



Test Report

Date: 2017-07-10

No.: DM123869

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Applicant: Shenzhen Jiayinking Technology Holding Company Limited
No.11-1 Anye Road, Anliang Village, Henggang Town,
Longgang District, Shenzhen, China

Manufacturer: Shenzhen Jiayinking Technology Holding Company Limited
No.11-1 Anye Road, Anliang Village, Henggang Town,
Longgang District, Shenzhen, China

Description of Sample(s):

Product:	Portable Bluetooth Turntable
Brand Name:	Innovative Technology, Victrola
Model Number:	VSC-550BT
FCC ID:	2ADA2-CS-14007

Date Sample(s) Received: 2016-05-31

Date Tested: 2016-06-06 to 2016-06-24, 2017-07-07

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)
For additional model(s) details, please page 3.


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

STC (Dongguan) Company Limited

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

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1.0 General Details

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

Product: Portable Bluetooth Turntable
Manufacturer: Shenzhen Jiayinking Technology Holding Company Limited
No.11-1 Anye Road, Anliang Village, Henggang Town, Longgang District, Shenzhen City, R.R.C.
Brand Name: Innovative Technology, Victrola
Model Number: VSC-550BT
Additional Model Number: ITVS-550BT, VSC-1400, ITVS-1400
Rating: Adapter 1: Input: 100-240Va.c. 50/60Hz 0.5A;
Output: 5Vd.c. 1000mA.
Adapter 2: Input: 100-240Va.c. 50/60Hz 0.4A;
Output: 5Vd.c. 1000mA.

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

Adapter 1: Brand name: N/A; Model no.: GKYP50100050UL1

Adapter 2: Brand name: N/A; Model no.: HB05J-0501004SPA

1.1.1 Description of EUT Operation

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

1.2 Date of Order

2016-05-31

1.3 Submitted Sample(s):

1 Sample

1.4 Test Duration

2016-06-06 to 2016-06-24, 2017-07-07

1.5 Country of Origin

China

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1.7 RF Module Details

Module Model Number:	BK3254
Module FCC ID:	
Module Transmission Type:	Bluetooth V4.1
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:	Inverted F antenna
Antenna Gain:	-0.68dBi

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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	☒	☐	☐
RF Exposure	FCC 47CFR 15.247(i)	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 / $\pi/4$ -DQPSK / 8DPSK	1MBps / 2MBps / 3MBps
Hopping Channel Separation	GFSK / $\pi/4$ -DQPSK / 8DPSK	1MBps / 2MBps / 3MBps
Number of Hopping Frequency	GFSK / $\pi/4$ -DQPSK / 8DPSK	1MBps / 2MBps / 3MBps
Time of Occupancy(Dwell Time)	8DPSK (DH1 / DH3 / DH5)	3MBps
Radiated Spurious Emissions	GFSK / $\pi/4$ -DQPSK / 8DPSK	1MBps / 2MBps / 3MBps
Band-edge compliance of Conducted Emission	GFSK / $\pi/4$ -DQPSK / 8DPSK	1MBps / 2MBps / 3MBps

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3.0 Test Results

3.1 Emission

3.1.1 Maximum Peak Conducted Output Power

Test Requirement:	FCC 47CFR 15.247(b)(1)
Test Method:	ANSI C63.10: 2013
Test Date:	2016-06-20
Mode of Operation:	Tx mode

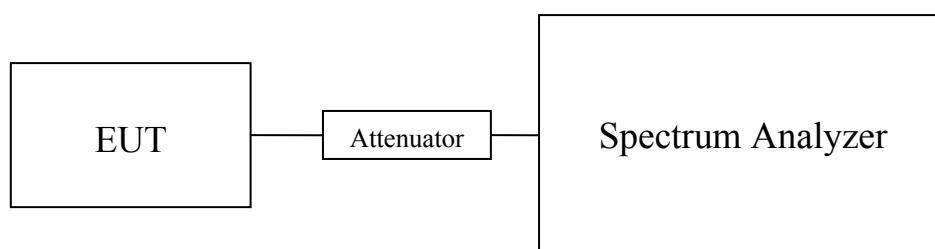
Test Method:

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

Spectrum Analyzer Setting:

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

Test Setup:



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

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

The maximum peak output power shall not exceed the following limits:
For Digital Transmission systems in 2400-2483.5 MHz Band: 1 Watt
Results of Bluetooth Communication mode (GFSK) (Fundamental Power): Pass

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

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2402	0.000515

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2441	0.000499

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.000436

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	0.000514

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2441	0.000497

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.000435

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

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2402	0.000514

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2441	0.000498

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.000436

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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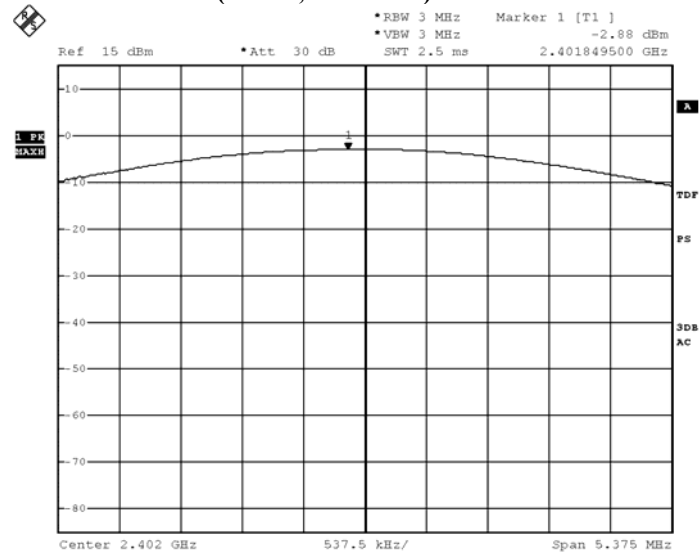
Test Report

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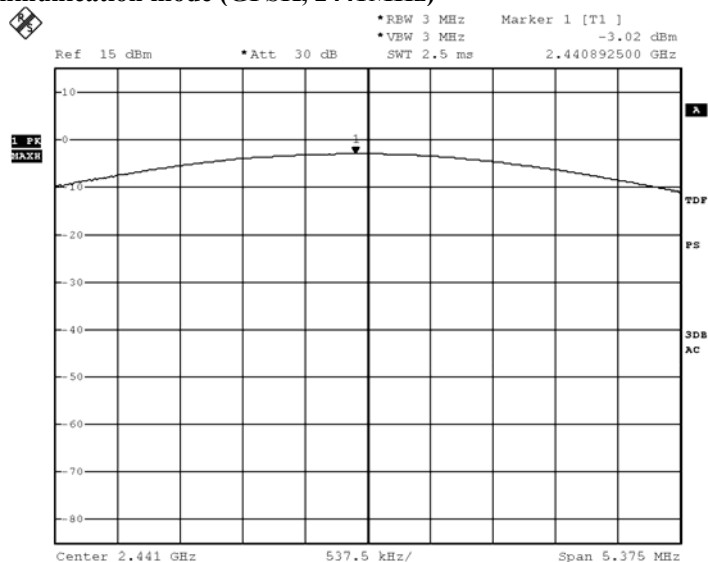
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Test plot of Maximum Peak Conducted Output Power : Bluetooth Communication mode (GFSK, 2402MHz)



