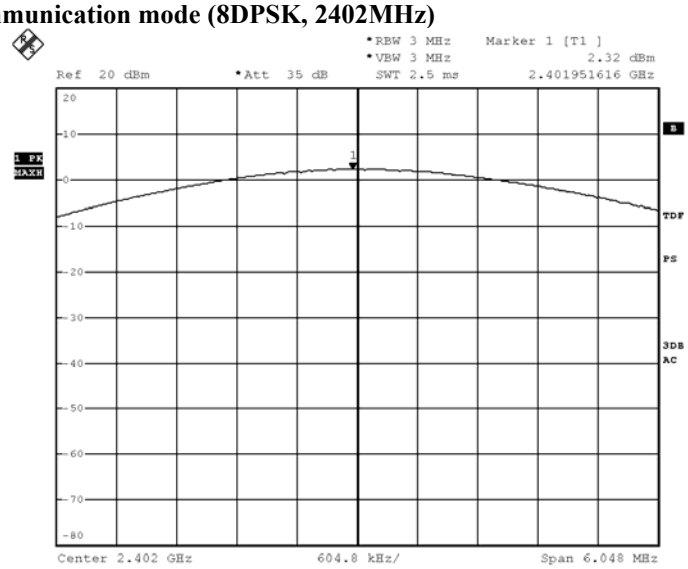
Bluetooth Communication mode (8DPSK, 2402MHz)



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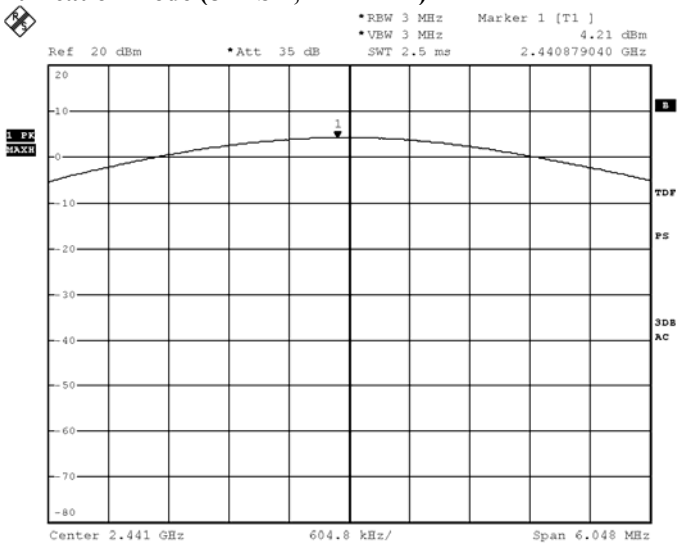
Date: 30.AUG.2016 10:44:59

Bluetooth Communication mode (8DPSK, 2441MHz)



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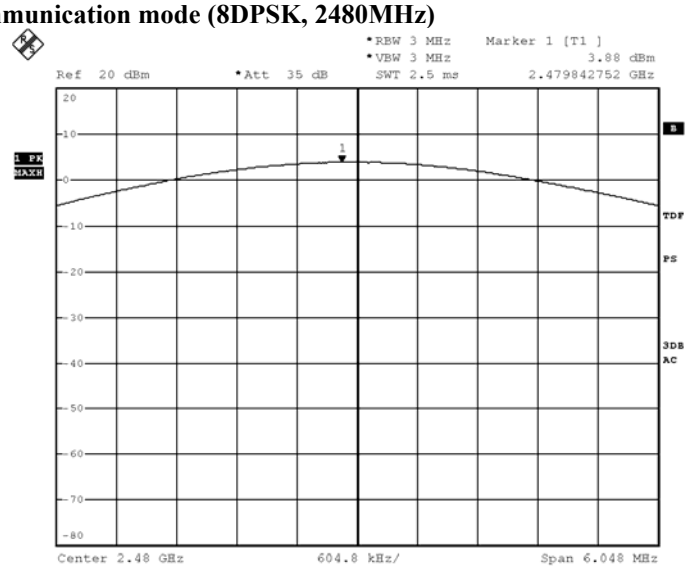
Bluetooth Communication mode (8DPSK, 2480MHz)



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3.1.2 Radiated Spurious Emissions

Test Requirement:	FCC 47CFR 15.209
Test Method:	ANSI C63.10: 2013
Test Date:	2016-09-08
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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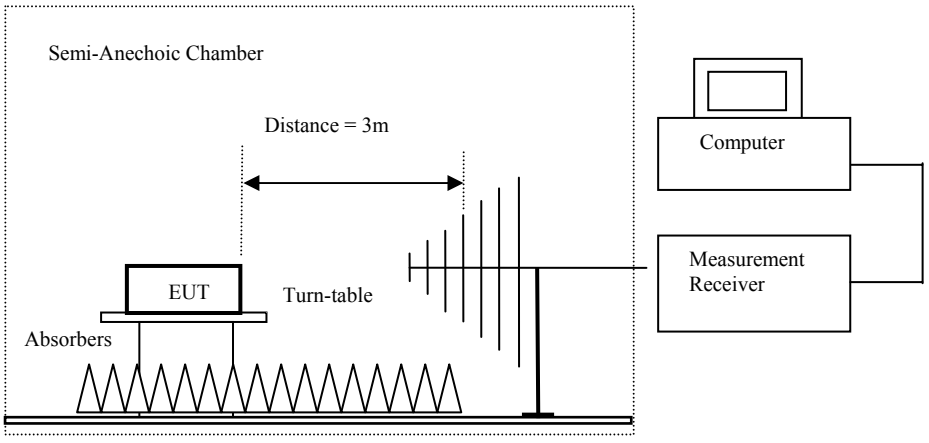
Spectrum Analyzer Setting:

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:



Ground Plane

- 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.

Block for Radiated emission:

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

Frequency Range	Quasi-Peak Limits
[MHz]	[μV/m]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
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 dBuV	Correction Factor dB/m	Field Strength dBuV/m	Field Strength uV/m	Limit uV/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

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

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dBμV/m	E-Field Polarity
4804.0	12.3	41.5	53.8	74.0	20.2	Vertical
4804.0	13.7	42.4	56.1	74.0	17.9	Horizontal
7206.0	10.1	45.1	55.2	74.0	18.8	Vertical
7206.0	9.3	46.2	55.5	74.0	18.5	Horizontal
9608.0	7.6	48.0	55.6	74.0	18.4	Vertical
9608.0	6.6	48.8	55.4	74.0	18.6	Horizontal
12010.0	4.5	51.5	56.0	74.0	18.0	Vertical
12010.0	3.7	52.4	56.1	74.0	17.9	Horizontal

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

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4804.0	0.8	41.5	42.3	54.0	11.7	Vertical
4804.0	-1.4	42.4	41.0	54.0	13.0	Horizontal
7206.0	-4.6	45.1	40.5	54.0	13.5	Vertical
7206.0	-6.0	46.2	40.2	54.0	13.8	Horizontal
9608.0	-7.5	48.0	40.5	54.0	13.5	Vertical
9608.0	-7.5	48.8	41.3	54.0	12.7	Horizontal
12010.0	-10.8	51.5	40.7	54.0	13.3	Vertical
12010.0	-10.1	52.4	42.3	54.0	11.7	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	15.9	41.6	57.5	74.0	16.5	Vertical
4882.0	11.6	42.5	54.1	74.0	19.9	Horizontal
7323.0	10.6	45.2	55.8	74.0	18.2	Vertical
7323.0	8.7	46.3	55.0	74.0	19.0	Horizontal
9764.0	7.5	48.1	55.6	74.0	18.4	Vertical
9764.0	5.7	48.9	54.6	74.0	19.4	Horizontal
12205.0	3.7	51.6	55.3	74.0	18.7	Vertical
12205.0	3.2	52.5	55.7	74.0	18.3	Horizontal

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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	-1.4	41.6	40.2	54.0	13.8	Vertical
4882.0	-1.2	42.5	41.3	54.0	12.7	Horizontal
7323.0	-4.7	45.2	40.5	54.0	13.5	Vertical
7323.0	-5.8	46.3	40.5	54.0	13.5	Horizontal
9764.0	-7.2	48.1	40.9	54.0	13.1	Vertical
9764.0	-8.1	48.9	40.8	54.0	13.2	Horizontal
12205.0	-11.1	51.6	40.5	54.0	13.5	Vertical
12205.0	-10.7	52.5	41.8	54.0	12.2	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	15.2	41.4	56.6	74.0	17.4	Vertical
4960.0	13.6	42.7	56.3	74.0	17.7	Horizontal
7440.0	9.4	45.6	55.0	74.0	19.0	Vertical
7440.0	8.3	46.5	54.8	74.0	19.2	Horizontal
9920.0	6.2	48.6	54.8	74.0	19.2	Vertical
9920.0	5.8	49.7	55.5	74.0	18.5	Horizontal
12400.0	3.9	51.7	55.6	74.0	18.4	Vertical
12400.0	2.6	52.7	55.3	74.0	18.7	Horizontal

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

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4960.0	-0.2	41.4	41.2	54.0	12.8	Vertical
4960.0	-1.4	42.7	41.3	54.0	12.7	Horizontal
7440.0	-5.0	45.6	40.6	54.0	13.4	Vertical
7440.0	-4.8	46.5	41.7	54.0	12.3	Horizontal
9920.0	-9.0	48.6	39.6	54.0	14.4	Vertical
9920.0	-9.2	49.7	40.5	54.0	13.5	Horizontal
12400.0	-10.0	51.7	41.7	54.0	12.3	Vertical
12400.0	-11.4	52.7	41.3	54.0	12.7	Horizontal

Result of Tx mode (2402.0 MHz) (π/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) (π/4-DQPSK mode) (Above 1GHz): Pass

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dBμV/m	E-Field Polarity
4804.0	13.2	41.5	54.7	74.0	19.3	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	7.8	48.0	55.8	74.0	18.2	Vertical
9608.0	5.7	48.8	54.5	74.0	19.5	Horizontal
12010.0	4.0	51.5	55.5	74.0	18.5	Vertical
12010.0	3.3	52.4	55.7	74.0	18.3	Horizontal

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Result of Tx mode (2402.0 MHz) (π/4-DQPSK mode) (Above 1GHz): Pass

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4804.0	-0.1	41.5	41.4	54.0	12.6	Vertical
4804.0	-1.9	42.4	40.5	54.0	13.5	Horizontal
7206.0	-4.8	45.1	40.3	54.0	13.7	Vertical
7206.0	-5.5	46.2	40.7	54.0	13.3	Horizontal
9608.0	-7.3	48.0	40.7	54.0	13.3	Vertical
9608.0	-7.4	48.8	41.4	54.0	12.6	Horizontal
12010.0	-10.1	51.5	41.4	54.0	12.6	Vertical
12010.0	-10.8	52.4	41.6	54.0	12.4	Horizontal

Result of Tx mode (2441.0 MHz) (π/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) (π/4-DQPSK mode) (Above 1GHz): Pass

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4882.0	15.3	41.6	56.9	74.0	17.1	Vertical
4882.0	13.3	42.5	55.8	74.0	18.2	Horizontal
7323.0	10.4	45.2	55.6	74.0	18.4	Vertical
7323.0	8.4	46.3	54.7	74.0	19.3	Horizontal
9764.0	6.9	48.1	55.0	74.0	19.0	Vertical
9764.0	6.3	48.9	55.2	74.0	18.8	Horizontal
12205.0	4.7	51.6	56.3	74.0	17.7	Vertical
12205.0	1.9	52.5	54.4	74.0	19.6	Horizontal

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Result of Tx mode (2441.0 MHz) (π/4-DQPSK mode) (Above 1GHz): Pass

Field Strength of Spurious Emissions Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
4882.0	-0.1	41.6	41.5	54.0	12.5	Vertical
4882.0	-1.5	42.5	41.0	54.0	13.0	Horizontal
7323.0	-4.6	45.2	40.6	54.0	13.4	Vertical
7323.0	-5.6	46.3	40.7	54.0	13.3	Horizontal
9764.0	-6.6	48.1	41.5	54.0	12.5	Vertical
9764.0	-8.3	48.9	40.6	54.0	13.4	Horizontal
12205.0	-10.4	51.6	41.2	54.0	12.8	Vertical
12205.0	-10.9	52.5	41.6	54.0	12.4	Horizontal

Result of Tx mode (2480.0 MHz) (π/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) (π/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	16.2	41.4	57.6	74.0	16.4	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	6.8	48.6	55.4	74.0	18.6	Vertical
9920.0	5.6	49.7	55.3	74.0	18.7	Horizontal
12400.0	4.8	51.7	56.5	74.0	17.5	Vertical
12400.0	3	52.7	55.7	74.0	18.3	Horizontal

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Result of Tx mode (2480.0 MHz) (π/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	0.3	41.4	41.7	54.0	12.3	Vertical
4960.0	-1.4	42.7	41.3	54.0	12.7	Horizontal
7440.0	-4.3	45.6	41.3	54.0	12.7	Vertical
7440.0	-5.3	46.5	41.2	54.0	12.8	Horizontal
9920.0	-7.2	48.6	41.4	54.0	12.6	Vertical
9920.0	-8.2	49.7	41.5	54.0	12.5	Horizontal
12400.0	-9.6	51.7	42.1	54.0	11.9	Vertical
12400.0	-12.4	52.7	40.3	54.0	13.7	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 dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dBμV/m	E-Field Polarity
4804.0	15.3	41.5	56.8	74.0	17.2	Vertical
4804.0	13.1	42.4	55.5	74.0	18.5	Horizontal
7206.0	9.1	45.1	54.2	74.0	19.8	Vertical
7206.0	9.2	46.2	55.4	74.0	18.6	Horizontal
9608.0	7.8	48.0	55.8	74.0	18.2	Vertical
9608.0	6.2	48.8	55.0	74.0	19.0	Horizontal
12010.0	4.7	51.8	56.5	74.0	17.5	Vertical
12010.0	3.1	52.4	55.5	74.0	18.5	Horizontal

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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	-0.5	41.5	41.0	54.0	13.0	Vertical
4804.0	-0.6	42.4	41.8	54.0	12.2	Horizontal
7206.0	-5.1	45.1	40.0	54.0	14.0	Vertical
7206.0	-4.9	46.2	41.3	54.0	12.7	Horizontal
9608.0	-6.6	48.0	41.4	54.0	12.6	Vertical
9608.0	-7.5	48.8	41.3	54.0	12.7	Horizontal
12010.0	-10.4	51.8	41.4	54.0	12.6	Vertical
12010.0	-11.0	52.4	41.4	54.0	12.6	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	15.1	41.6	56.7	74.0	17.3	Vertical
4882.0	13.3	42.5	55.8	74.0	18.2	Horizontal
7323.0	10.1	45.2	55.3	74.0	18.7	Vertical
7323.0	8.4	46.3	54.7	74.0	19.3	Horizontal
9764.0	7	48.1	55.1	74.0	18.9	Vertical
9764.0	5.8	48.9	54.7	74.0	19.3	Horizontal
12205.0	4.0	51.5	55.5	74.0	18.5	Vertical
12205.0	3.2	52.5	55.7	74.0	18.3	Horizontal

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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	-0.7	41.6	40.9	54.0	13.1	Vertical
4882.0	-2.0	42.5	40.5	54.0	13.5	Horizontal
7323.0	-4.6	45.2	40.6	54.0	13.4	Vertical
7323.0	-5.9	46.3	40.4	54.0	13.6	Horizontal
9764.0	-7.8	48.1	40.3	54.0	13.7	Vertical
9764.0	-8.4	48.9	40.5	54.0	13.5	Horizontal
12205.0	-11.0	51.6	40.6	54.0	13.4	Vertical
12205.0	-10.0	52.5	42.5	54.0	11.5	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	14.9	41.4	56.3	74.0	17.7	Vertical
4960.0	12.8	42.7	55.5	74.0	18.5	Horizontal
7440.0	8.8	45.6	54.4	74.0	19.6	Vertical
7440.0	8.1	46.5	54.6	74.0	19.4	Horizontal
9920.0	6.9	48.6	55.5	74.0	18.5	Vertical
9920.0	5.0	49.7	54.7	74.0	19.3	Horizontal
12400.0	4.9	51.7	56.6	74.0	17.4	Vertical
12400.0	3.3	52.7	56.0	74.0	18.0	Horizontal

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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	0.1	41.4	41.5	54.0	12.5	Vertical
4960.0	-2.4	42.7	40.3	54.0	13.7	Horizontal
7440.0	-3.9	45.6	41.7	54.0	12.3	Vertical
7440.0	-7.1	46.5	39.4	54.0	14.6	Horizontal
9920.0	-7.6	48.6	41.0	54.0	13.0	Vertical
9920.0	-9.4	49.7	40.3	54.0	13.7	Horizontal
12400.0	-9.3	51.7	42.4	54.0	11.6	Vertical
12400.0	-11.2	52.7	41.5	54.0	12.5	Horizontal

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

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

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

Correction Factor included Antenna Factor and Cable Attenuation.

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

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

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Radiated Emissions Measurement:

Limit：

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

Result： Radiated Emissions (GFSK Lowest)

Field Strength of Band-edge Compliance Peak Value						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dBμV/m	E-Field Polarity
2390.0	13.3	36.8	50.1	74.0	23.9	Vertical

Field Strength of Band-edge Compliance Average Value						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dBμV/m	E-Field Polarity
2390.0	5.4	36.8	42.2	54.0	11.8	Vertical

Result： Radiated Emissions (GFSK Highest)

Field Strength of Band-edge Compliance Peak Value						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dBμV/m	E-Field Polarity
2483.5	28.4	36.4	64.8	74.0	9.2	Horizontal

Field Strength of Band-edge Compliance Average Value						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dBμV/m	E-Field Polarity
2483.5	4.3	36.4	40.7	54.0	13.3	Horizontal

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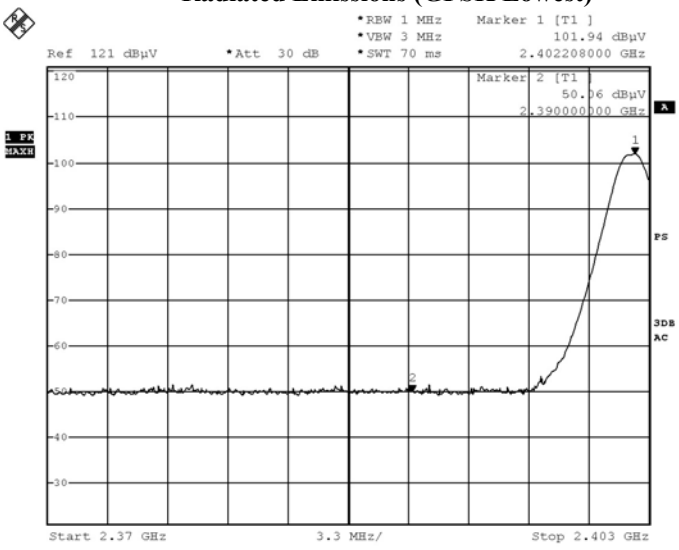
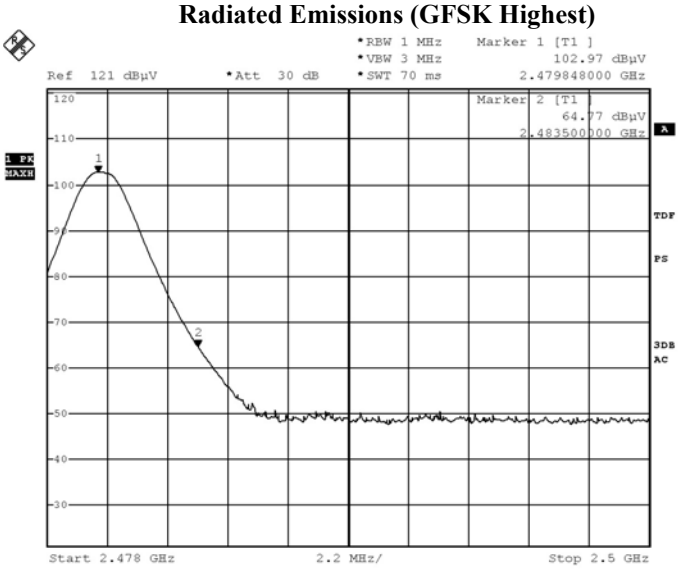
Radiated Emissions (GFSK Lowest)



Radiated Emissions (GFSK Highest)



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Radiated Emissions Measurement:

Limit：

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

Result： Radiated Emissions (π/4-DQPSK Lowest)

Field Strength of Band-edge Compliance Peak Value						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dBμV/m	E-Field Polarity
2390.0	12.9	36.8	49.7	74.0	24.3	Vertical

Field Strength of Band-edge Compliance Average Value						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dBμV/m	E-Field Polarity
2390.0	4.7	36.8	41.5	54.0	12.5	Vertical

Result： Radiated Emissions (π/4-DQPSK Highest)

Field Strength of Band-edge Compliance Peak Value						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dBμV/m	E-Field Polarity
2483.5	27.8	36.4	64.2	74.0	9.8	Horizontal

Field Strength of Band-edge Compliance Average Value						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dBμV/m	E-Field Polarity
2483.5	6.6	36.4	43.0	54.0	11.0	Horizontal

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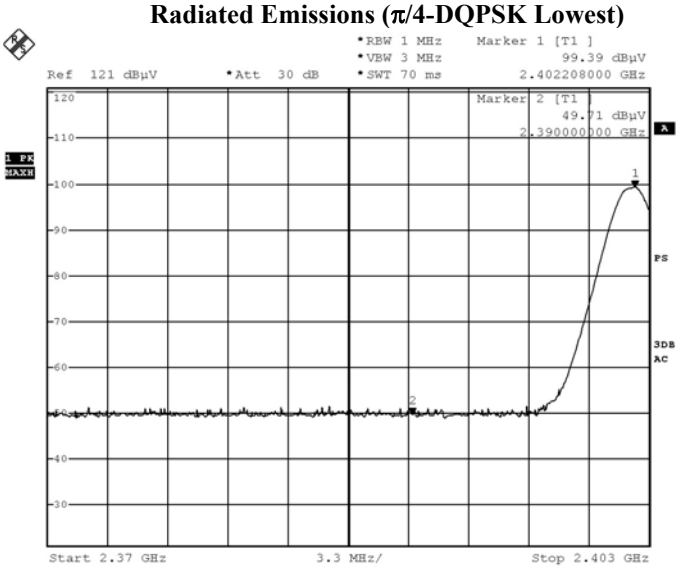
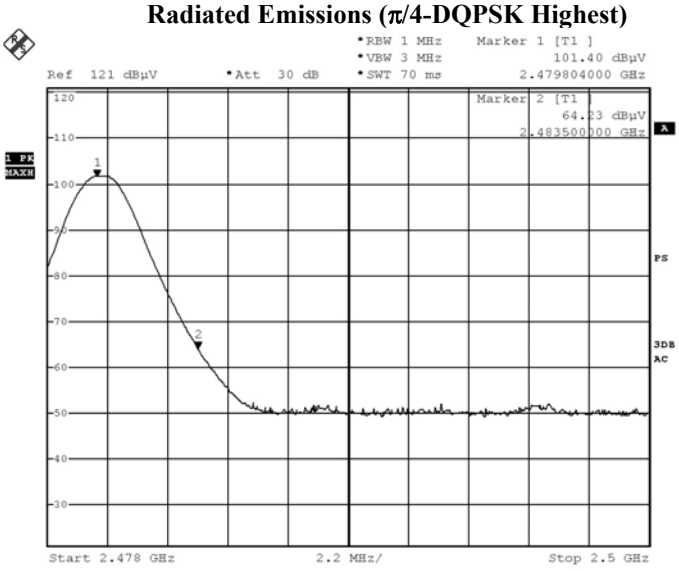
Radiated Emissions (π/4-DQPSK Lowest)



Radiated Emissions (π/4-DQPSK Highest)



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Radiated Emissions Measurement:

Limit：

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

Result： Radiated Emissions (8DPSK Lowest)

Field Strength of Band-edge Compliance Peak Value						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dBμV/m	E-Field Polarity
2400.0	13.3	36.8	50.1	74.0	23.9	Vertical

Field Strength of Band-edge Compliance Average Value						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dBμV/m	E-Field Polarity
2400.0	4.9	36.8	41.7	54.0	12.3	Vertical

Result： Radiated Emissions (8DPSK Highest)

Field Strength of Band-edge Compliance Peak Value						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dBμV/m	E-Field Polarity
2483.5	27.9	36.4	64.3	74.0	9.7	Horizontal

Field Strength of Band-edge Compliance Average Value						
Frequency MHz	Measured Level @3m dBμV	Correction Factor dB/m	Field Strength dBμV/m	Limit @3m dBμV/m	Margin dBμV/m	E-Field Polarity
2483.5	6.4	36.4	42.8	54.0	11.2	Horizontal

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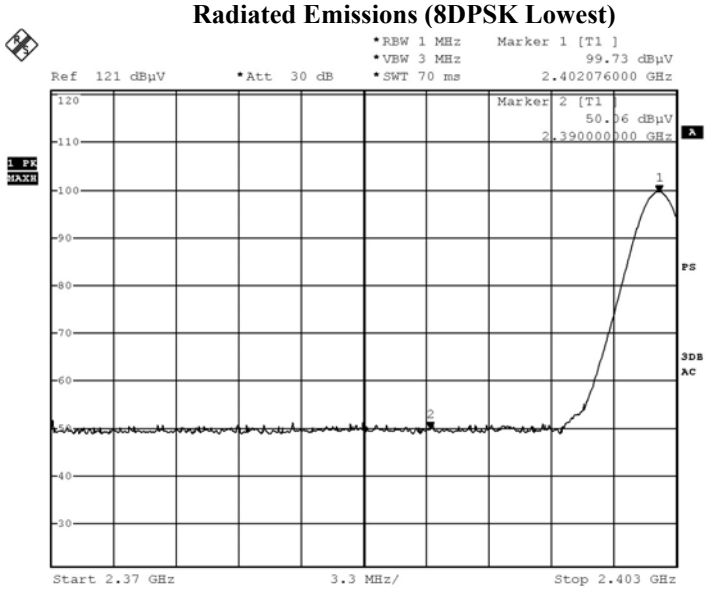
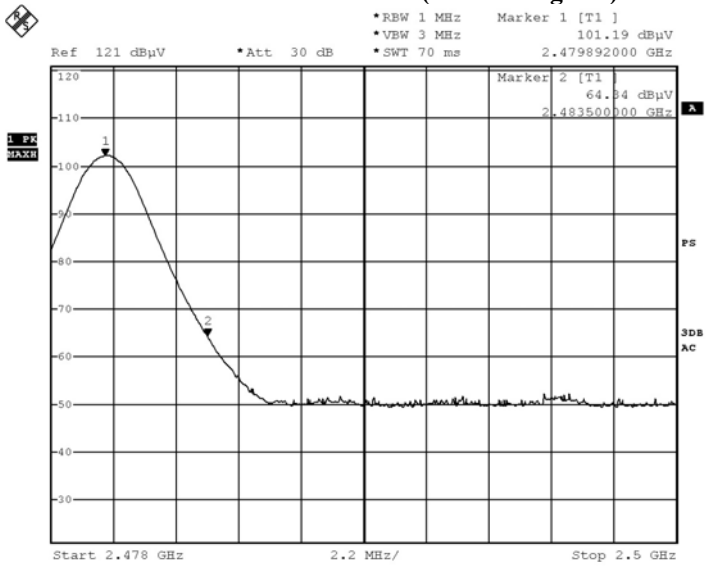
Radiated Emissions (8DPSK Lowest)



Radiated Emissions (8DPSK Highest)



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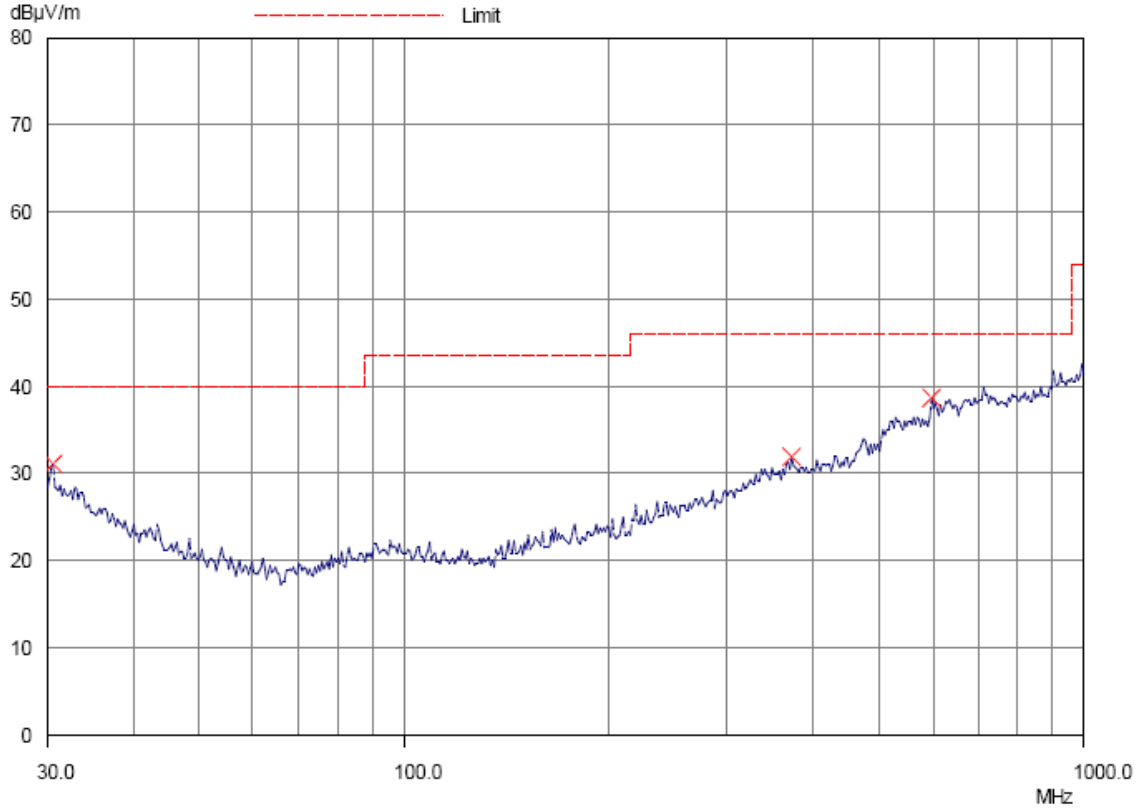
Limits for Radiated Emissions [FCC 47 CFR 15.209 Class B]:

Frequency Range	Quasi-Peak Limits
[MHz]	[μV/m]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
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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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
30.3	Horizontal	31.0	40.0	15.1	100
369.8	Horizontal	31.9	46.0	17.7	200
596.5	Horizontal	38.6	46.0	15.1	200

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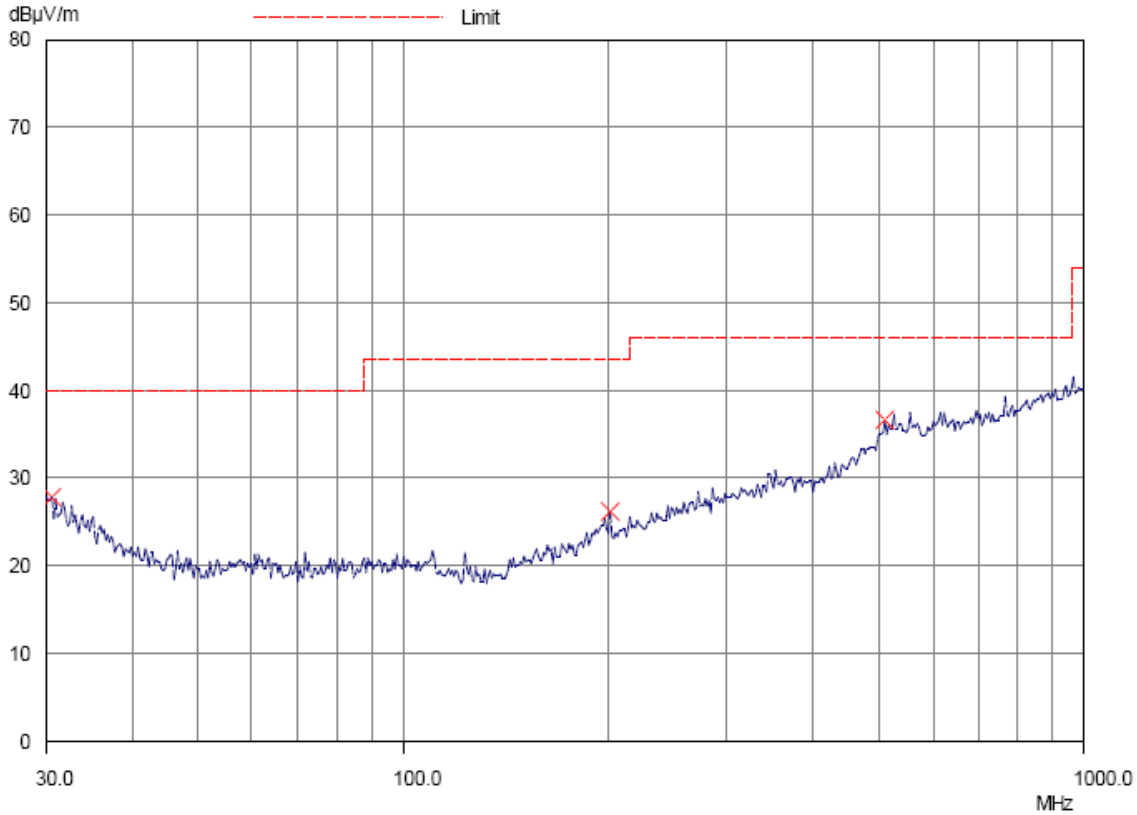
Limits for Radiated Emissions [FCC 47 CFR 15.209 Class B]:

Frequency Range	Quasi-Peak Limits
[MHz]	[μV/m]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
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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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
30.4	Vertical	27.9	40.0	24.8	100
199.8	Vertical	26.1	43.5	20.2	150
506.5	Vertical	36.6	46.0	67.6	200

Remarks:
Calculated measurement uncertainty (30MHz – 1GHz): 4.9dB
Emissions in the vertical and horizontal polarizations have been investigated and the worst-case test results are recorded in this report.

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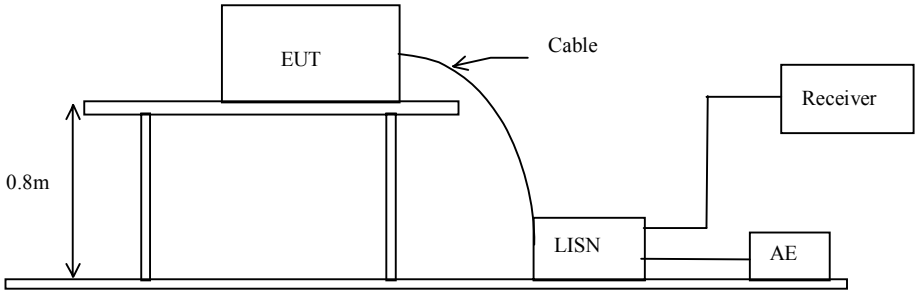
3.1.3 AC Mains Conducted Emissions (0.15MHz to 30MHz)

Test Requirement:	FCC 47CFR 15.207
Test Method:	ANSI C63.10: 2013
Test Date:	2016-09-01
Mode of Operation:	Charging mode
Test Voltage:	120Va.c. 60Hz

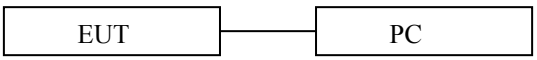
Test Method:

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:



Block for Conducted Emission:



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Limit for Conducted Emissions (FCC 47 CFR 15.207):

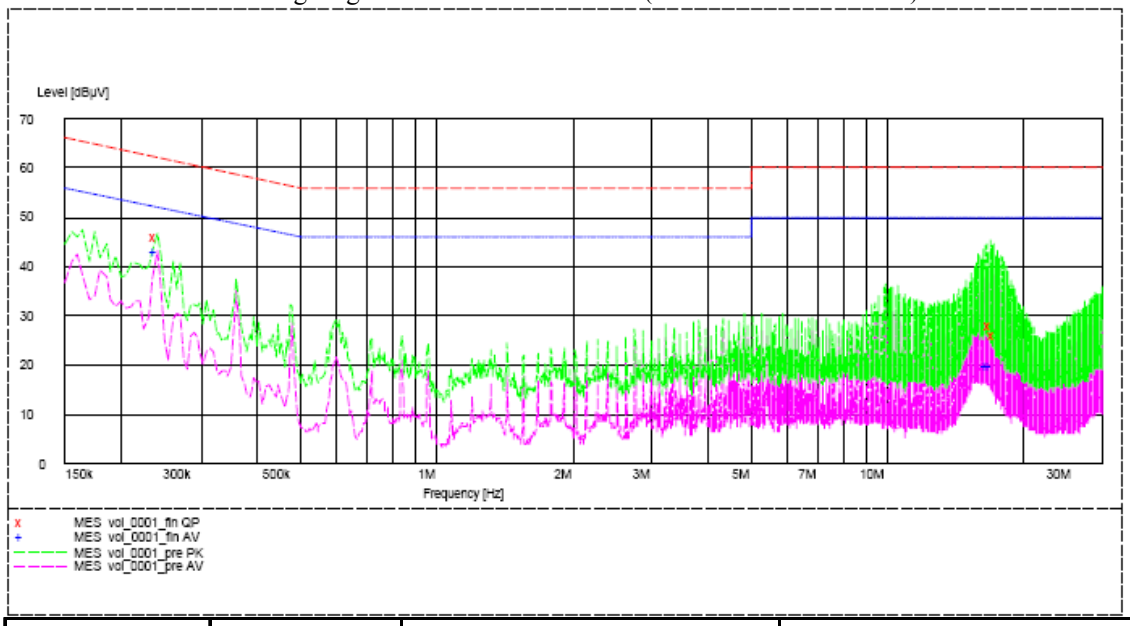
Frequency Range [MHz]	Quasi-Peak Limits [dBμV]	Average [dBμV]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

* Decreases with the logarithm of the frequency.