BMP
Date: 20.JUN.2016 15:25:28

Bluetooth Communication mode (GFSK, 2441MHz)



BMP
Date: 20.JUN.2016 15:25:02

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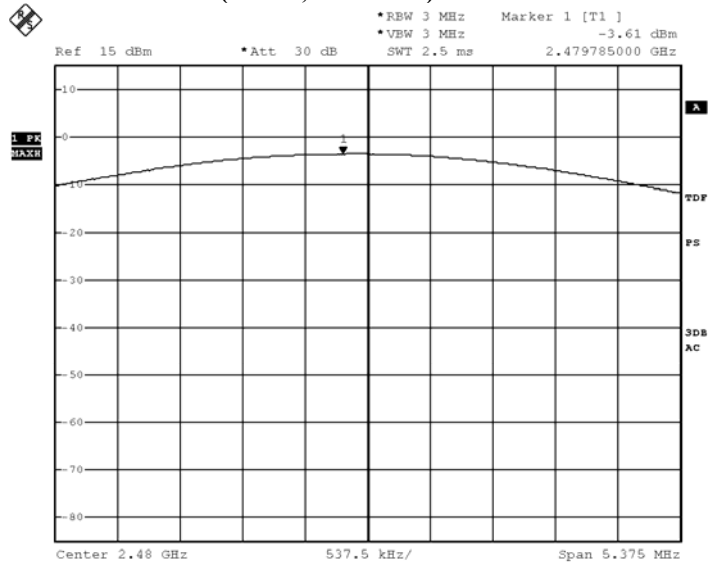
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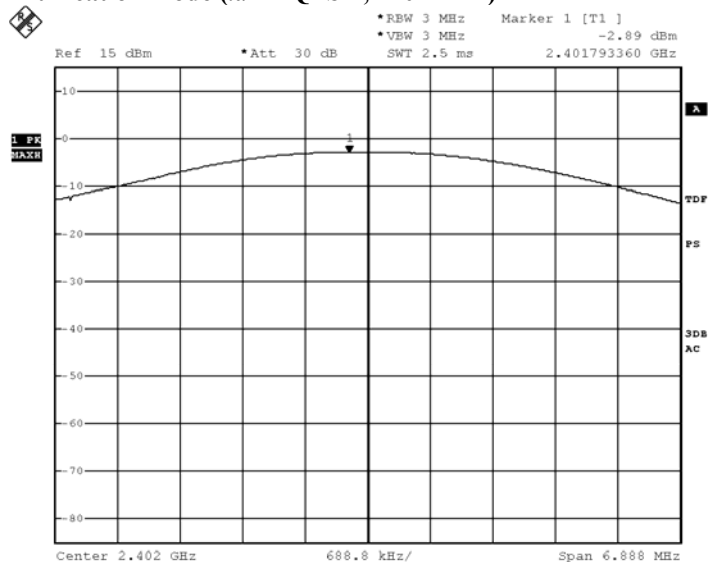
Bluetooth Communication mode (GFSK, 2480MHz)



BMP

Date: 20.JUN.2016 15:25:53

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



BMP

Date: 20.JUN.2016 15:27:57

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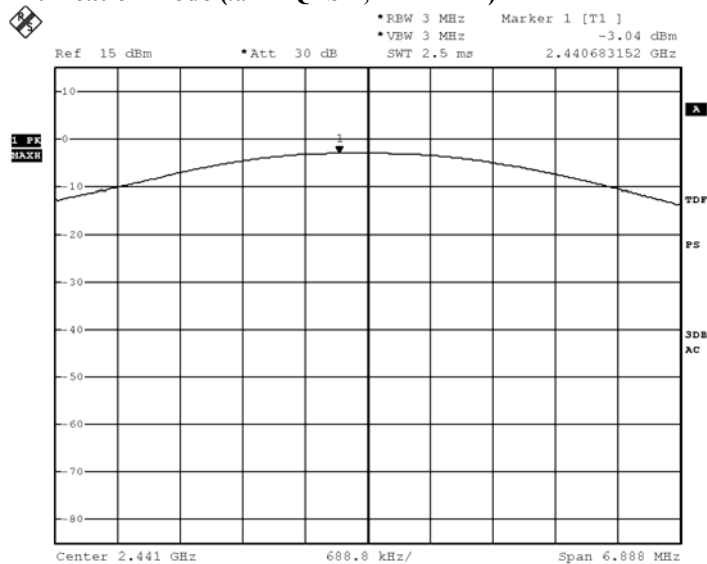
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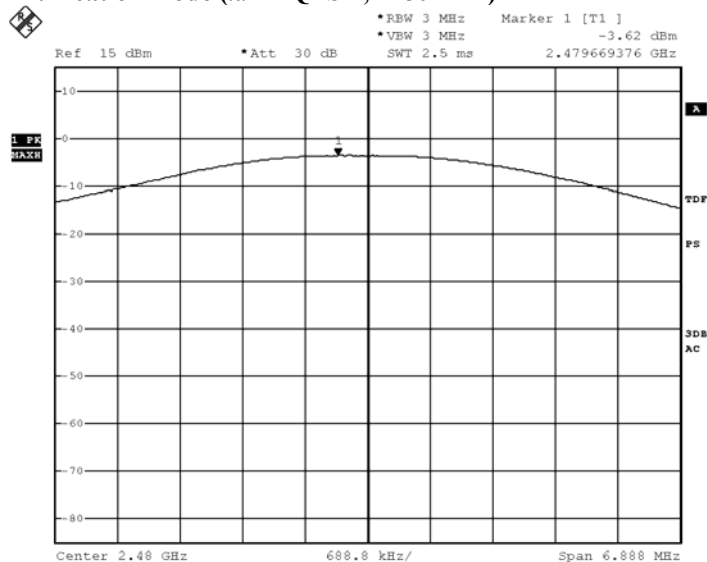
Bluetooth Communication mode ($\pi/4$ DQPSK, 2441MHz)