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

Result of Charging 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 dBμV	Limit dBμV	Level dBμV	Limit dBμV
Live	0.240	46.0	62.0	-*-	-*-
Live	16.905	27.9	60.0	-*-	-*-
Live	17.265	26.3	60.0	-*-	-*-
Live	0.240	-*-	-*-	43.2	52.0
Live	16.665	-*-	-*-	19.9	50.0
Live	16.905	-*-	-*-	19.8	50.0

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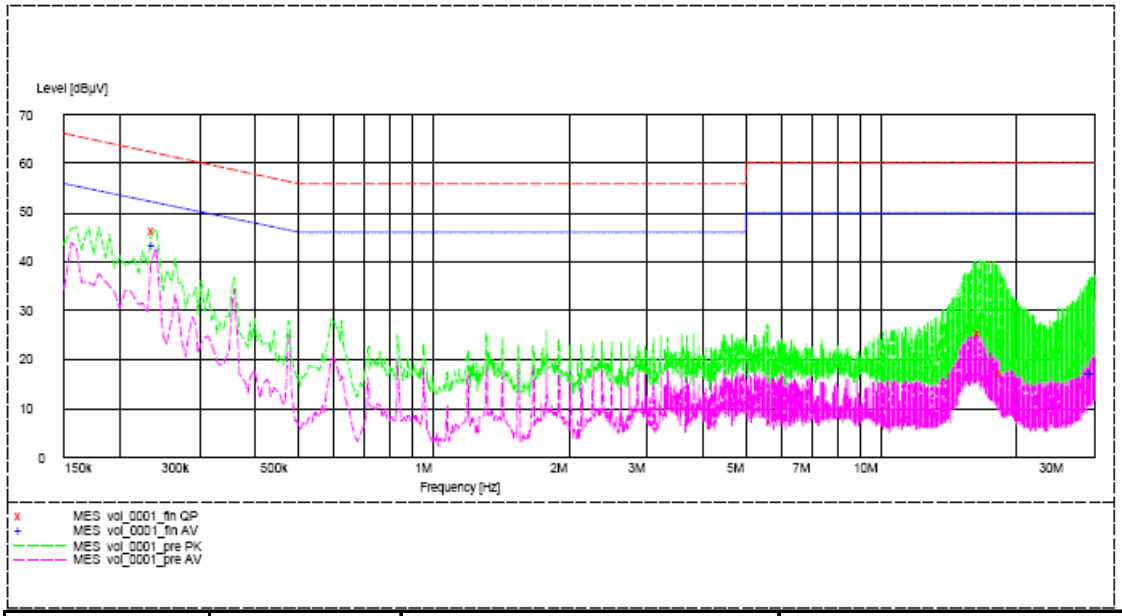
Limit for Conducted Emissions (FCC 47 CFR 15.207):

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

* Decreases with the logarithm of the frequency.
Limits for Conducted Emissions Test, please refer to limit lines (Quasi-Peak and Average) in the following diagram.

Result of Charging 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 Level dBµV	Quasi-peak Limit dBµV	Average Level dBµV	Average Limit dBµV
Neutral	0.240	46.1	62.0	-*-	-*-
Neutral	16.605	25.4	60.0	-*-	-*-
Neutral	18.515	17.2	60.0	-*-	-*-
Neutral	0.240	-*-	-*-	43.4	52.0
Neutral	29.405	-*-	-*-	17.3	50.0
Neutral	19.645	-*-	-*-	17.5	50.0

Remarks:
Calculated measurement uncertainty (0.15MHz – 30MHz): 3.2dB
-*- Emission(s) that is far below the corresponding limit line.

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3.1.4 Number of Hopping Frequency

Limit of Number of Hopping Frequency

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

Test Method:

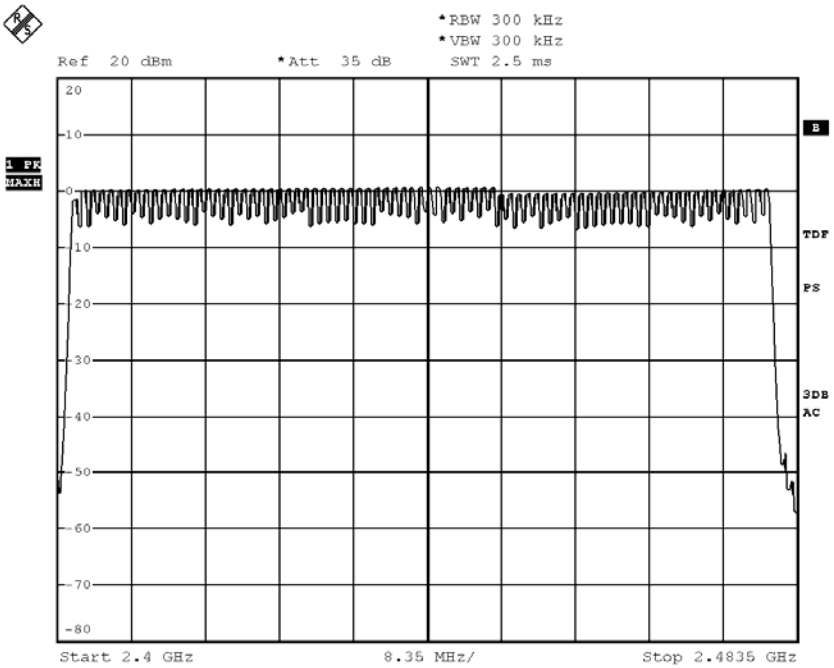
The RF output of the EUT was connected to the spectrum analyzer by a low loss cable.

Spectrum Analyzer Setting:

RBW = 1MHz, VBW ≥ 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: 30.AUG.2016 11:12:54

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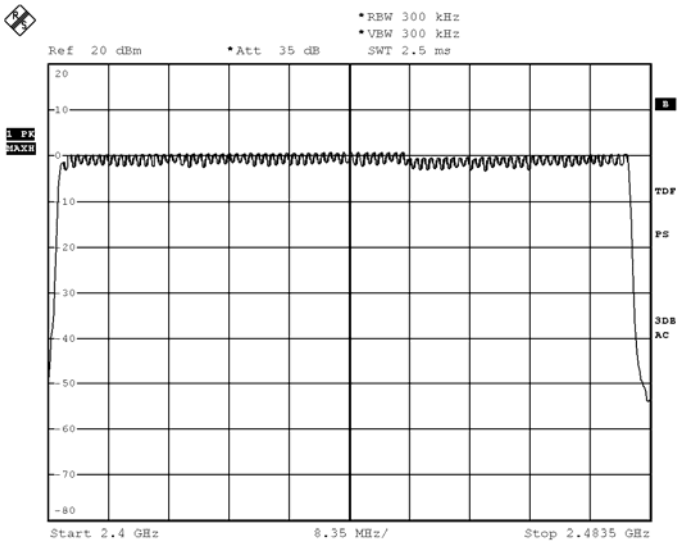
π/4-DQPSK: 79 of 79 Channel



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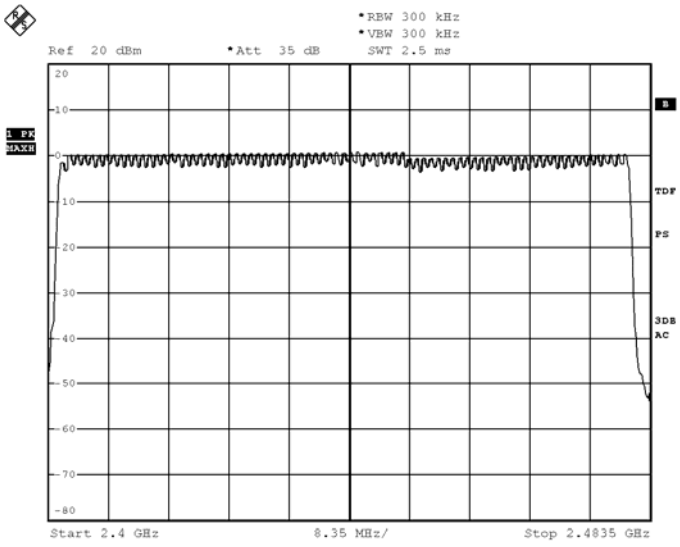
Date: 30.AUG.2016 11:03:10

8DPSK: 79 of 79 Channel



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3.1.5 20dB Bandwidth

Test Requirement:	FCC 47CFR 15.247(a)(1)
Test Method:	ANSI C63.10: 2013
Test Date:	2016-08-30
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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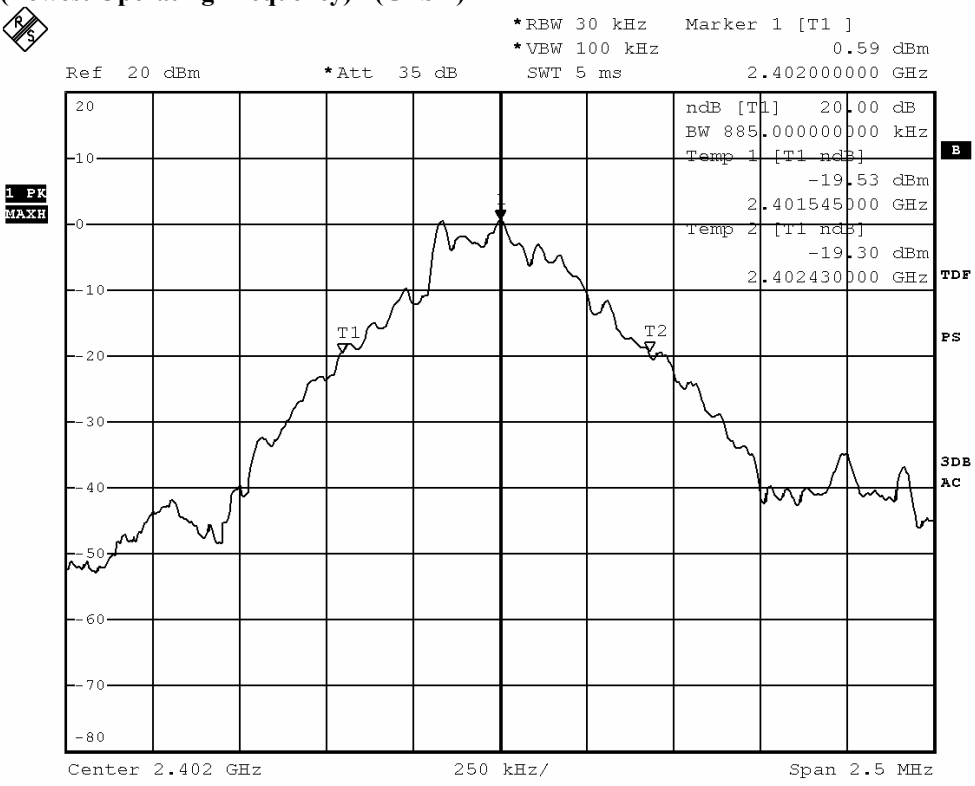
Fundamental Frequency [MHz]	20dB Bandwidth [kHz]	FCC Limits [MHz]
2402	885.0	Within 2400-2483.5

(Lowest Operating Frequency) - (GFSK)



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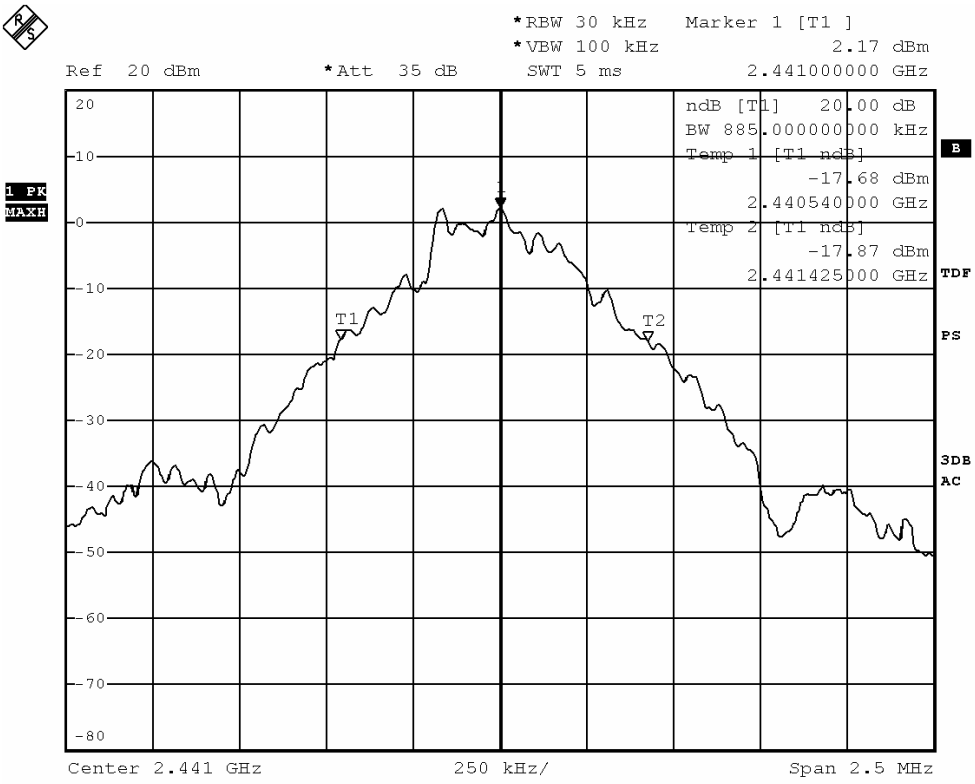
Fundamental Frequency [MHz]	20dB Bandwidth [kHz]	FCC Limits [MHz]
2441	885.0	Within 2400-2483.5

(Middle Operating Frequency) - (GFSK)



BMP

Date: 30.AUG.2016 10:03:59

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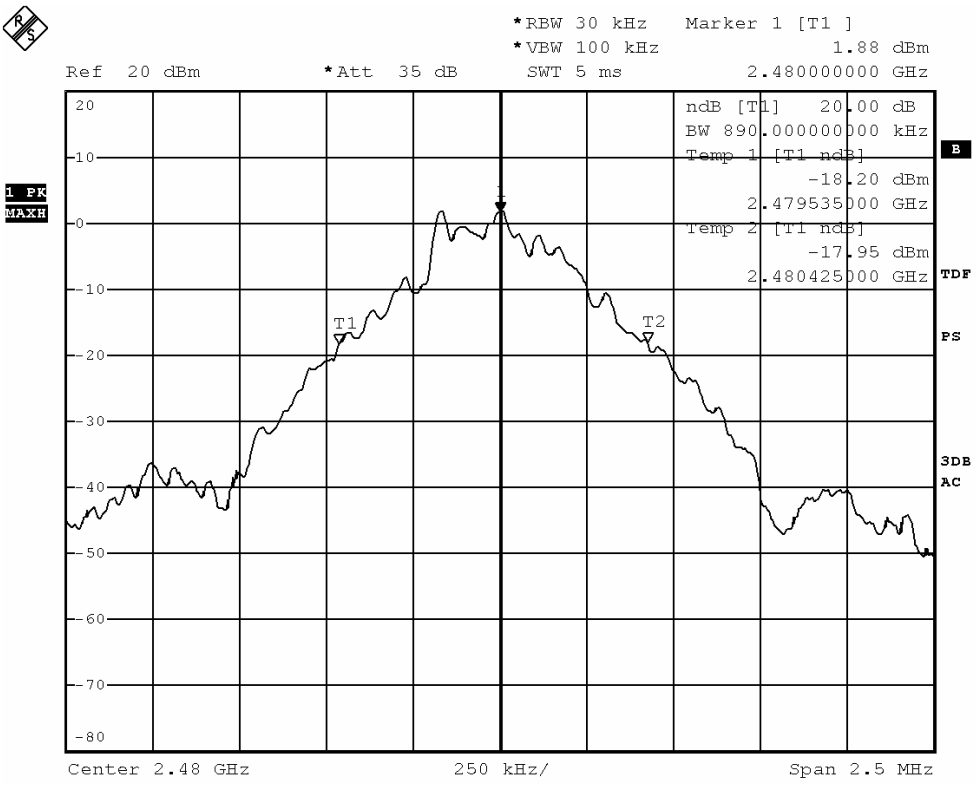
Fundamental Frequency [MHz]	20dB Bandwidth [kHz]	FCC Limits [MHz]
2480	890.0	Within 2400-2483.5

(Highest Operating Frequency) - (GFSK)



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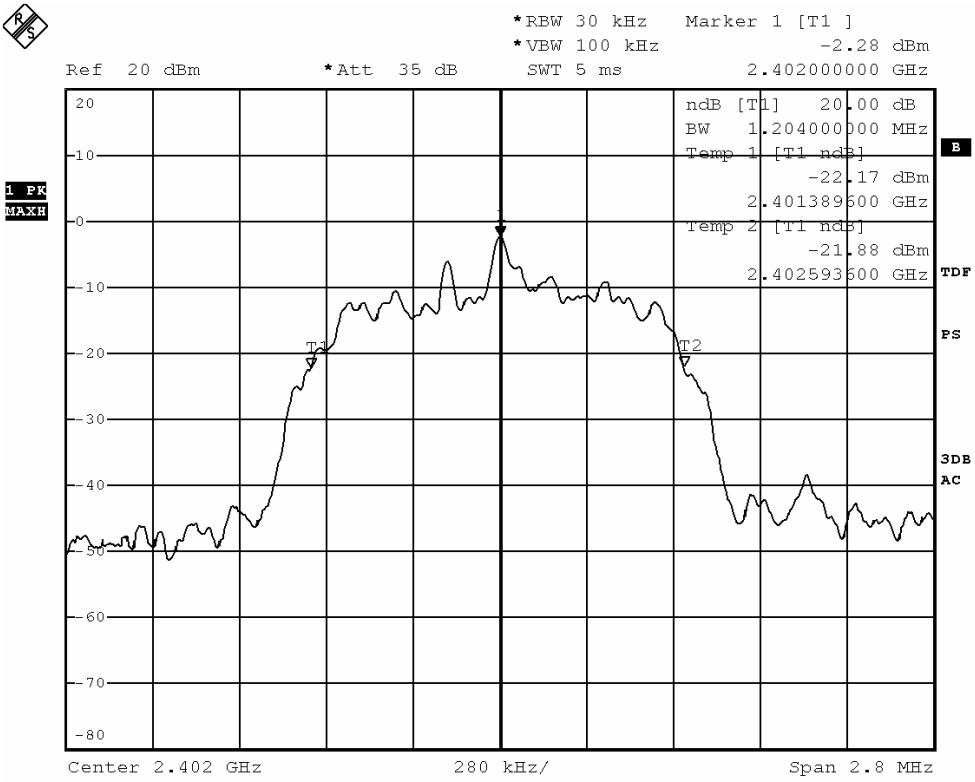
Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	1.204	Within 2400-2483.5

(Lowest Operating Frequency) - (π/4-DQPSK)



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Date: 30.AUG.2016 10:07:06

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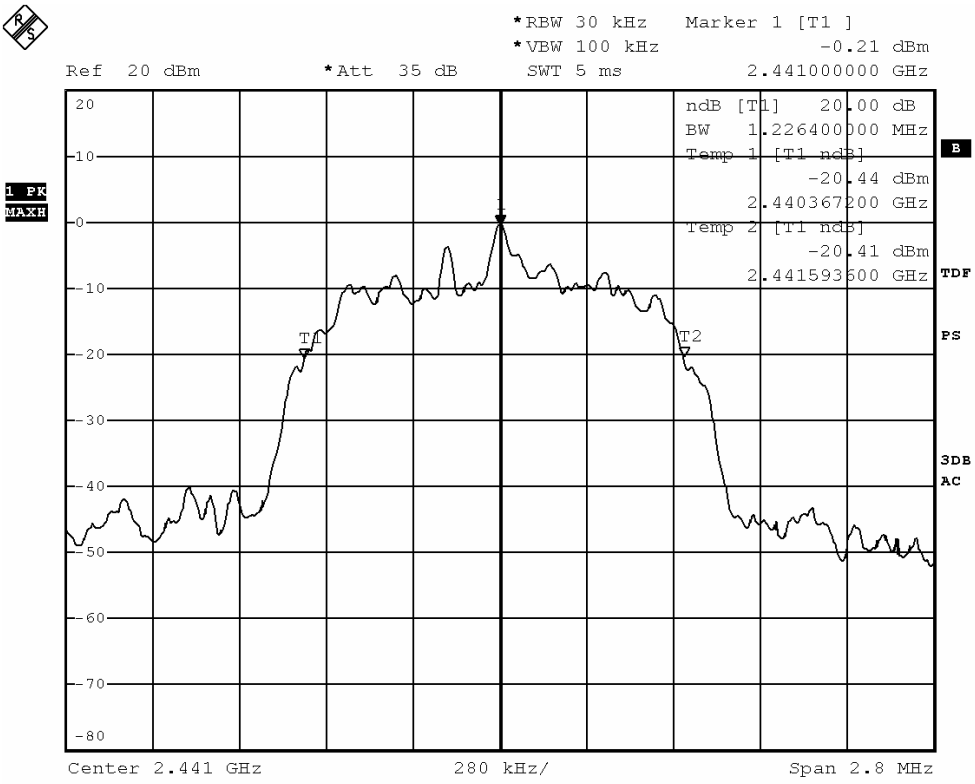
Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2441	1.2264	Within 2400-2483.5

(Middle Operating Frequency) - (π/4 -DQPSK)



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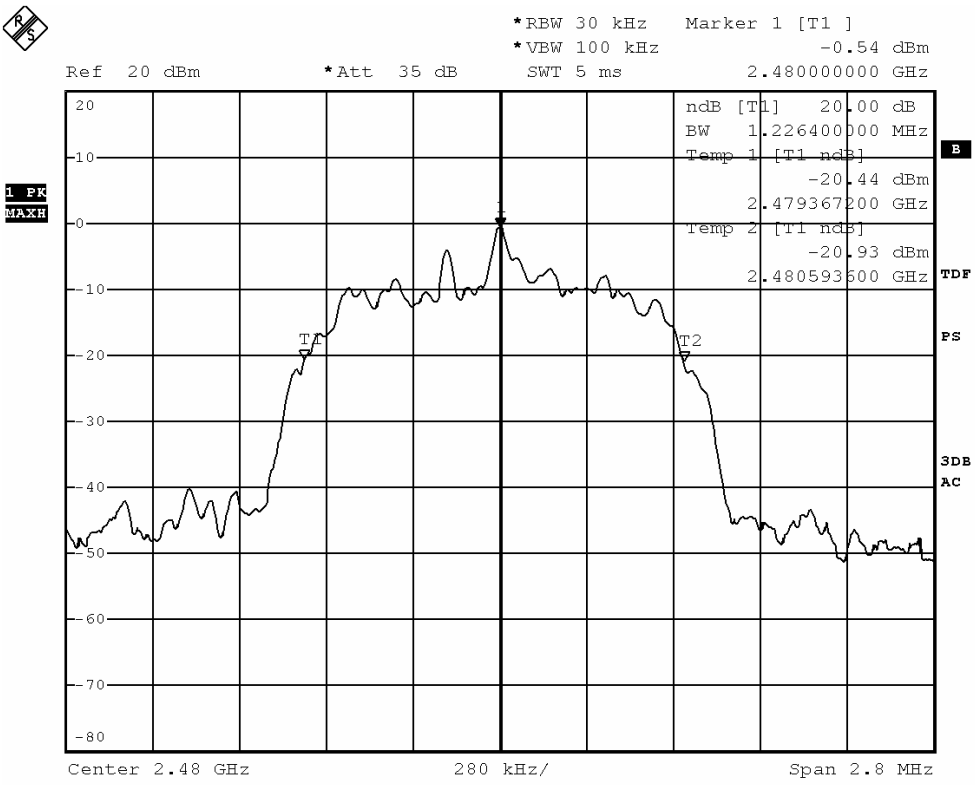
Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2480	1.2264	Within 2400-2483.5

(Highest Operating Frequency) - (π/4 -DQPSK)



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Date: 30.AUG.2016 10:05:28

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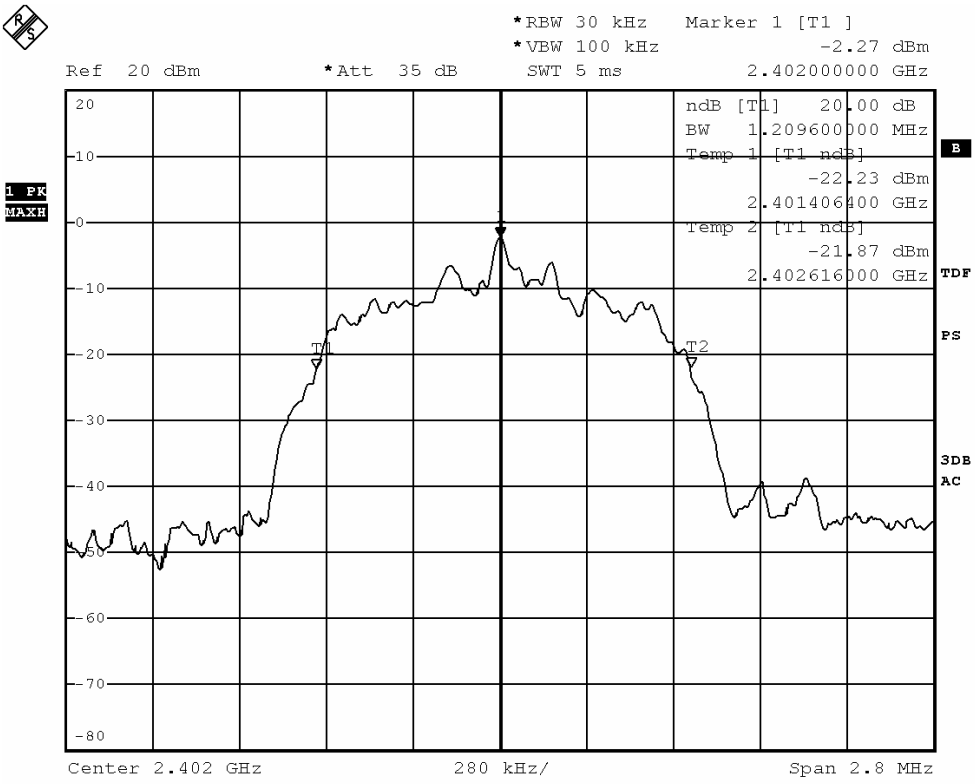
Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	1.2096	Within 2400-2483.5

(Lowest Operating Frequency) - (8DPSK)



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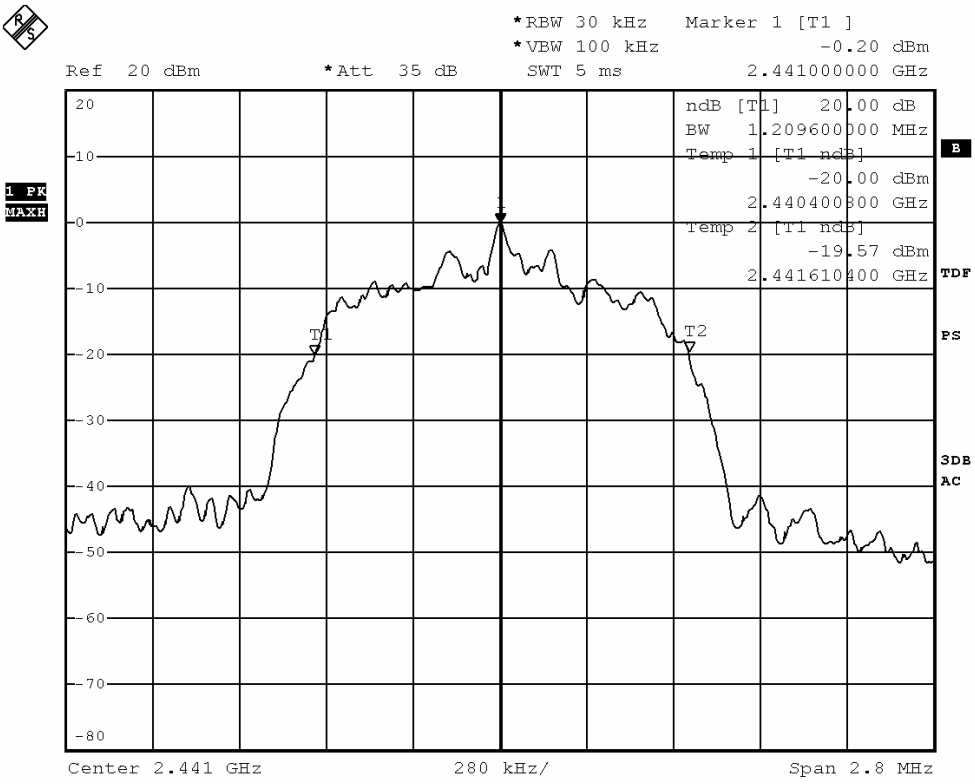
Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2441	1.2096	Within 2400-2483.5

(Middle Operating Frequency) - (8DPSK)



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Date: 30.AUG.2016 10:08:34

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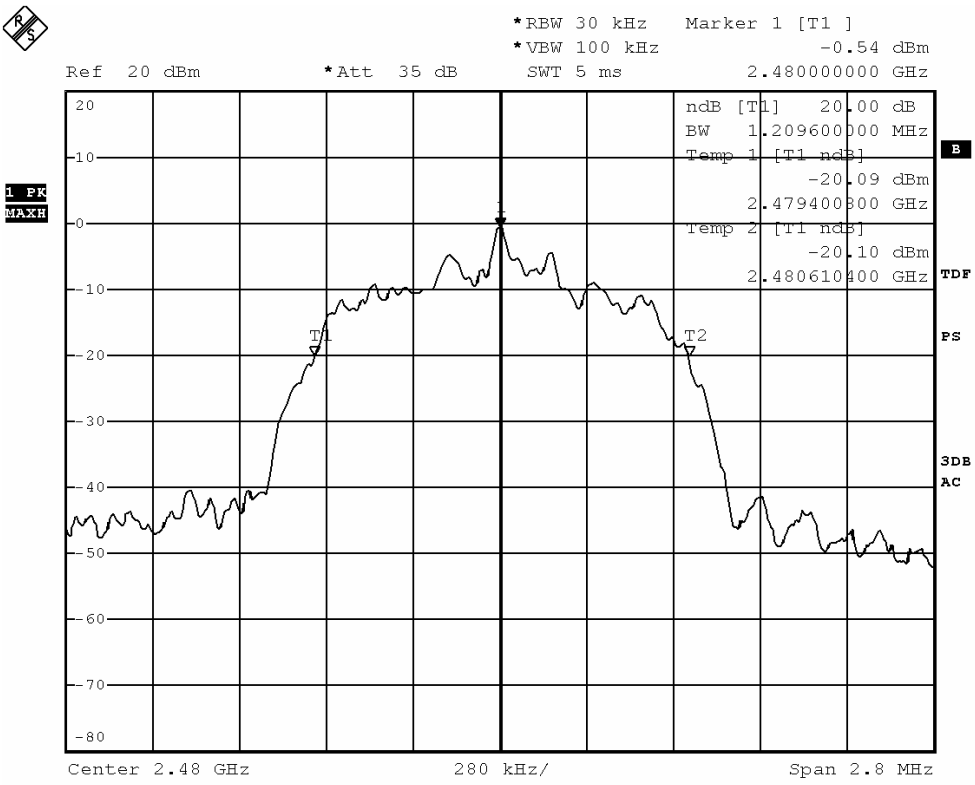
Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2480	1.2096	Within 2400-2483.5

(Highest Operating Frequency) - (8DPSK)



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3.1.6 Hopping Channel Separation

Requirements:

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

Limit:

The measured maximum bandwidth = 890KHz (GFSK)

The measured maximum bandwidth * 2/3 = 1.2264MHz * 2/3 =817.6kHz(π/4 DQPSK, 8DPSK)

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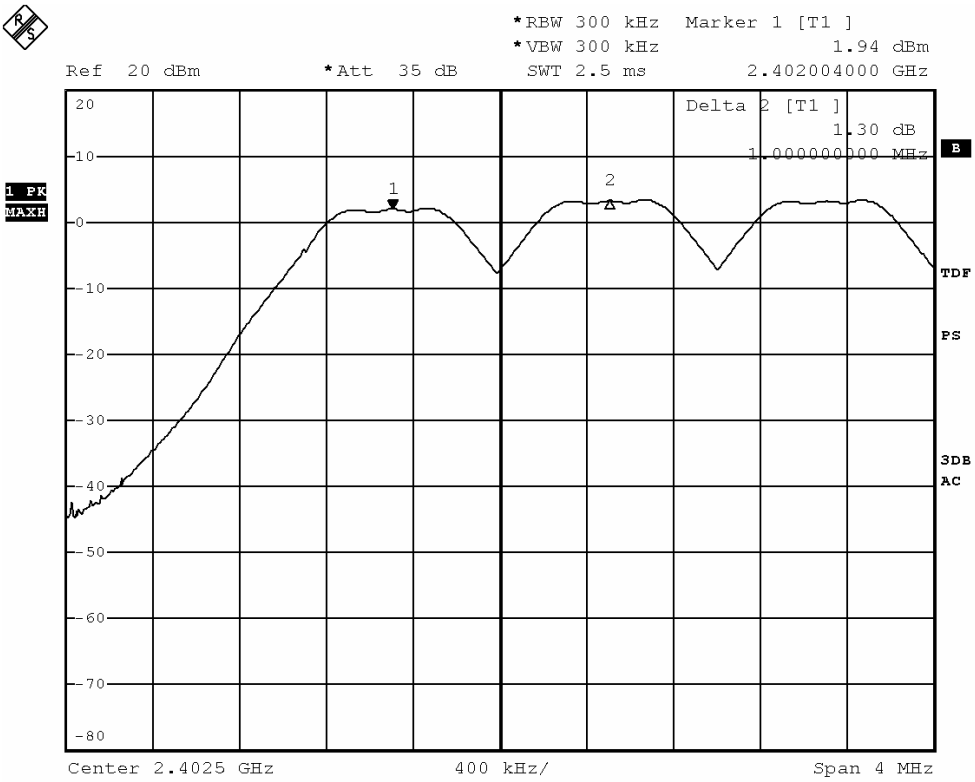
Channel separation = 1MHz (>890kHz) （Lowest） (GFSK)



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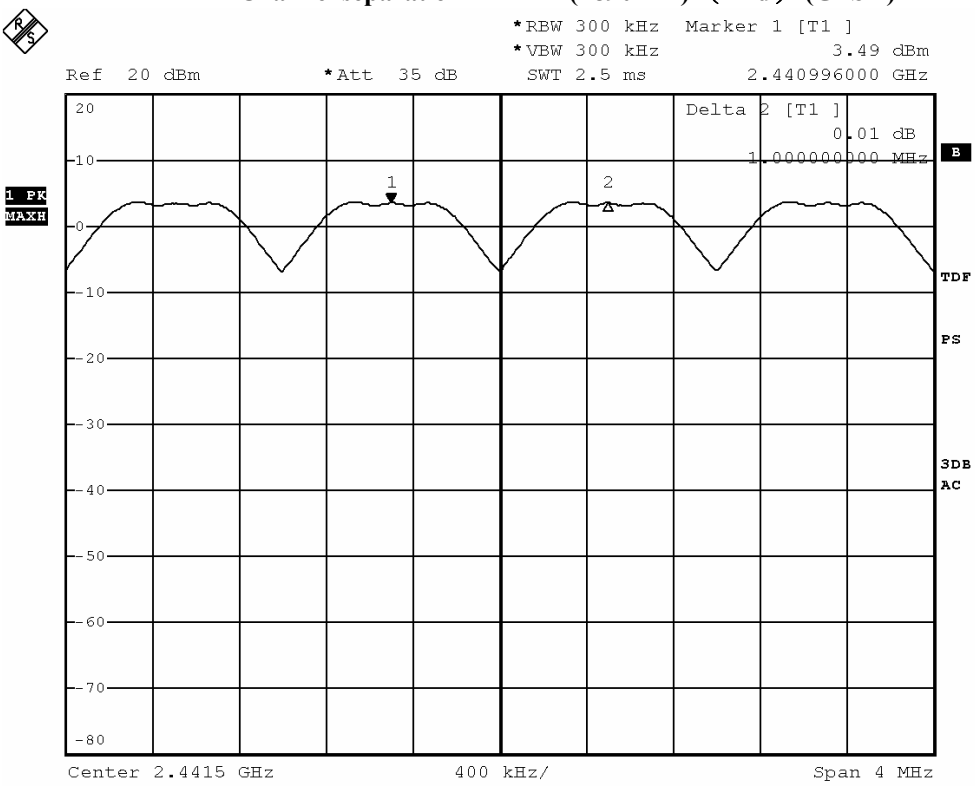
Channel separation = 1MHz (>890kHz) （Mid） (GFSK)



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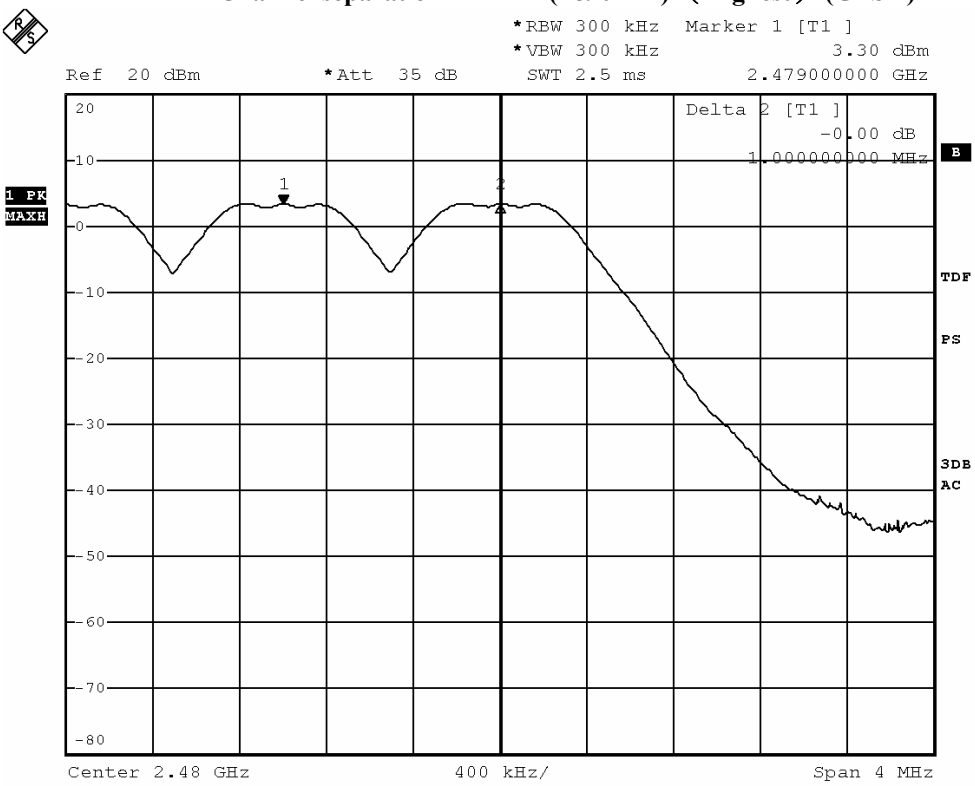
Channel separation = 1MHz (>890kHz) （Highest） (GFSK)