BMP

Date: 20.JUN.2016 15:27:20

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



BMP

Date: 20.JUN.2016 15:26:49

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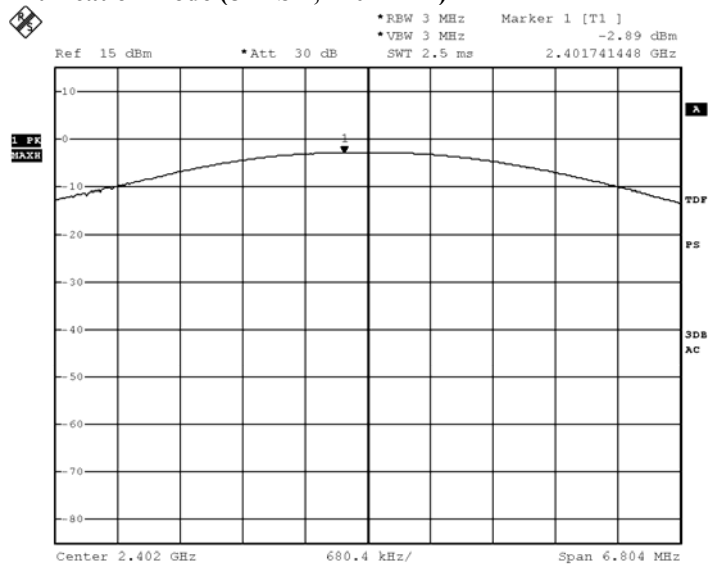
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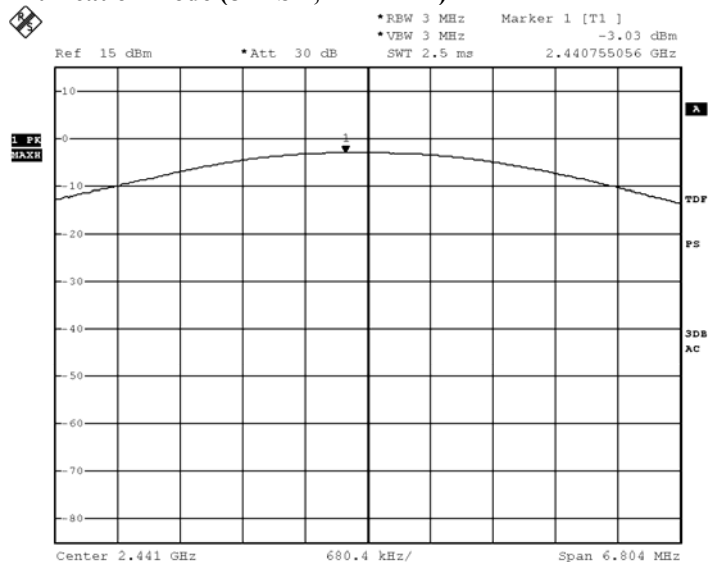
Bluetooth Communication mode (8DPSK, 2402MHz)



BMP

Date: 20.JUN.2016 15:29:02

Bluetooth Communication mode (8DPSK, 2441MHz)



BMP

Date: 20.JUN.2016 15:29:39

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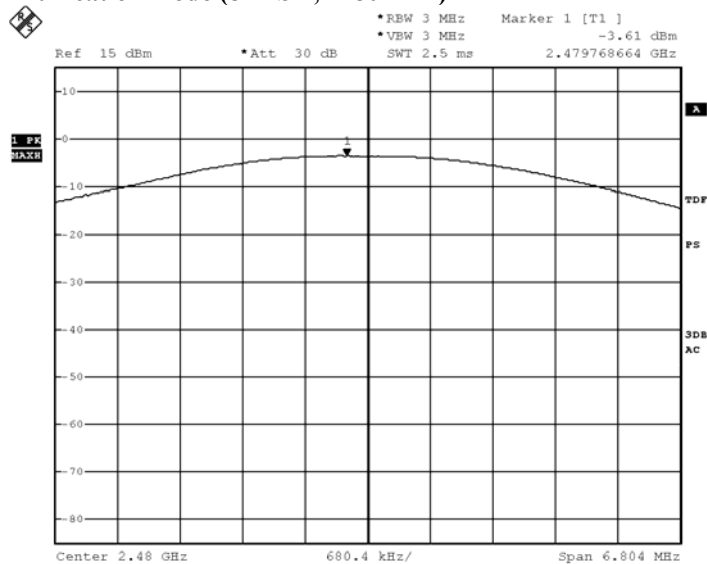
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Bluetooth Communication mode (8DPSK, 2480MHz)



BMP

Date: 20.JUN.2016 15:30:13

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3.1.2 Radiated Spurious Emissions

Test Requirement:	FCC 47CFR 15.209
Test Method:	ANSI C63.10: 2013
Test Date:	2016-06-06 to 2016-06-22
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 G/F of The Hong Kong Standards and Testing Centre Ltd. with a metal ground plane filed with the FCC pursuant to section 2.948 of the FCC rules, with Registration Number: 607756.

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Spectrum Analyzer Setting:

9KHz – 30MHz (Pk & Av)

RBW: 10kHz

VBW: 30kHz

Sweep: Auto

Span: Fully capture the emissions being measured

Trace: Max. hold

30MHz – 1GHz (QP)

RBW: 120kHz

VBW: 120kHz

Sweep: Auto

Span: Fully capture the emissions being measured

Trace: Max. hold

Above 1GHz (Pk)

RBW: 1MHz

VBW: 1MHz

Sweep: Auto

Span: Fully capture the emissions being measured

Trace: Max. hold

Above 1GHz (Av)

RBW: 1MHz

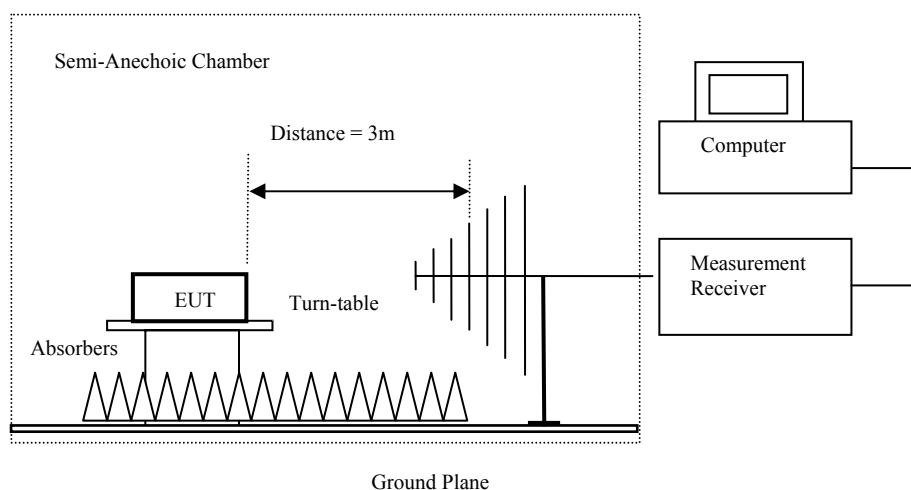
VBW: 10Hz

Sweep: Auto

Span: Fully capture the emissions being measured

Trace: Max. hold

Test Setup:



- Absorbers placed on top of the ground plane are for measurements above 1000MHz only.
- Measurements between 30MHz to 1000MHz made with Bi-log antennas, above 1000MHz horn antennas are used, 9kHz to 30MHz loop antennas are used.