BMP

Date: 30.AUG.2016 10:20:38

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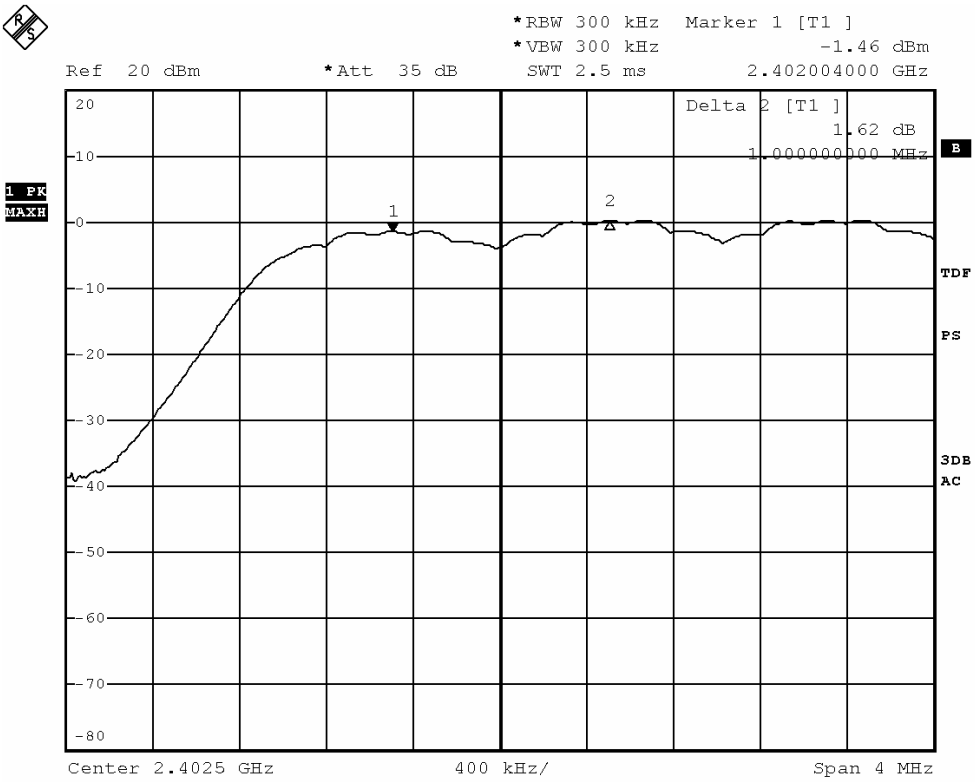
Channel separation = 1MHz (>817.6kHz) （Lowest）(π/4 DQPSK)



BMP

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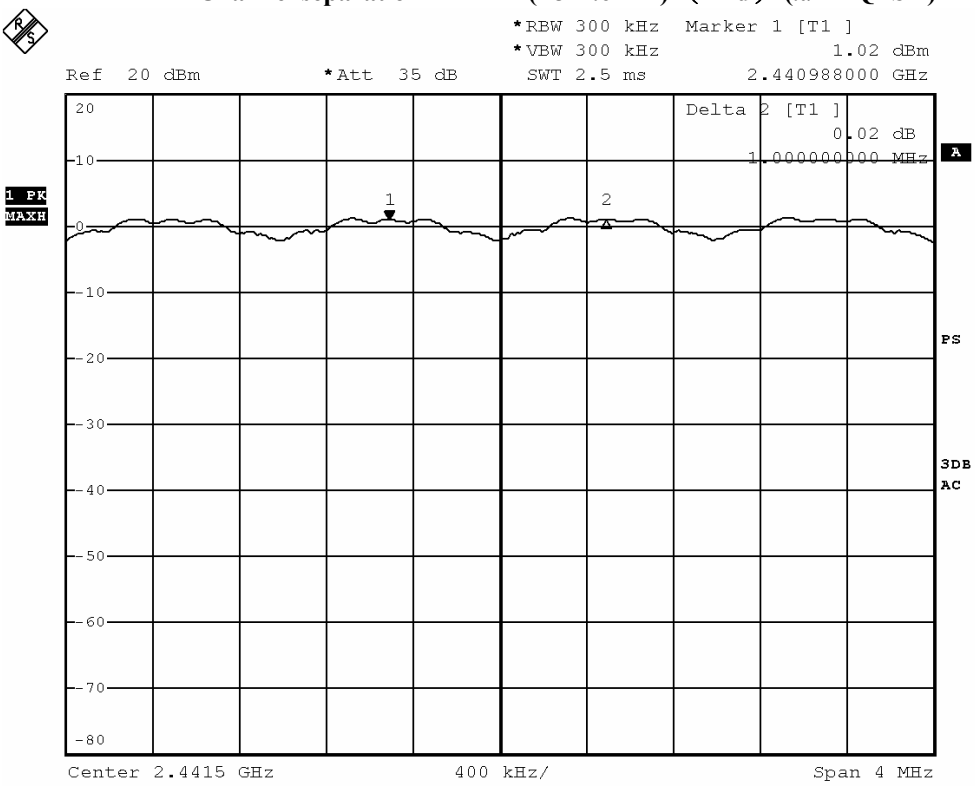
Channel separation = 1MHz (>817.6kHz) （Mid） (π/4 DQPSK)



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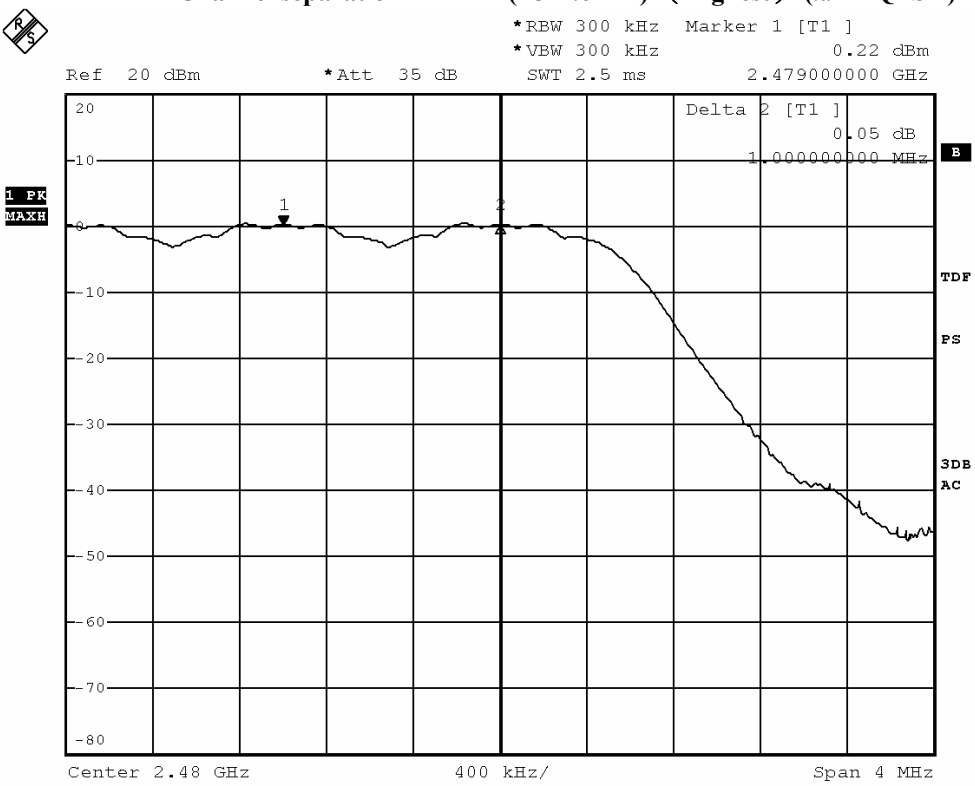
Channel separation = 1MHz (>817.6kHz) （Highest） (π/4 DQPSK)



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Date: 30.AUG.2016 10:19:19

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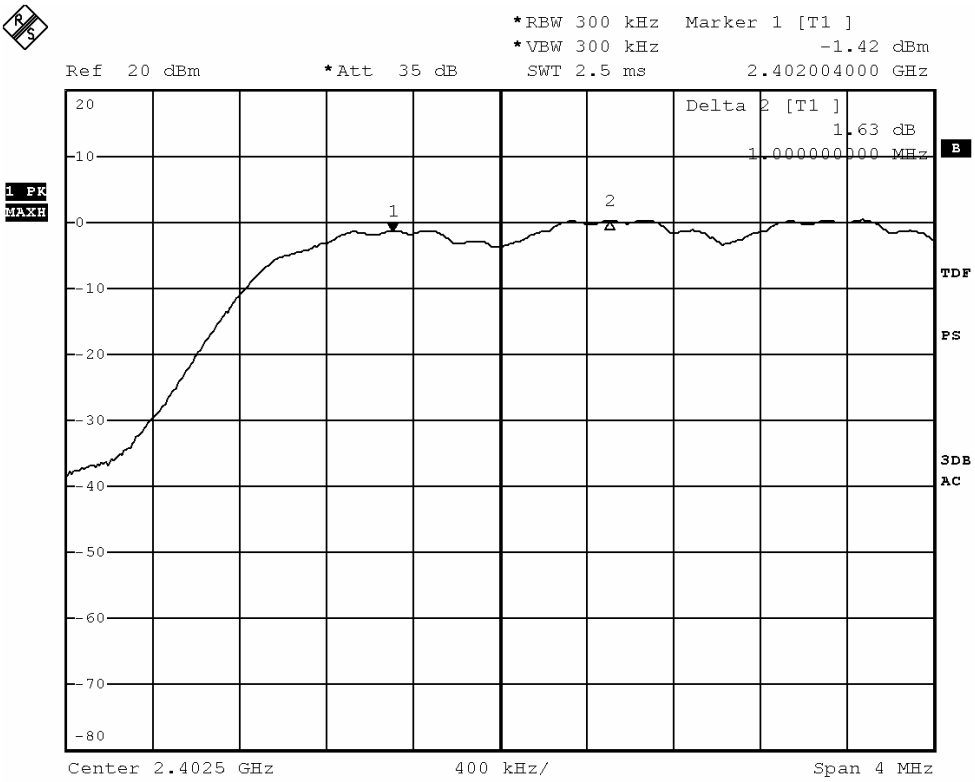
Channel separation = 1MHz (>817.6kHz) （Lowest） (8DPSK)



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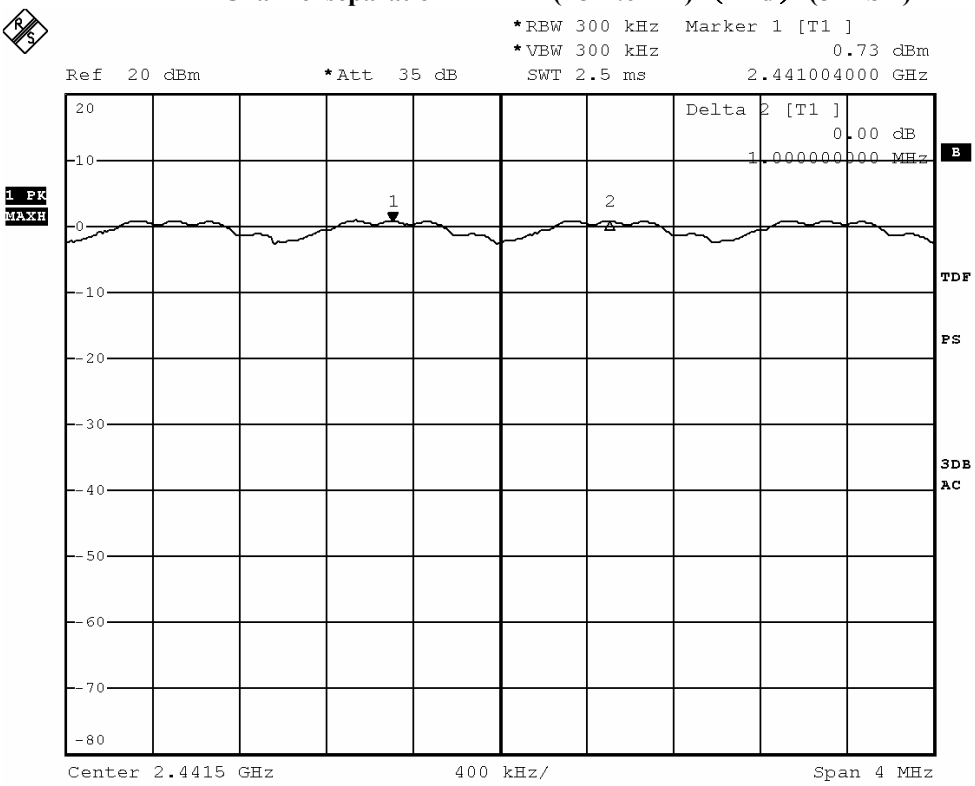
Channel separation = 1MHz (>817.6kHz) （Mid） (8DPSK)



BMP

Date: 30.AUG.2016 10:11:57

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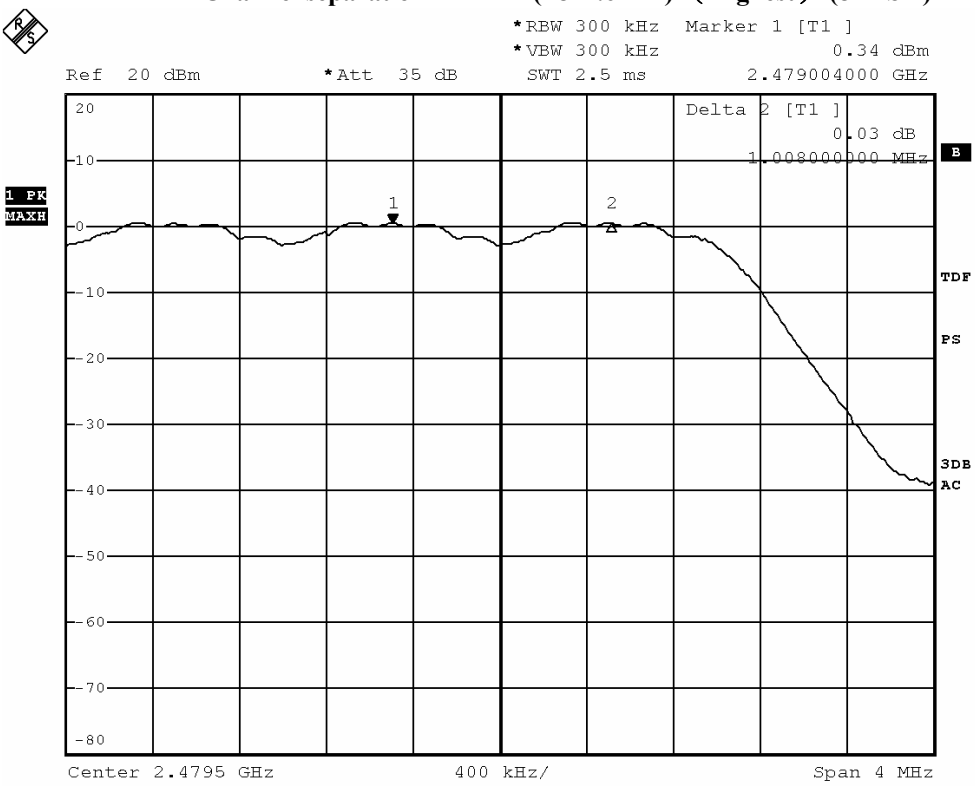
Channel separation = 1MHz (>817.6kHz) （Highest） (8DPSK)



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Date: 30.AUG.2016 10:10:40

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3.1.7 Band-edge Compliance of RF Conducted Emissions Measurement:

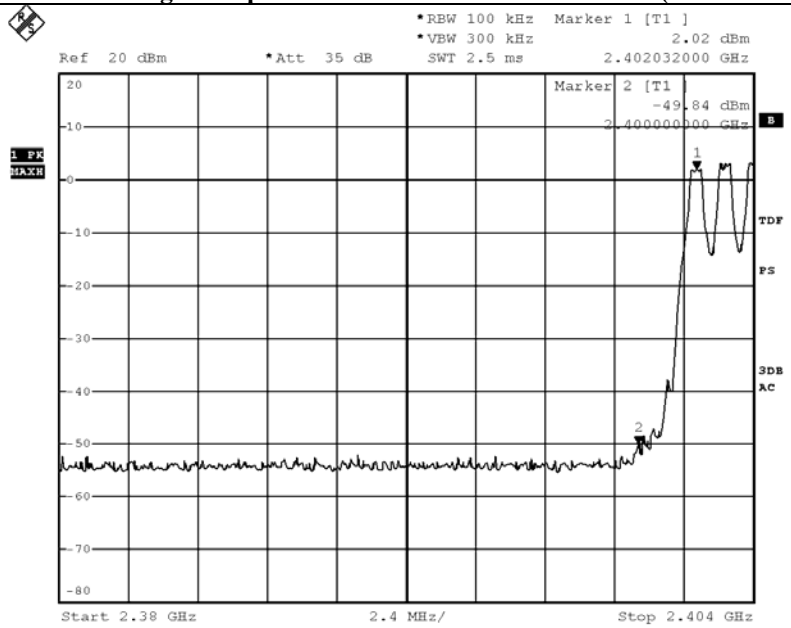
Limit：

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. 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)	51.86

Band-edge Compliance of RF Conducted Emissions (GFSK Lowest)



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Date: 30.AUG.2016 10:26:20

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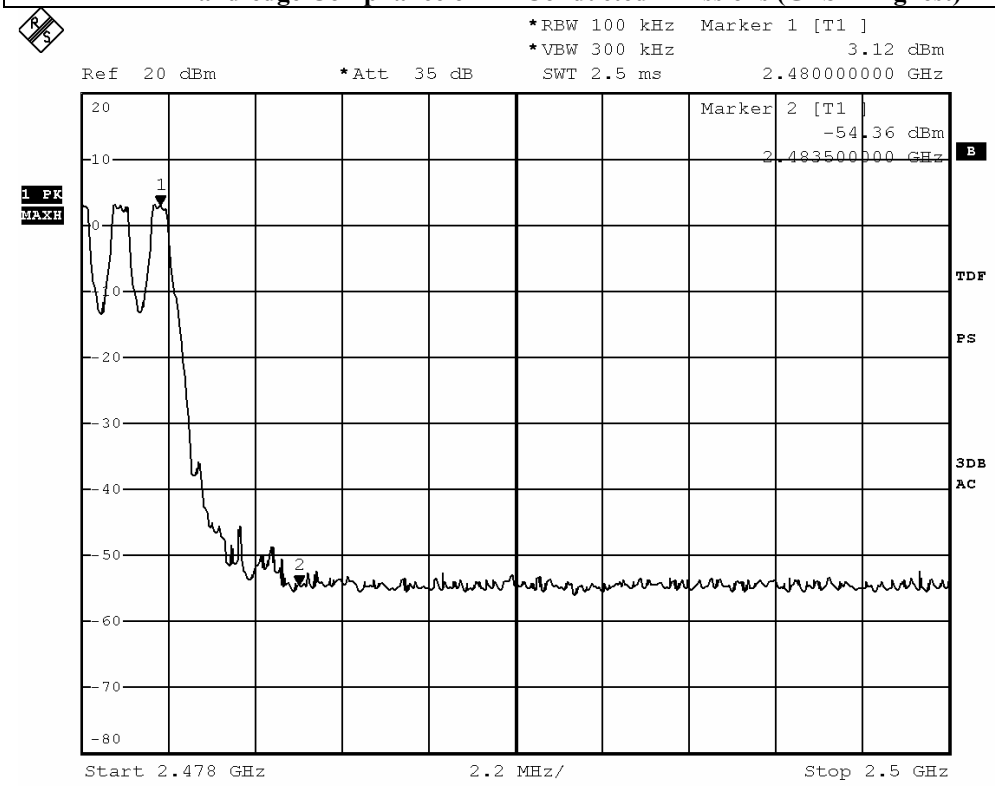
Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
Highest Fundamental (2480) - 2483.5	57.48

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



BMP

Date: 30.AUG.2016 10:32:20

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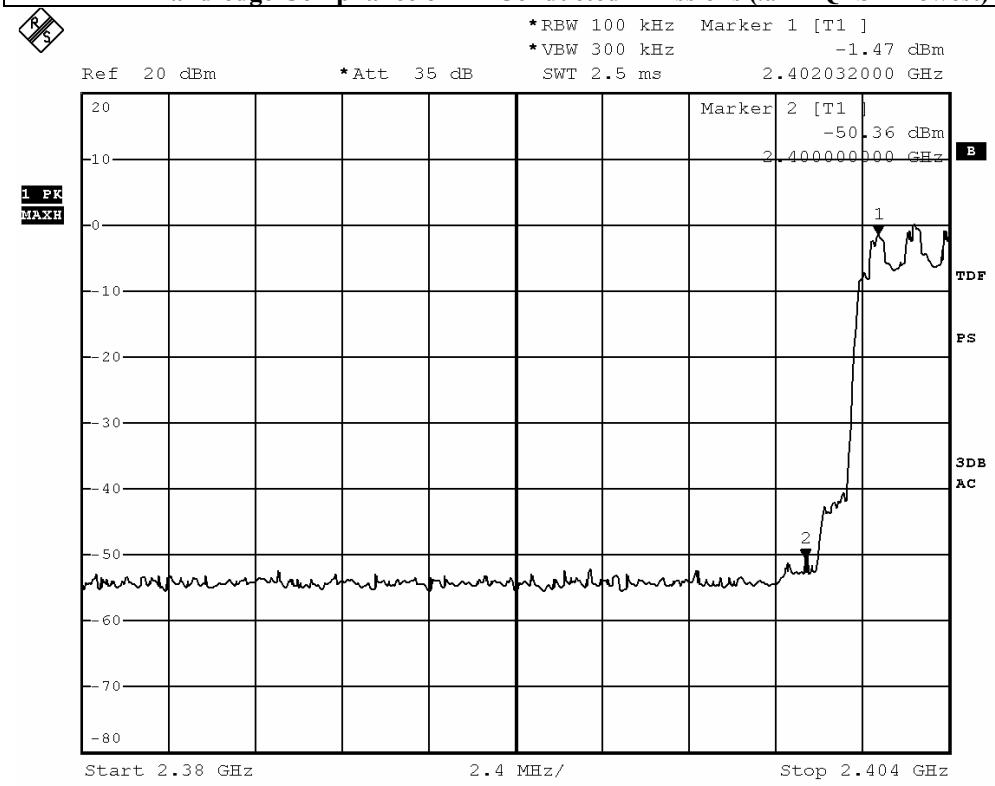
Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	48.89

Band-edge Compliance of RF Conducted Emissions (π/4 DQPSK Lowest)



BMP

Date: 30.AUG.2016 10:27:27

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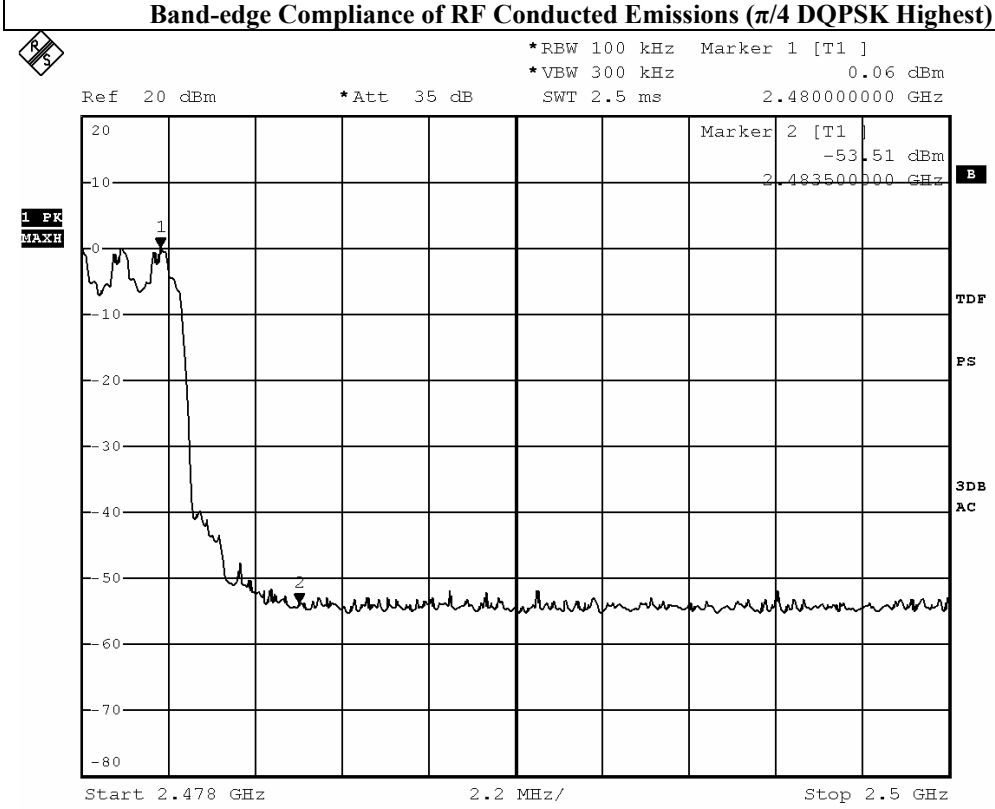
Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
Highest Fundamental (2480) - 2483.5	53.57

Band-edge Compliance of RF Conducted Emissions (π/4 DQPSK Highest)



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Date: 30.AUG.2016 10:31:25

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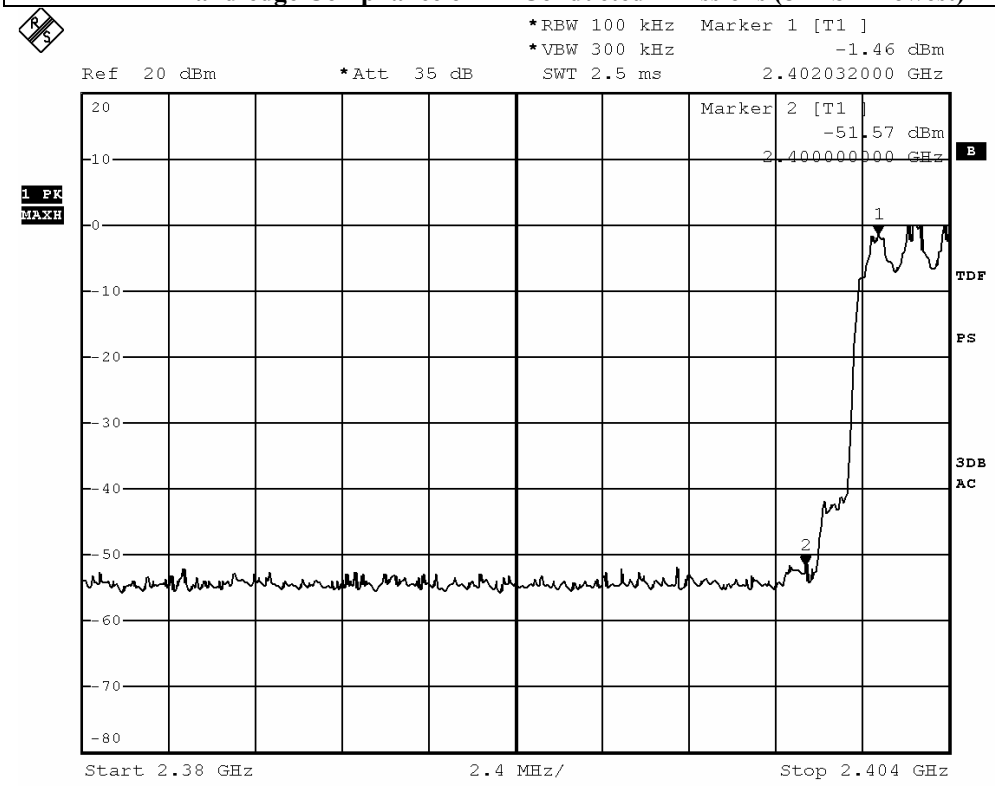
Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	50.11

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



BMP

Date: 30.AUG.2016 10:28:21

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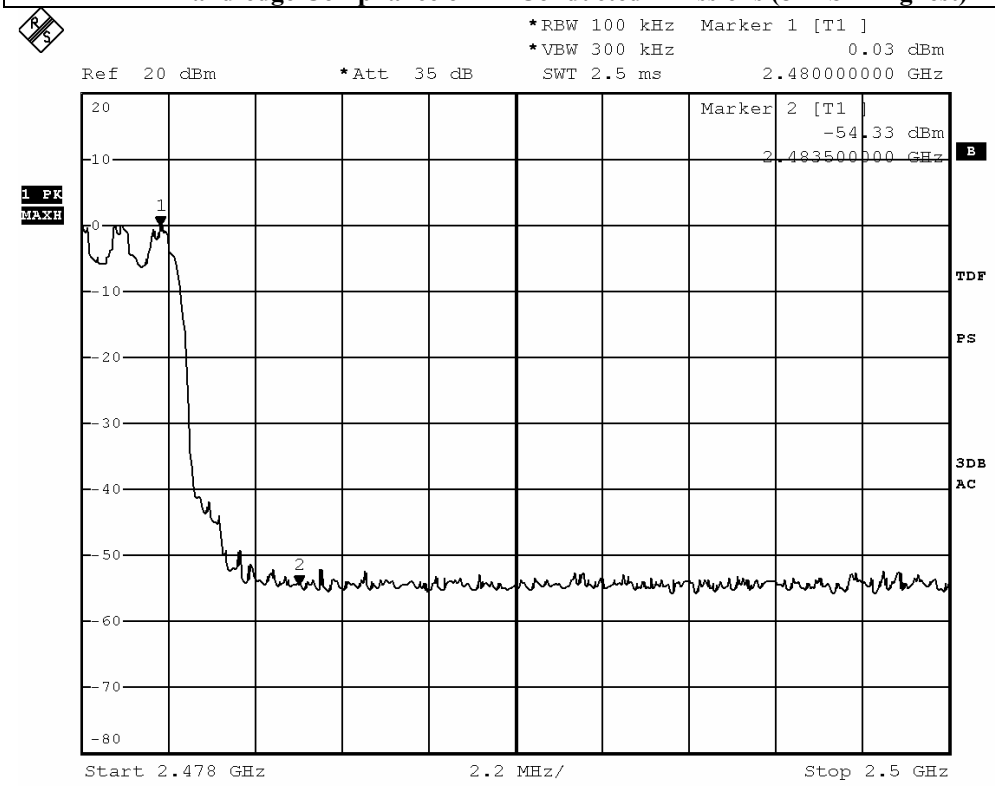
Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
Highest Fundamental (2480) - 2483.5	54.36

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



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Date: 30.AUG.2016 10:30:06

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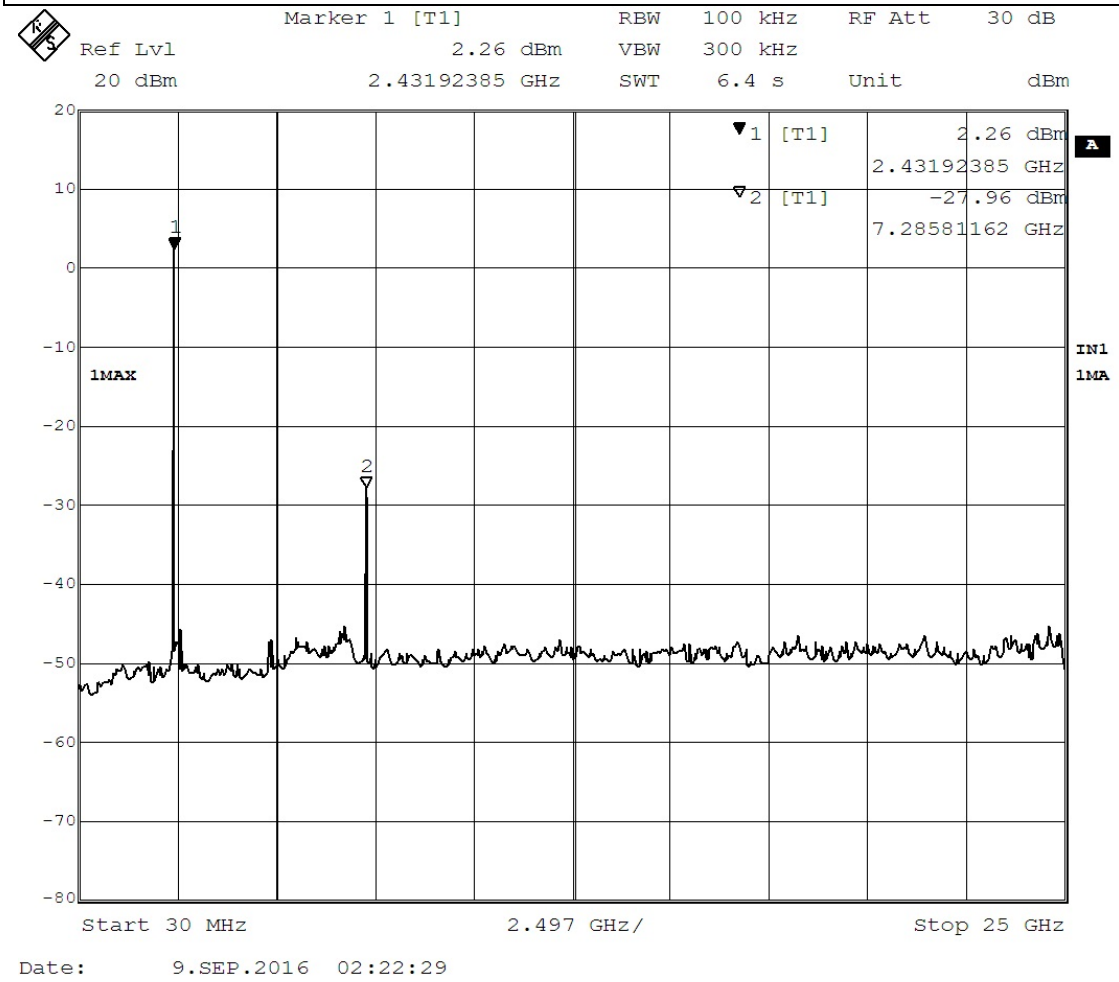
Band-edge Compliance of RF Conducted Emissions Measurement:

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

Band-edge Compliance of RF Conducted Emissions (GFSK 2441)



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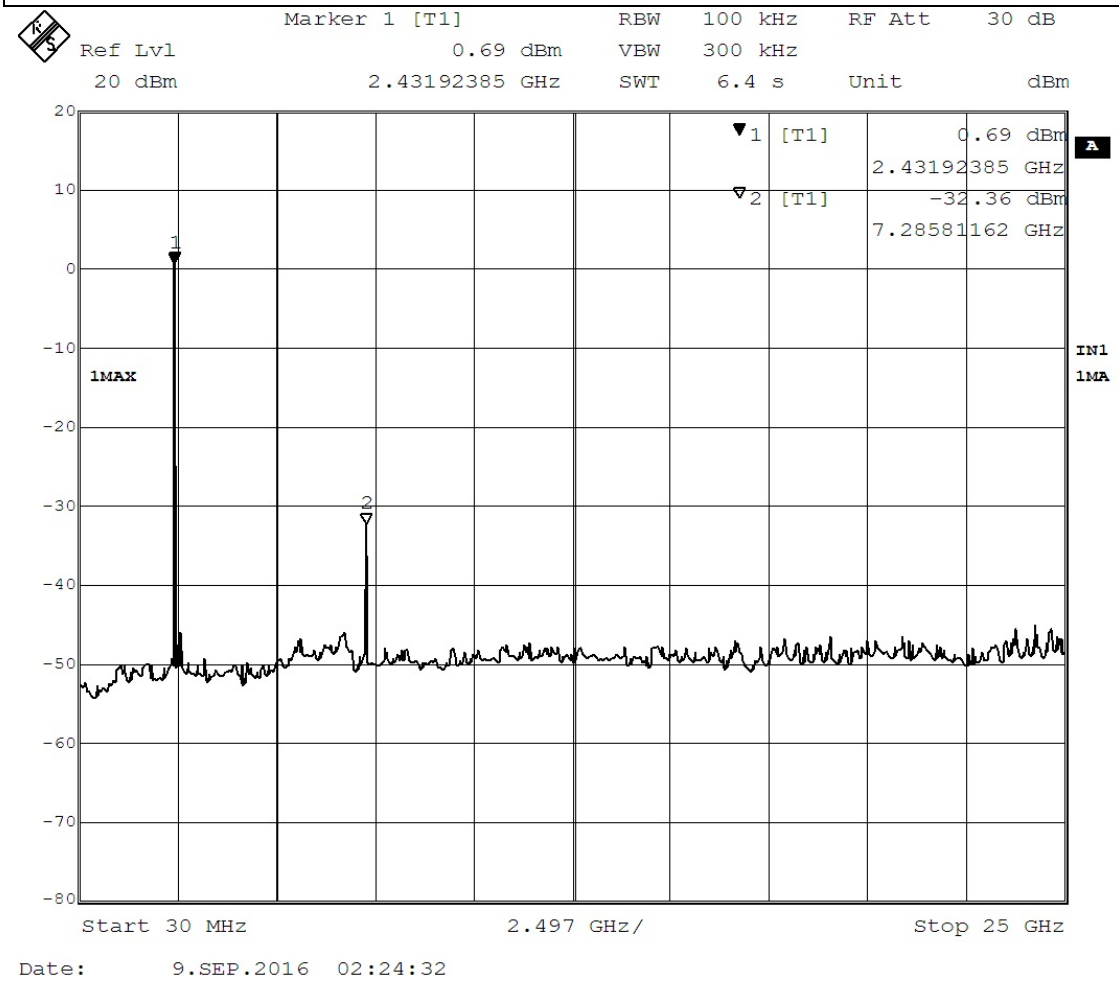
Band-edge Compliance of RF Conducted Emissions (π/4-DQPSK 2441)