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

Frequency Range	Quasi-Peak Limits
[MHz]	[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	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBuV	dB/m	dBuV/m	uV/m	uV/m	
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	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dB μ V	dB/m	dB μ V/m	dB μ V/m	dB	
4804.0	16.4	41.5	57.9	74.0	16.1	Vertical
4804.0	15.3	42.4	57.7	74.0	16.3	Horizontal
7206.0	12.5	45.1	57.6	74.0	16.4	Vertical
7206.0	11.6	46.2	57.8	74.0	16.2	Horizontal
9608.0	7.7	48.0	55.7	74.0	18.3	Vertical
9608.0	6.6	48.8	55.4	74.0	18.6	Horizontal
12010.0	4.0	51.5	55.5	74.0	18.5	Vertical
12010.0	3.6	52.4	56.0	74.0	18.0	Horizontal

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

Field Strength of Spurious Emissions						
Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dB	E-Field Polarity
4804.0	0.9	41.5	42.4	54.0	11.6	Vertical
4804.0	0.0	42.4	42.4	54.0	11.6	Horizontal
7206.0	-3.6	45.1	41.5	54.0	12.5	Vertical
7206.0	-5.9	46.2	40.3	54.0	13.7	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	-11.3	51.5	40.2	54.0	13.8	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 dB	E-Field Polarity
4882.0	16.4	41.6	58.0	74.0	16.0	Vertical
4882.0	15.7	42.5	58.2	74.0	15.8	Horizontal
7323.0	12.6	45.2	57.8	74.0	16.2	Vertical
7323.0	11.6	46.3	57.9	74.0	16.1	Horizontal
9764.0	7.7	48.1	55.8	74.0	18.2	Vertical
9764.0	5.5	48.9	54.4	74.0	19.6	Horizontal
12205.0	3.7	51.6	55.3	74.0	18.7	Vertical
12205.0	3.4	52.5	55.9	74.0	18.1	Horizontal

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Result of Tx mode (2441.0 MHz) (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 dB	E-Field Polarity
4882.0	1.1	41.6	42.7	54.0	11.3	Vertical
4882.0	0.3	42.5	42.8	54.0	11.2	Horizontal
7323.0	-5.2	45.2	40.0	54.0	14.0	Vertical
7323.0	-4.0	46.3	42.3	54.0	11.7	Horizontal
9764.0	-7.7	48.1	40.4	54.0	13.6	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	-10.6	52.5	41.9	54.0	12.1	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 dB	E-Field Polarity
4960.0	16.8	41.4	58.2	74.0	15.8	Vertical
4960.0	15.2	42.7	57.9	74.0	16.1	Horizontal
7440.0	12.1	45.6	57.7	74.0	16.3	Vertical
7440.0	11.1	46.5	57.6	74.0	16.4	Horizontal
9920.0	6.8	48.6	55.4	74.0	18.6	Vertical
9920.0	5.3	49.7	55.0	74.0	19.0	Horizontal
12400.0	4.3	51.7	56.0	74.0	18.0	Vertical
12400.0	3.2	52.7	55.9	74.0	18.1	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 dB	E-Field Polarity
4960.0	1.3	41.4	42.7	54.0	11.3	Vertical
4960.0	-0.9	42.7	41.8	54.0	12.2	Horizontal
7440.0	-3.0	45.6	42.6	54.0	11.4	Vertical
7440.0	-4.3	46.5	42.2	54.0	11.8	Horizontal
9920.0	-9.1	48.6	39.5	54.0	14.5	Vertical
9920.0	-9.2	49.7	40.5	54.0	13.5	Horizontal
12400.0	-10.2	51.7	41.5	54.0	12.5	Vertical
12400.0	-11.5	52.7	41.2	54.0	12.8	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	E-Field Polarity
4804.0	15.4	41.5	56.9	74.0	17.1	Vertical
4804.0	14.6	42.4	57.0	74.0	17.0	Horizontal
7206.0	12.0	45.1	57.1	74.0	16.9	Vertical
7206.0	11.2	46.2	57.4	74.0	16.6	Horizontal
9608.0	7.6	48.0	55.6	74.0	18.4	Vertical
9608.0	5.8	48.8	54.6	74.0	19.4	Horizontal
12010.0	4.6	51.5	56.1	74.0	17.9	Vertical
12010.0	3.4	52.4	55.8	74.0	18.2	Horizontal

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Result of Tx mode (2402.0 MHz) ($\pi/4$ -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 dB	E-Field Polarity
4804.0	0.5	41.5	42.0	54.0	12.0	Vertical
4804.0	-0.9	42.4	41.5	54.0	12.5	Horizontal
7206.0	-2.8	45.1	42.3	54.0	11.7	Vertical
7206.0	-3.5	46.2	42.7	54.0	11.3	Horizontal
9608.0	-7.3	48.0	40.7	54.0	13.3	Vertical
9608.0	-7.8	48.8	41.0	54.0	13.0	Horizontal
12010.0	-9.7	51.5	41.8	54.0	12.2	Vertical
12010.0	-10.8	52.4	41.6	54.0	12.4	Horizontal

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

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level 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 dB	E-Field Polarity
4882.0	16.2	41.6	57.8	74.0	16.2	Vertical
4882.0	15.0	42.5	57.5	74.0	16.5	Horizontal
7323.0	11.6	45.2	56.8	74.0	17.2	Vertical
7323.0	11.6	46.3	57.9	74.0	16.1	Horizontal
9764.0	7.8	48.1	55.9	74.0	18.1	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	3.6	52.5	56.1	74.0	17.9	Horizontal

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

Field Strength of Spurious Emissions						
Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dB	E-Field Polarity
4882.0	1.1	41.6	42.7	54.0	11.3	Vertical
4882.0	0.1	42.5	42.6	54.0	11.4	Horizontal
7323.0	-3.8	45.2	41.4	54.0	12.6	Vertical
7323.0	-3.5	46.3	42.8	54.0	11.2	Horizontal
9764.0	-6.6	48.1	41.5	54.0	12.5	Vertical
9764.0	-8.9	48.9	40.0	54.0	14.0	Horizontal
12205.0	-9.8	51.6	41.8	54.0	12.2	Vertical
12205.0	-10.8	52.5	41.7	54.0	12.3	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 dB	E-Field Polarity
4960.0	15.7	41.4	57.1	74.0	16.9	Vertical
4960.0	14.7	42.7	57.4	74.0	16.6	Horizontal
7440.0	11.9	45.6	57.5	74.0	16.5	Vertical
7440.0	11.2	46.5	57.7	74.0	16.3	Horizontal
9920.0	6.9	48.6	55.5	74.0	18.5	Vertical
9920.0	5.6	49.7	55.3	74.0	18.7	Horizontal
12400.0	4.6	51.7	56.3	74.0	17.7	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) ($\pi/4$ -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 dB	E-Field Polarity
4960.0	1.5	41.4	42.9	54.0	11.1	Vertical
4960.0	-0.4	42.7	42.3	54.0	11.7	Horizontal
7440.0	-3.7	45.6	41.9	54.0	12.1	Vertical
7440.0	-4	46.5	42.5	54.0	11.5	Horizontal
9920.0	-7.8	48.6	40.8	54.0	13.2	Vertical
9920.0	-8.7	49.7	41.0	54.0	13.0	Horizontal
12400.0	-10.2	51.7	41.5	54.0	12.5	Vertical
12400.0	-12.5	52.7	40.2	54.0	13.8	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	E-Field Polarity
4804.0	15.6	41.5	57.1	74.0	16.9	Vertical
4804.0	14.5	42.4	56.9	74.0	17.1	Horizontal
7206.0	12.3	45.1	57.4	74.0	16.6	Vertical
7206.0	11.5	46.2	57.7	74.0	16.3	Horizontal
9608.0	7.5	48.0	55.5	74.0	18.5	Vertical
9608.0	6.5	48.8	55.3	74.0	18.7	Horizontal
12010.0	4.3	51.8	56.1	74.0	17.9	Vertical
12010.0	3.5	52.4	55.9	74.0	18.1	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 dB	E-Field Polarity
4804.0	0.5	41.5	42.0	54.0	12.0	Vertical
4804.0	-1.0	42.4	41.4	54.0	12.6	Horizontal
7206.0	-3.2	45.1	41.9	54.0	12.1	Vertical
7206.0	-3.6	46.2	42.6	54.0	11.4	Horizontal
9608.0	-7.4	48.0	40.6	54.0	13.4	Vertical
9608.0	-8.3	48.8	40.5	54.0	13.5	Horizontal
12010.0	-10.6	51.8	41.2	54.0	12.8	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 dB	E-Field Polarity
4882.0	15.6	41.6	57.2	74.0	16.8	Vertical
4882.0	14.4	42.5	56.9	74.0	17.1	Horizontal
7323.0	12.3	45.2	57.5	74.0	16.5	Vertical
7323.0	10.7	46.3	57.0	74.0	17.0	Horizontal
9764.0	6.6	48.1	54.7	74.0	19.3	Vertical
9764.0	5.6	48.9	54.5	74.0	19.5	Horizontal
12205.0	4.2	51.5	55.7	74.0	18.3	Vertical
12205.0	3.8	52.5	56.3	74.0	17.7	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 dB	E-Field Polarity
4882.0	0.6	41.6	42.2	54.0	11.8	Vertical
4882.0	-0.6	42.5	41.9	54.0	12.1	Horizontal
7323.0	-3.1	45.2	42.1	54.0	11.9	Vertical
7323.0	-3.9	46.3	42.4	54.0	11.6	Horizontal
9764.0	-8.5	48.1	39.6	54.0	14.4	Vertical
9764.0	-8.5	48.9	40.4	54.0	13.6	Horizontal
12205.0	-10.9	51.6	40.7	54.0	13.3	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 dB	E-Field Polarity
4960.0	15.7	41.4	57.1	74.0	16.9	Vertical
4960.0	14.6	42.7	57.3	74.0	16.7	Horizontal
7440.0	12.0	45.6	57.6	74.0	16.4	Vertical
7440.0	10.5	46.5	57.0	74.0	17.0	Horizontal
9920.0	6.3	48.6	54.9	74.0	19.1	Vertical
9920.0	5.0	49.7	54.7	74.0	19.3	Horizontal
12400.0	4.8	51.7	56.5	74.0	17.5	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 dB	E-Field Polarity
4960.0	0.5	41.4	41.9	54.0	12.1	Vertical
4960.0	-2.3	42.7	40.4	54.0	13.6	Horizontal
7440.0	-2.8	45.6	42.8	54.0	11.2	Vertical
7440.0	-4.3	46.5	42.2	54.0	11.8	Horizontal
9920.0	-7.1	48.6	41.5	54.0	12.5	Vertical
9920.0	-9.3	49.7	40.4	54.0	13.6	Horizontal
12400.0	-9.4	51.7	42.3	54.0	11.7	Vertical
12400.0	-11.3	52.7	41.4	54.0	12.6	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)).

RF Radiated Emissions (GFSK Lowest)

Field Strength of Band-edge Compliance						
Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBμV	dB/m	dBμV/m	dBμV/m	dB	
2390.0	15.7	36.8	52.5	74.0	21.5	Vertical

Field Strength of Band-edge Compliance						
Average Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBμV	dB/m	dBμV/m	dBμV/m	dB	
2390.0	3.6	36.8	40.4	54.0	13.6	Vertical

RF Radiated Emissions (GFSK Highest)

Field Strength of Band-edge Compliance						
Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBμV	dB/m	dBμV/m	dBμV/m	dB	
2483.5	17.9	36.4	54.3	74.0	19.7	Horizontal

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

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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)).

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

Field Strength of Band-edge Compliance						
Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dB μ V	dB/m	dB μ V/m	dB μ V/m	dB	
2390.0	15.4	36.8	52.2	74.0	21.8	Vertical

Field Strength of Band-edge Compliance						
Average Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dB μ V	dB/m	dB μ V/m	dB μ V/m	dB	
2390.0	3.6	36.8	40.4	54.0	13.6	Vertical

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

Field Strength of Band-edge Compliance						
Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dB μ V	dB/m	dB μ V/m	dB μ V/m	dB	
2483.5	20.8	36.4	57.2	74.0	16.8	Horizontal

Field Strength of Band-edge Compliance						
Average Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dB μ V	dB/m	dB μ V/m	dB μ V/m	dB	
2483.5	5.7	36.4	42.1	54.0	11.9	Horizontal

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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)).