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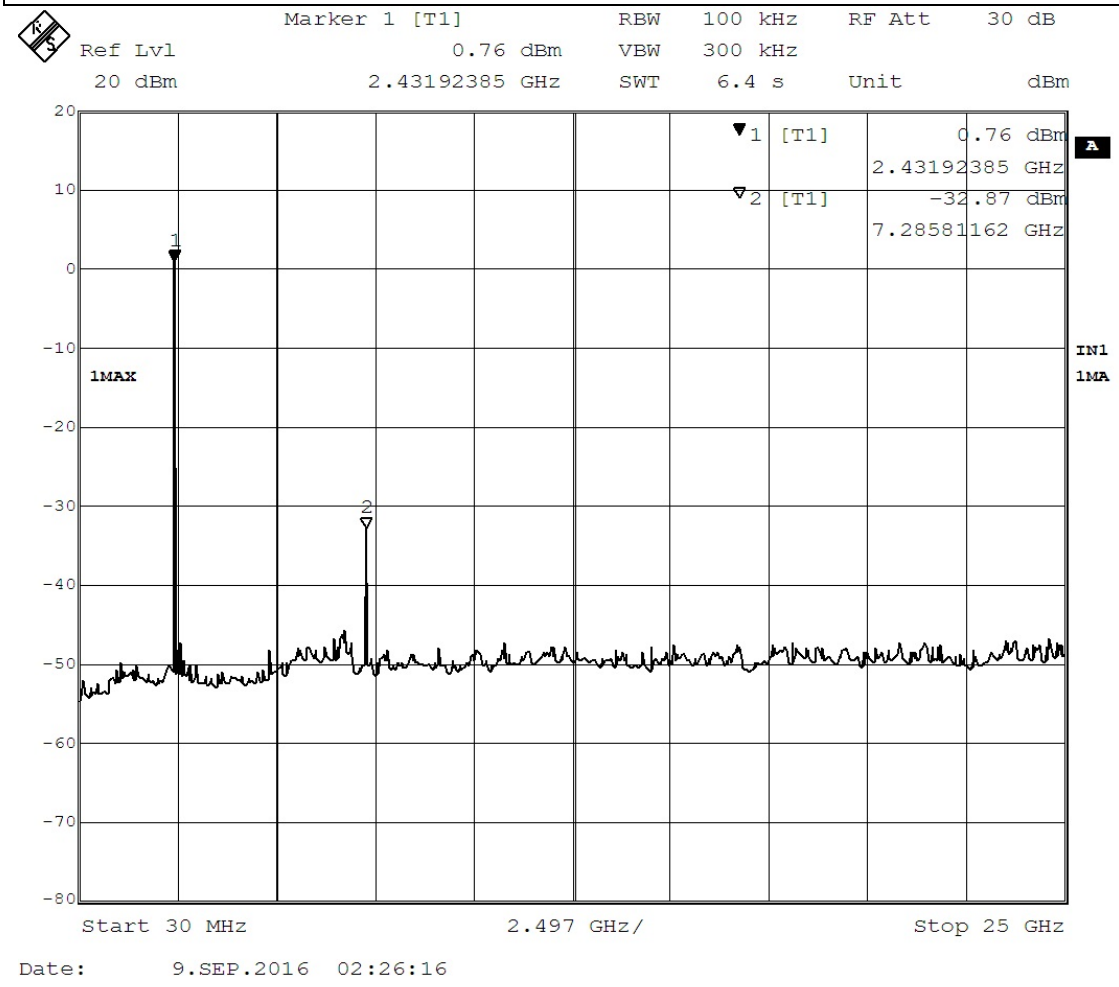
Band-edge Compliance of RF Conducted Emissions (8DPSK 2441)



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3.1.8 Time of Occupancy (Dwell Time)

Requirements:

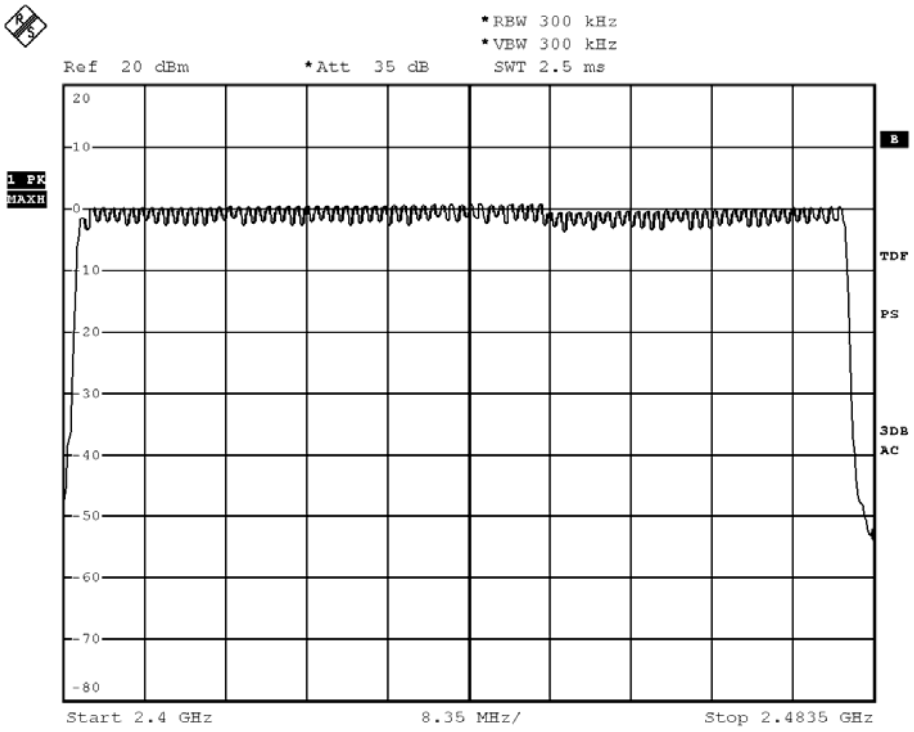
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channel employed.
No requirements for Digital Transmission System.

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

Observed duration: 0.4s x 79 = 31.6s

Measurement Data:

Channel Occupied in 8DPSK: 79 of 79 Channel



BMP

Date: 30.AUG.2016 10:57:36

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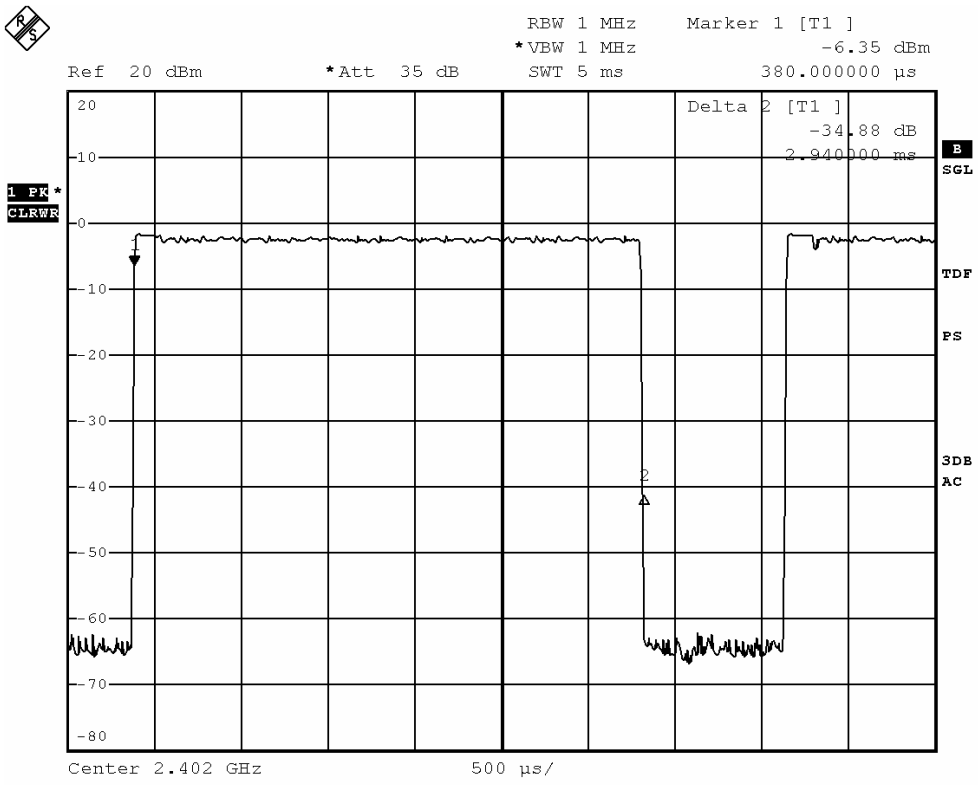
DH5 Packet:

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

Fig. A
[Pulse duration of Lowest Channel]



BMP

Date: 30.AUG.2016 10:37:08

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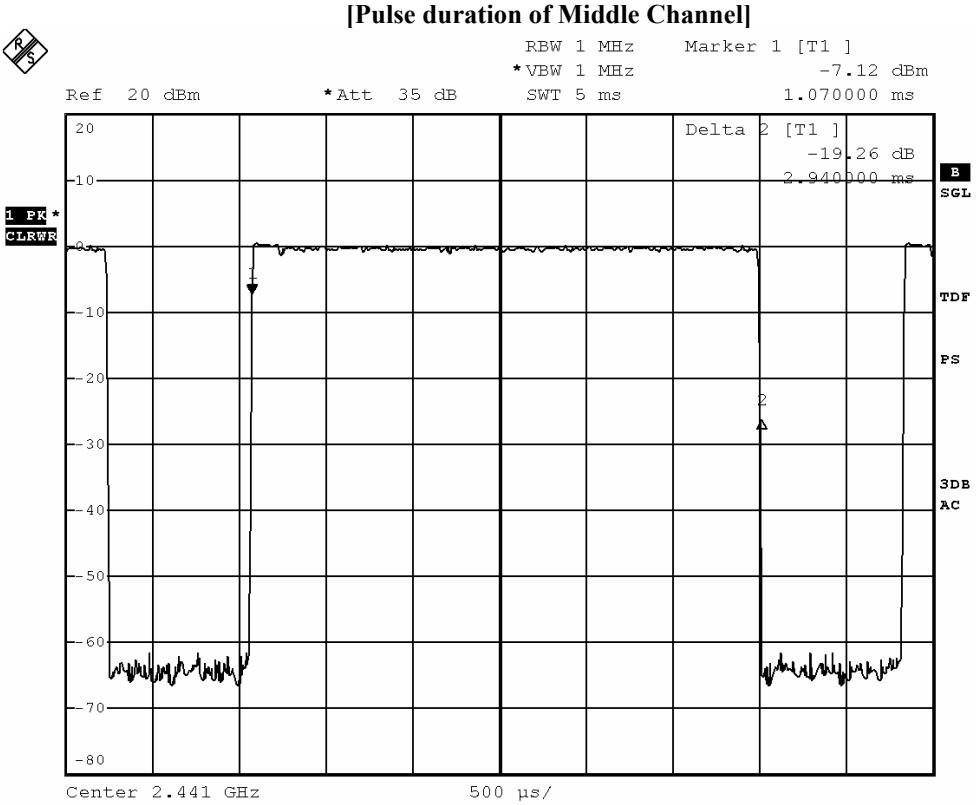
Fig. B
[Pulse duration of Middle Channel]



BMP

Date: 30.AUG.2016 10:36:44

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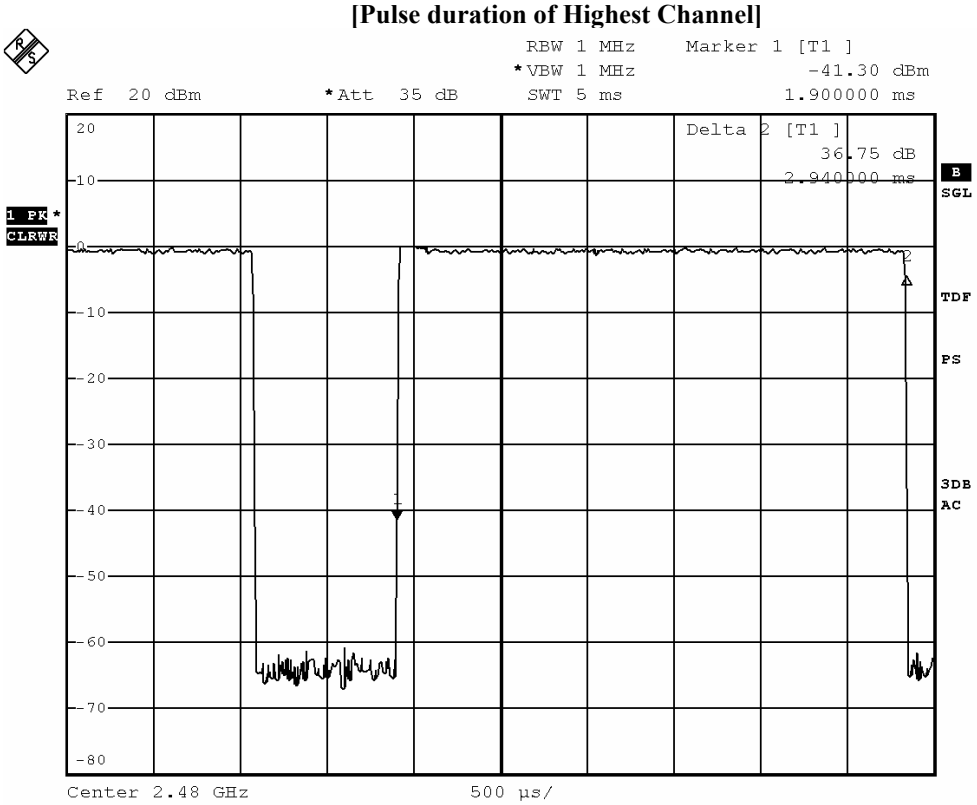
Fig. C
[Pulse duration of Highest Channel]



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Date: 30.AUG.2016 10:36:21

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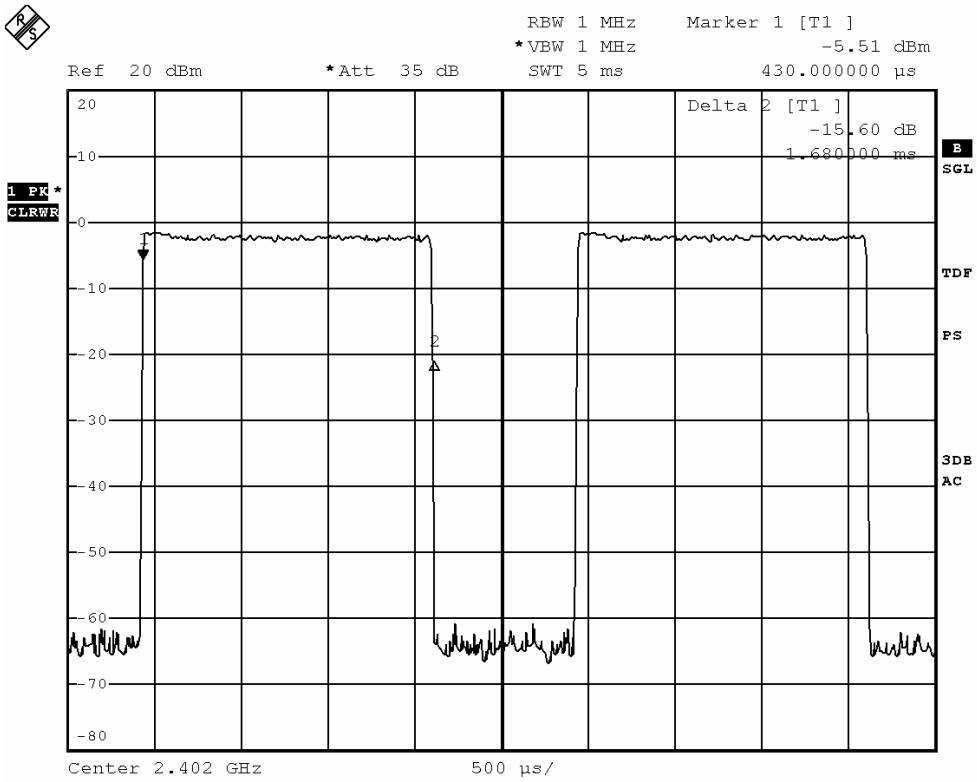
DH3 Packet:

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

Fig. D
[Pulse duration of Lowest Channel]



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Date: 30.AUG.2016 10:34:40

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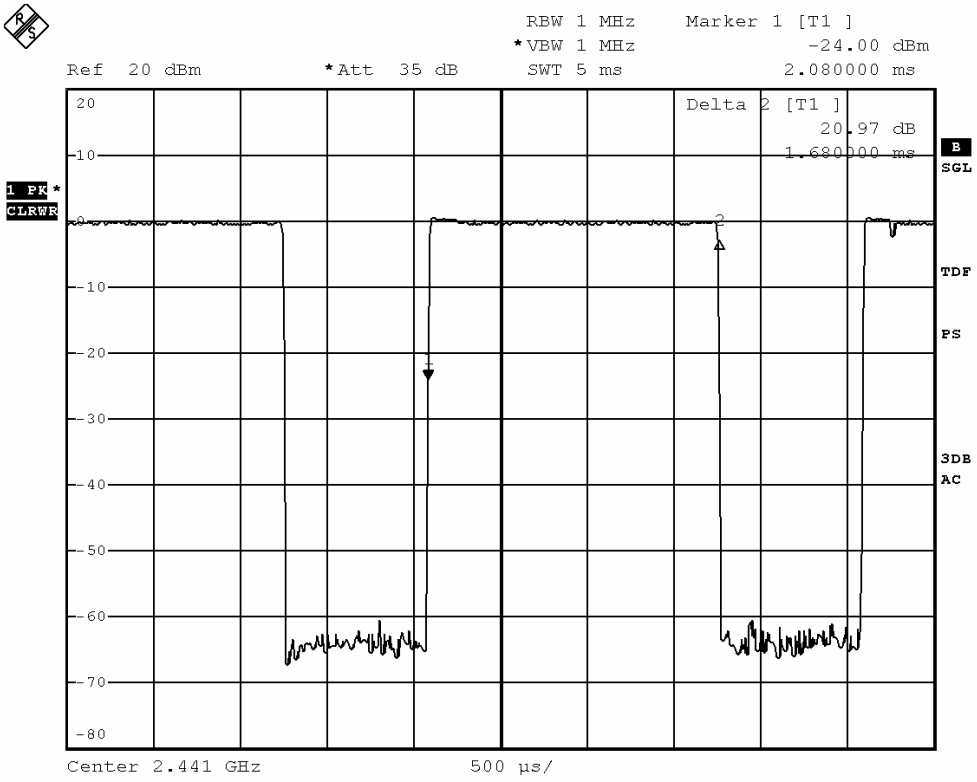
Fig. E
[Pulse duration of Middle Channel]



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Date: 30.AUG.2016 10:35:11

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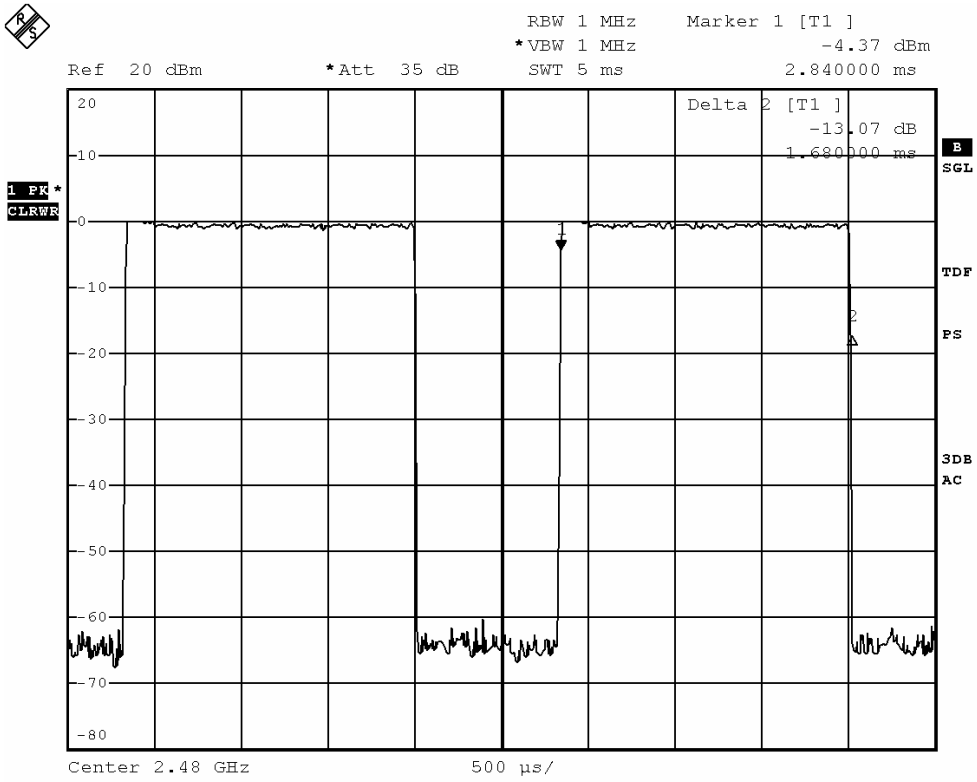
Fig. F
[Pulse duration of Highest Channel]