RF Radiated Emissions (8DPSK Lowest)

Field Strength of Band-edge Compliance						
Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBμV	dB/m	dBμV/m	dBμV/m	dB	
2390.0	16.0	36.8	52.8	74.0	21.2	Vertical

Field Strength of Band-edge Compliance						
Average Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBμV	dB/m	dBμV/m	dBμV/m	dB	
2390.0	4.9	36.8	41.7	54.0	12.3	Vertical

RF Radiated Emissions (8DPSK Highest)

Field Strength of Band-edge Compliance						
Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBμV	dB/m	dBμV/m	dBμV/m	dB	
2483.5	21.0	36.4	57.4	74.0	16.6	Horizontal

Field Strength of Band-edge Compliance						
Average Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBμV	dB/m	dBμV/m	dBμV/m	dB	
2483.5	6.2	36.4	42.6	54.0	11.4	Horizontal

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

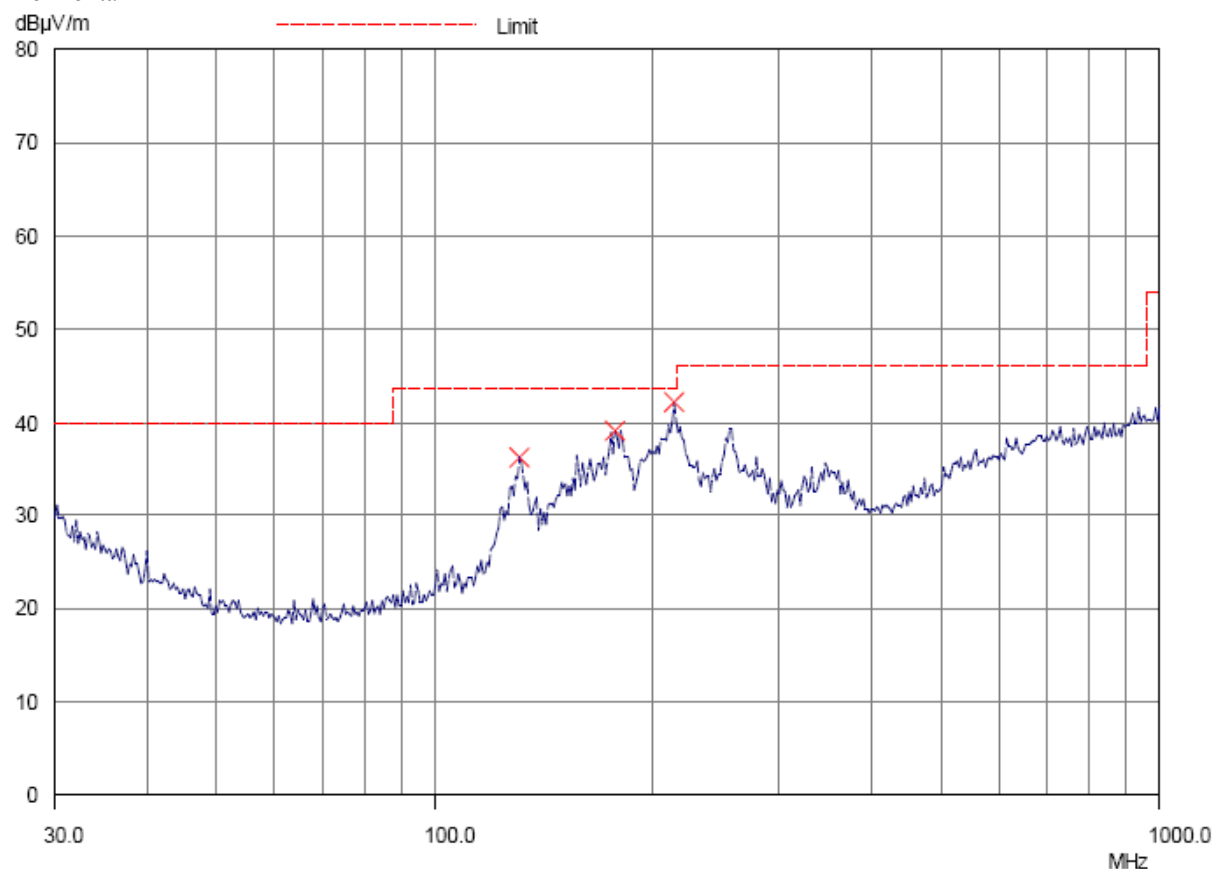
Frequency Range	Quasi-Peak Limits
[MHz]	[$\mu\text{V/m}$]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

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

Result of Bluetooth Communication mode (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
130.7	Horizontal	34.2	43.5	51.3	150
176.3	Horizontal	37.1	43.5	71.6	150
212.5	Horizontal	40.2	43.5	102.3	150

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

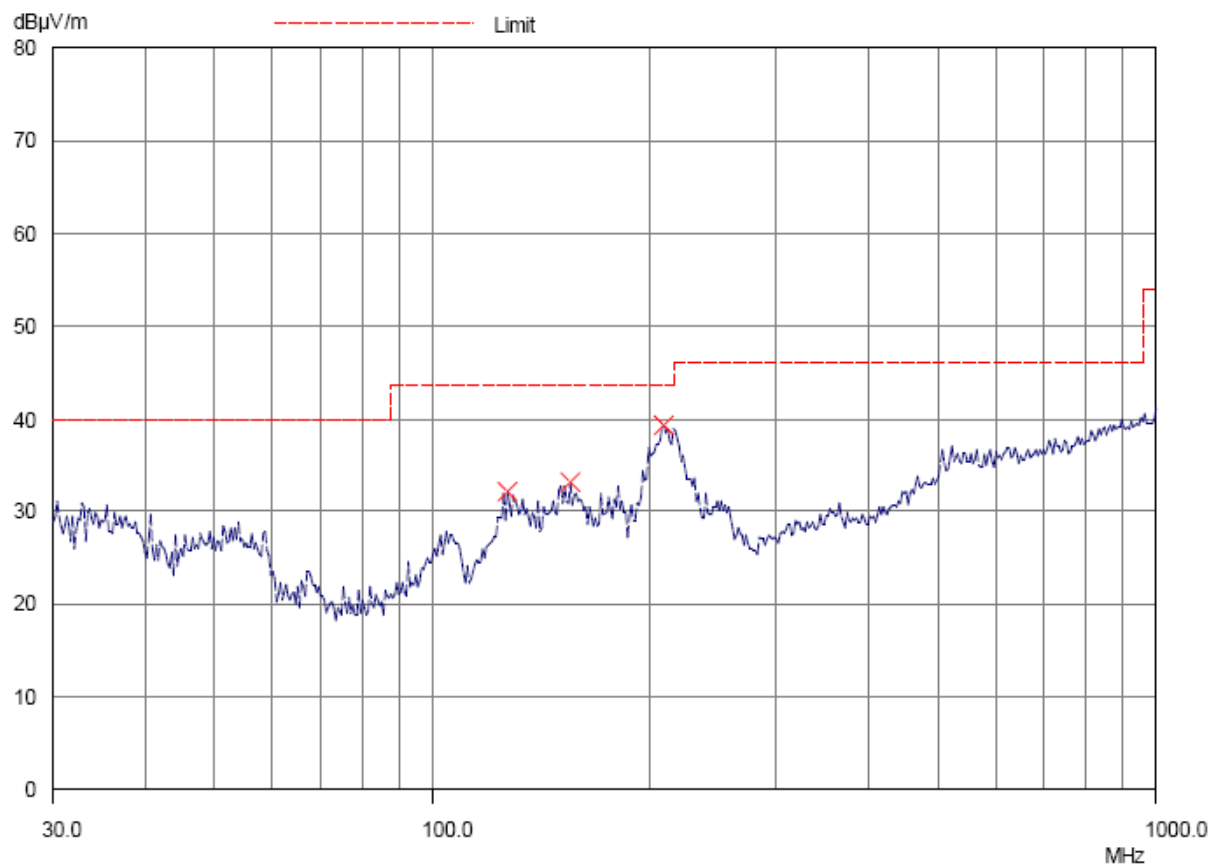
Frequency Range	Quasi-Peak Limits
[MHz]	[μ V/m]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