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Date: 30.AUG.2016 10:35:40

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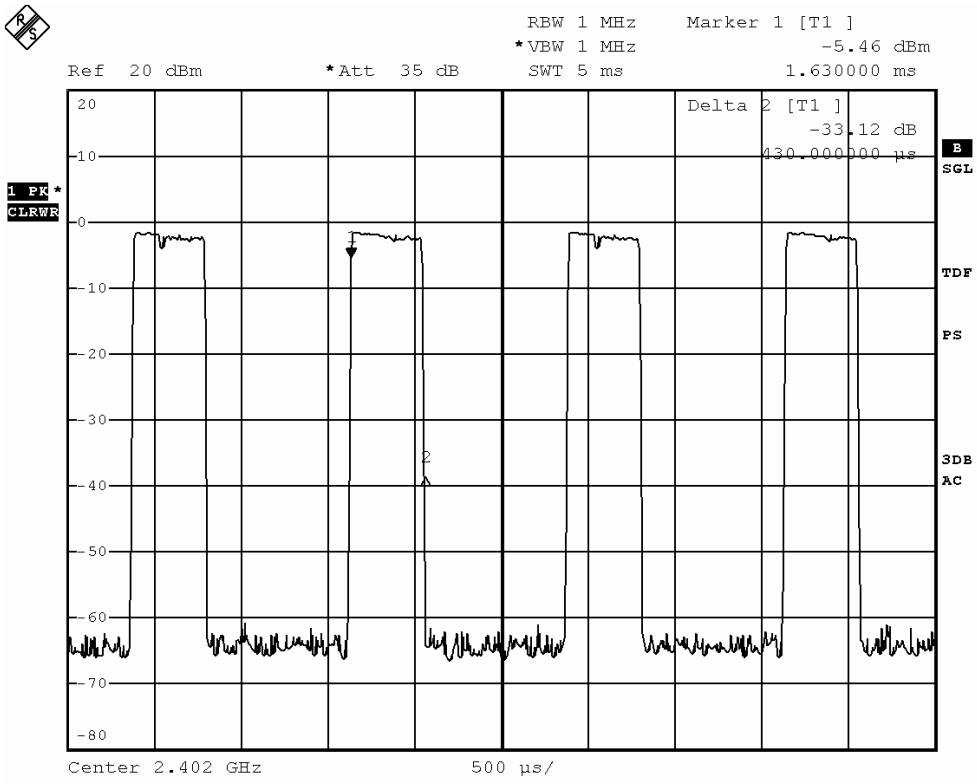
DH1 Packet:

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

Fig. G
[Pulse duration of Lowest Channel]



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Date: 30.AUG.2016 10:34:10

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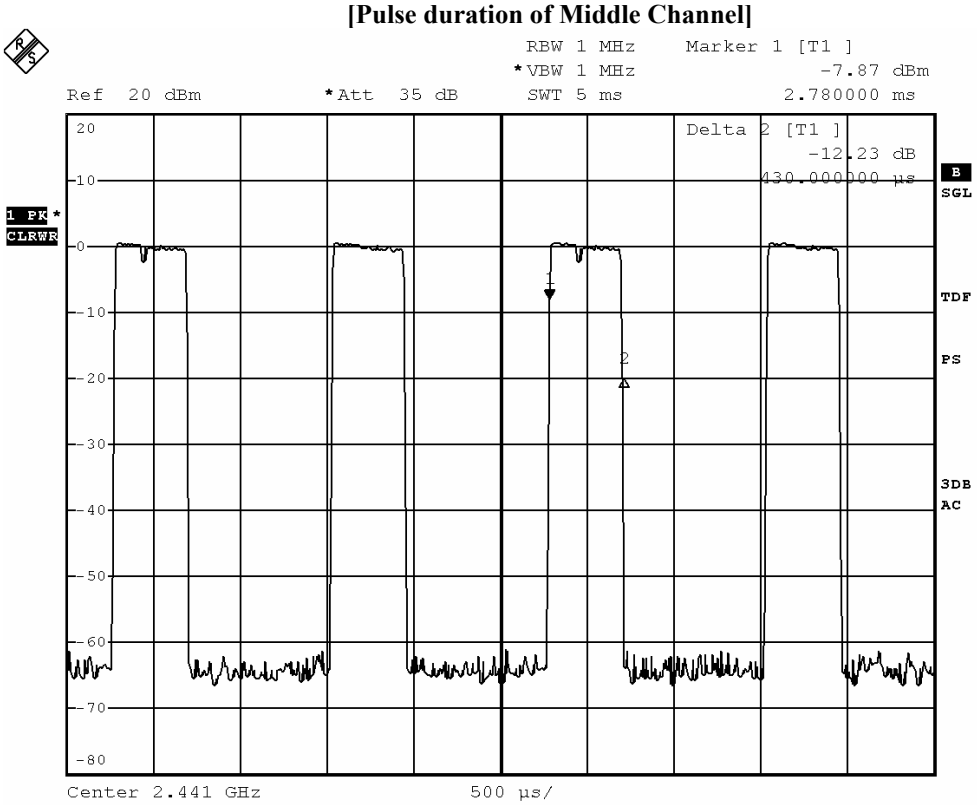
Fig. H
[Pulse duration of Middle Channel]



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Date: 30.AUG.2016 10:33:44

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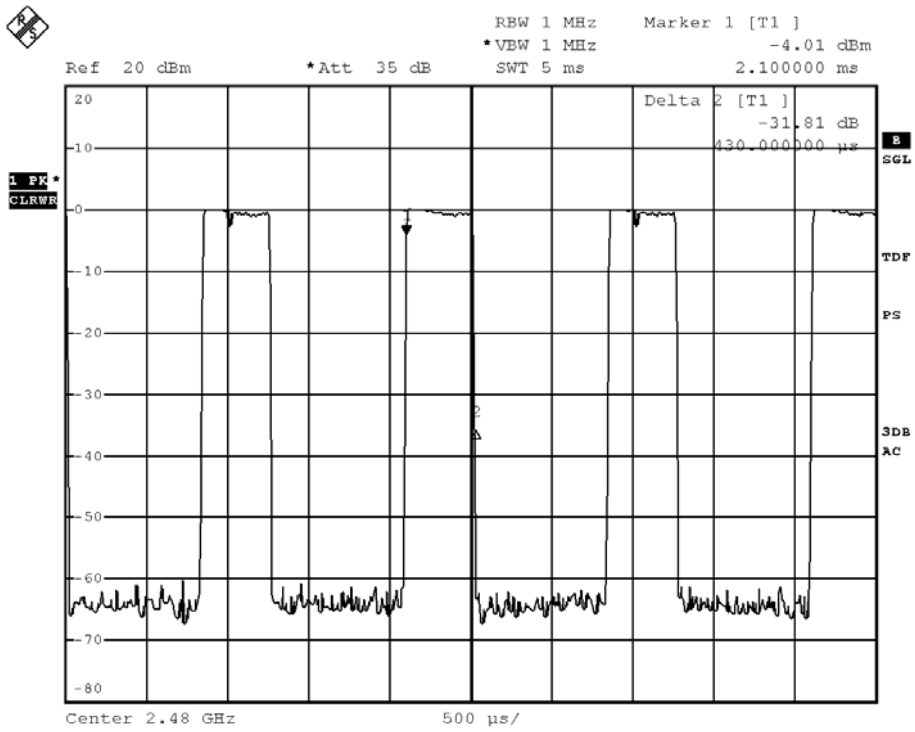
Fig. I
[Pulse duration of Highest Channel]



BMP

Date: 30.AUG.2016 10:33:18

Time of occupancy (Dwell Time):

Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (s)	Limits (s)	Test Results
DH5	2402	2.940	0.313	0.400	Complies
DH5	2441	2.940	0.313	0.400	Complies
DH5	2480	2.940	0.313	0.400	Complies
DH3	2402	1.680	0.269	0.400	Complies
DH3	2441	1.680	0.269	0.400	Complies
DH3	2480	1.680	0.269	0.400	Complies
DH1	2402	0.430	0.138	0.400	Complies
DH1	2441	0.430	0.138	0.400	Complies
DH1	2480	0.430	0.138	0.400	Complies

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3.1.9 Channel Centre Frequency

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

The EUT operates in according with the Bluetooth system specification within the 2400 - 2483.5 MHz frequency band.
RF channels for Bluetooth systems are spaced 1 MHz and are ordered in channel number k. In order to comply with out-of-band regulations, a lower frequency guard band of 2.0 MHz and a higher frequency guard band of 3.5MHz is used.

The operating frequencies of each channel are as follows:

First RF channel start from 2400MHz + 2MHz guard band = 2402MHz
Frequency of RF Channel = 2402+k MHz, k = 1,…,79 (Channel separation = 1MHz)

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3.1.10 Pseudorandom Hopping Algorithm

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

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

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3.1.11 Antenna Requirement

Test Requirements: § 15.203

Test Specification:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Test Results:

This is Dielectric Chip antenna. There is no external antenna, the antenna gain =2dBi. User is unable to remove or changed the Antenna.

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Appendix A

List of Measurement Equipment

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EMD004	LISN	ROHDE & SCHWARZ	ESH3-Z5	100102	2016.3.29	2017.3.29
EMD022	EMI Test Receiver	ROHDE & SCHWARZ	ESCS30	100314	2016.3.29	2017.3.29
EMD035	EMI Test Receiver	ROHDE & SCHWARZ	ESCI	100441	2016.3.29	2017.3.29
EMD036	EMI Test Receiver	ROHDE & SCHWARZ	ESIB 26	100388	2016.3.29	2017.3.29
EMD041	TWO-LINE V-NETWORK	ROHDE & SCHWARZ	ENV216	100261	2016.3.29	2017.3.29
EMD061	Biconilog Antenna	ETS.LINDGREN	3142C	00060439	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 lnstrument Co., Ltd	AN97005SS	79707454	N/A	N/A
EMD103	Intelligent Frequency	Ainuo lnstrument 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	2015.04.28	2017.04.28
EMD131	Standard Gain Horn Antenna (18GHz – 26.5GHz)	Chengdu AINFO lnc.	JXTXLB-42-15-C-KF	J2021100721001	2015.04.09	2017.04.09
RE01	RF cable	N/A	N/A	N/A	2014-9-28	2016-9-27
RE02	RF cable	N/A	N/A	N/A	2014-9-28	2016-9-27

Remarks:-

N/A Not Applicable or Not Available

Appendix B

Ancillary Equipment

ITEM NO.	DESCRIPTION	MODEL NO.	FCC ID	REMARK
1	DELL COMPUTER	DCSM	N/A	CONNECTEDTO THE EUT INPUT PORT
2	USB Cable	N/A	N/A	80 cm unshielded cable

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Appendix C

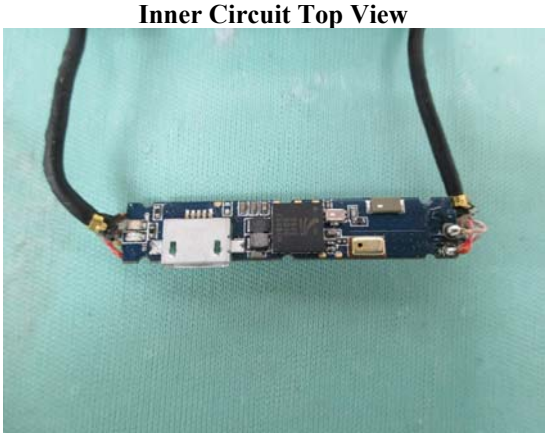
Photographs of EUT

Front View of the product

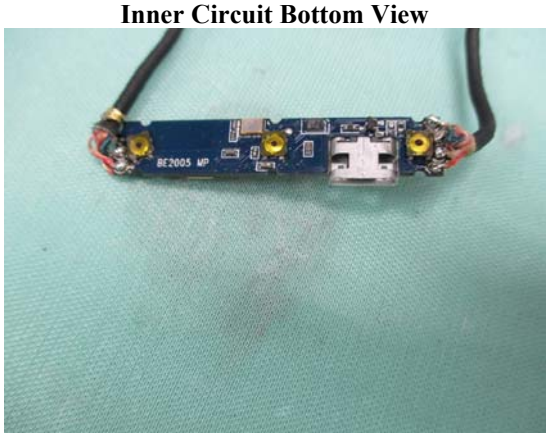
Rear View of the product

Inside View of the product

Inner Circuit Top View



Inner Circuit Bottom View



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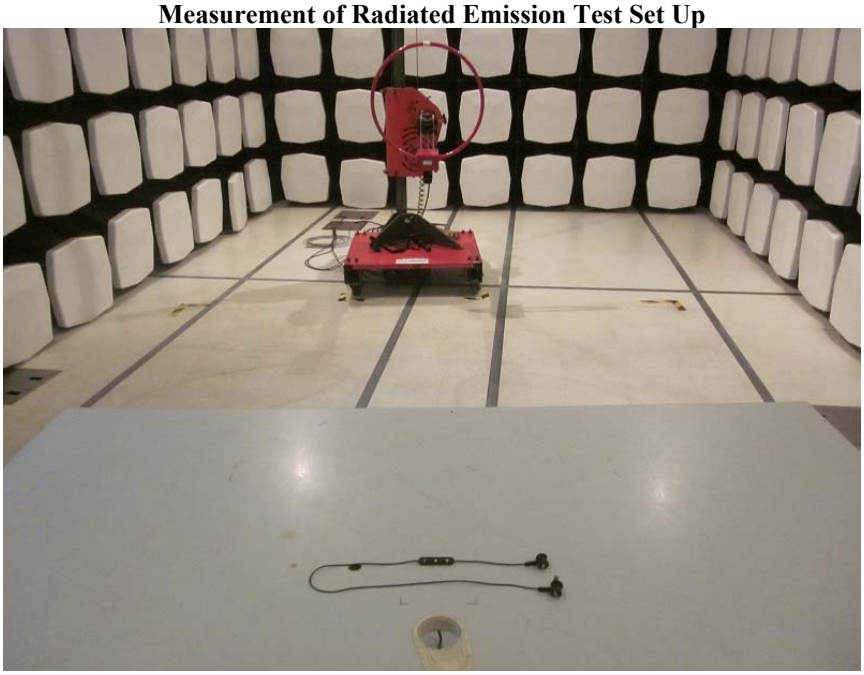
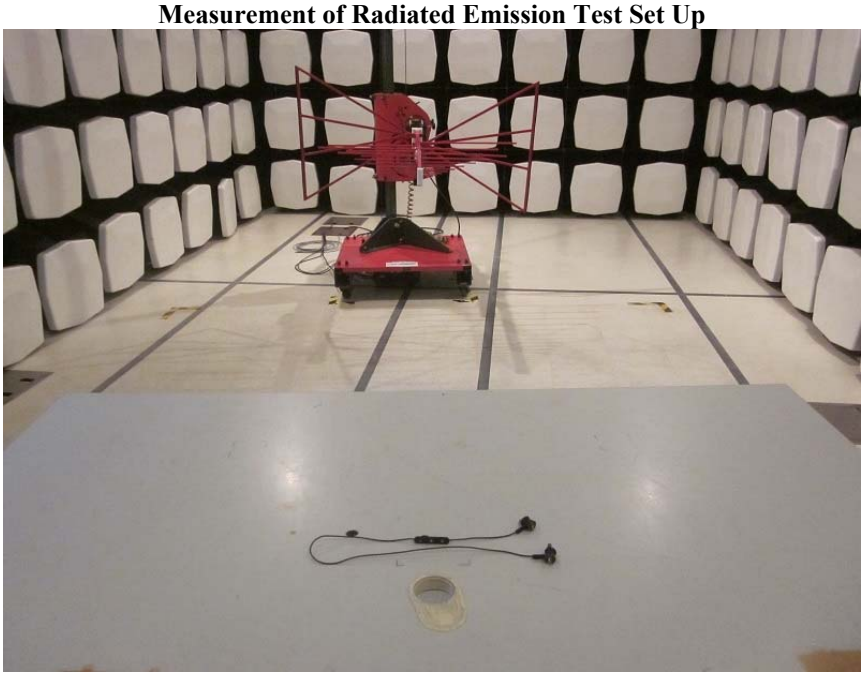
Photographs of EUT

Measurement of Radiated Emission Test Set Up



Measurement of Radiated Emission Test Set Up



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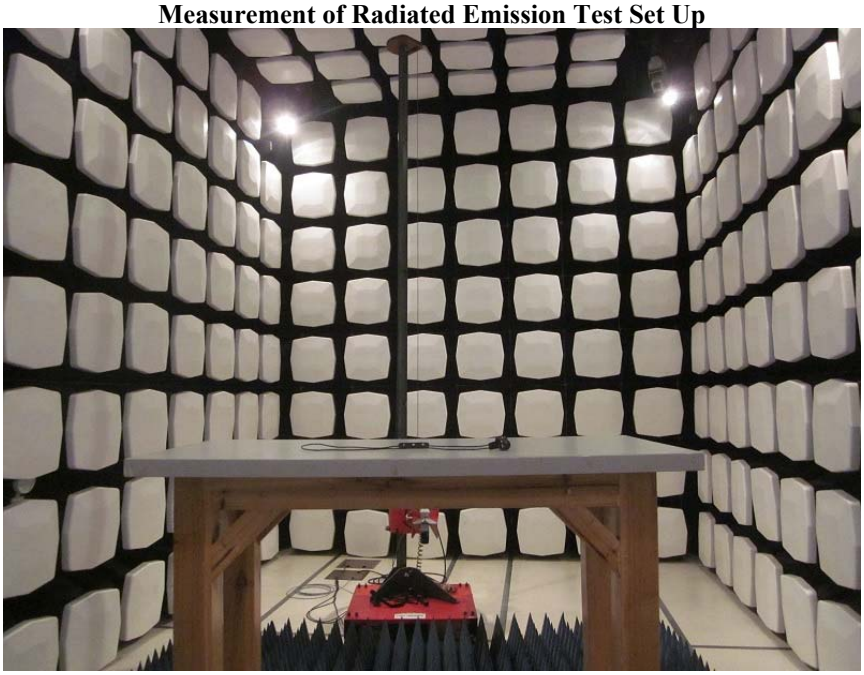
Photographs of EUT

Measurement of Radiated Emission Test Set Up



Measurement of Conducted Emission Test Set Up

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

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