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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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
126.8	Vertical	30.1	43.5	32.0	150
155.0	Vertical	31.2	43.5	36.3	150
208.4	Vertical	37.8	43.5	77.6	150

Remarks:

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

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

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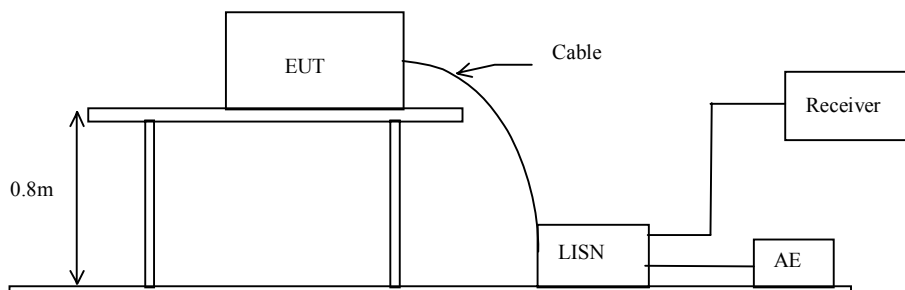
3.1.3 AC Mains Conducted Emissions (0.15MHz to 30MHz)

Test Requirement:	FCC 47CFR 15.207
Test Method:	ANSI C63.10: 2013
Test Date:	2016-06-14
Mode of Operation:	Bluetooth Communication 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:



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Limit for Conducted Emissions (FCC 47 CFR 15.207):

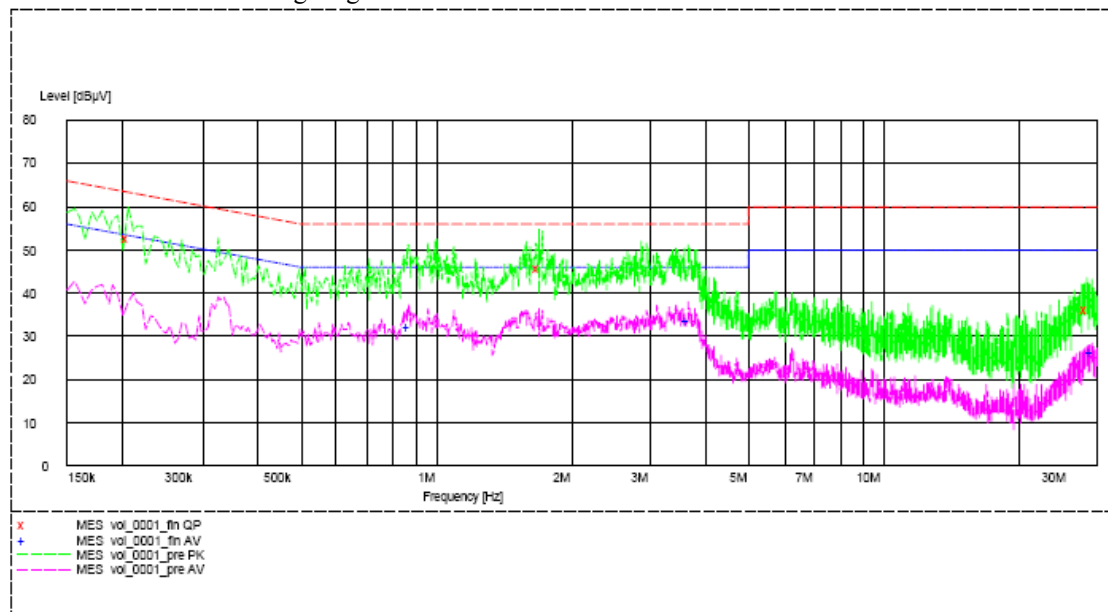
Frequency Range [MHz]	Quasi-Peak Limits [dBμV]	Average [dBμV]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

* Decreases with the logarithm of the frequency.

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

Result of Bluetooth Communication mode (L): PASS

Please refer to the following diagram for individual results.



Conductor Live or Neutral	Frequency MHz	Quasi-peak		Average	
		Level dBμV	Limit dBμV	Level dBμV	Limit dBμV
Live	0.205	52.5	63.0	-*-	-*-
Live	1.695	45.8	56.0	-*-	-*-
Live	28.540	36.5	60.0	-*-	-*-
Live	0.870	-*-	-*-	32.1	46.0
Live	3.655	-*-	-*-	33.3	46.0
Live	29.060	-*-	-*-	26.4	50.0

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Limit for Conducted Emissions (FCC 47 CFR 15.207):

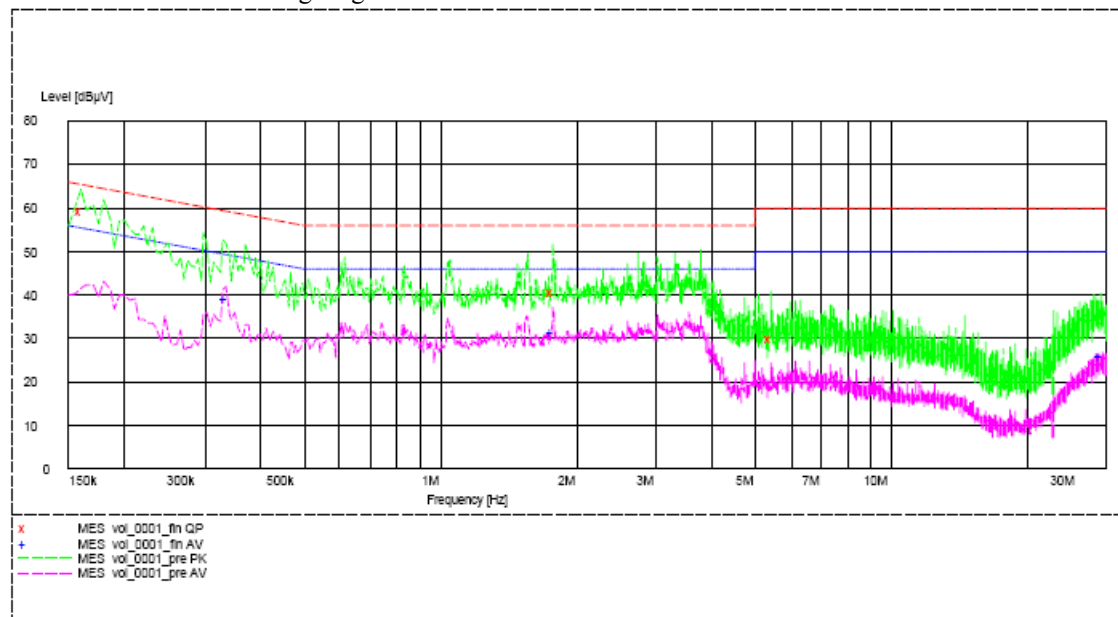
Frequency Range [MHz]	Quasi-Peak Limits [dBμV]	Average [dBμV]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

* Decreases with the logarithm of the frequency.

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

Result of Bluetooth Communication mode (N): PASS

Please refer to the following diagram for individual results.



Conductor Live or Neutral	Frequency MHz	Quasi-peak		Average	
		Level dBμV	Limit dBμV	Level dBμV	Limit dBμV
Neutral	0.160	59.4	66.0	-*-	-*-
Neutral	1.780	40.5	56.0	-*-	-*-
Neutral	5.400	29.9	60.0	-*-	-*-
Neutral	0.335	-*-	-*-	39.1	49.0
Neutral	1.780	-*-	-*-	31.3	46.0
Neutral	29.325	-*-	-*-	25.9	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:

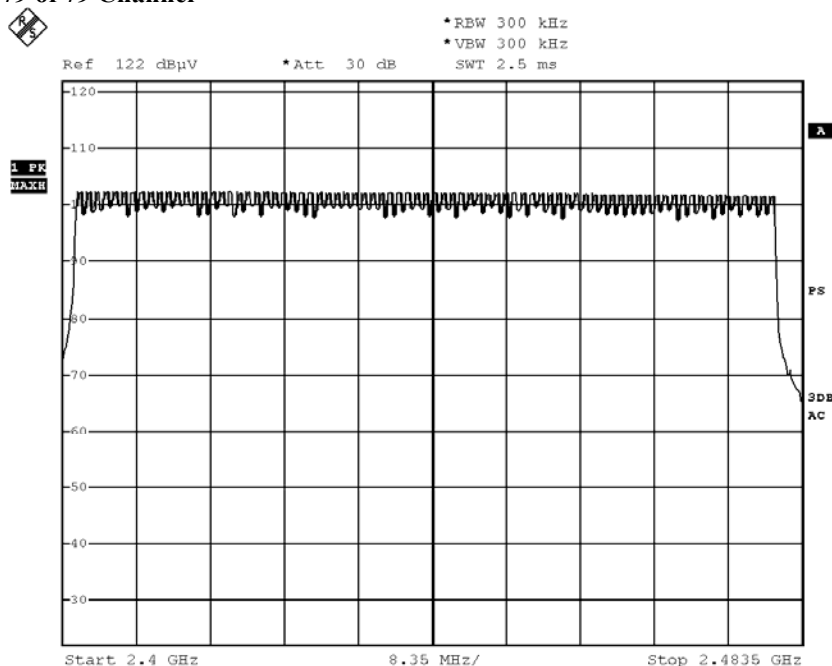
RBW = 1MHz, VBW $\geq$ RBW, Sweep = Auto, Span = the frequency band of operation
Detector = Peak, Trace = Max. hold

Test Setup:

As Test Setup of clause 3.1.1 in this test report.

Measurement Data:

GFSK: 79 of 79 Channel



BMP

Date: 20.JUN.2016 13:15:44

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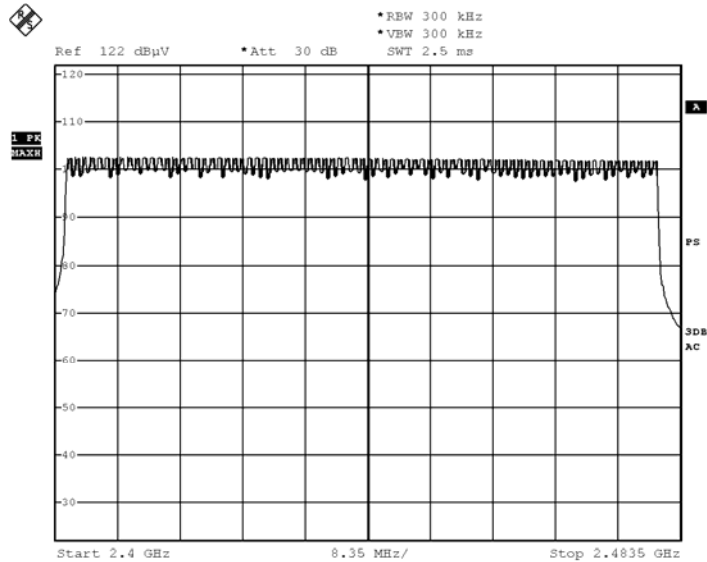
Test Report

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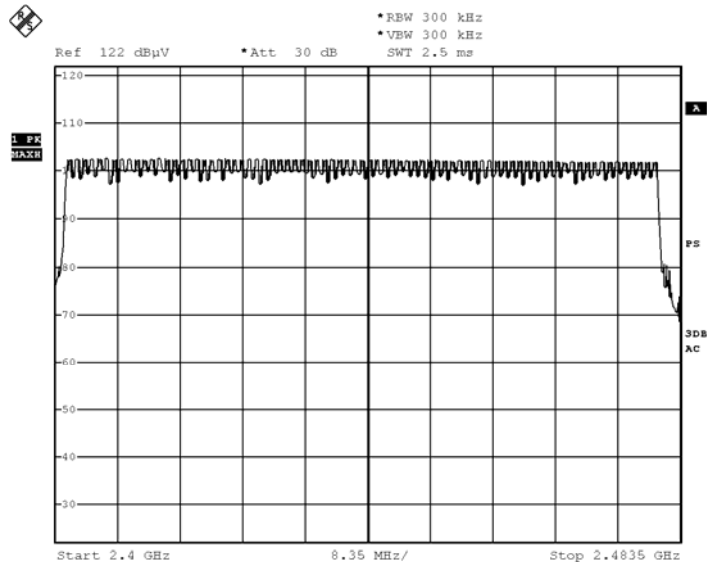
$\pi/4$ -DQPSK: 79 of 79 Channel



BMP

Date: 20.JUN.2016 15:18:14

8DPSK: 79 of 79 Channel



BMP

Date: 20.JUN.2016 15:10:35

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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:	2016-06-20
Mode of Operation:	TX mode

Remark:

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

Test Method:

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

Spectrum Analyzer Setting:

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

Test Setup:

As Test Setup of clause 3.1.1 in this test report.

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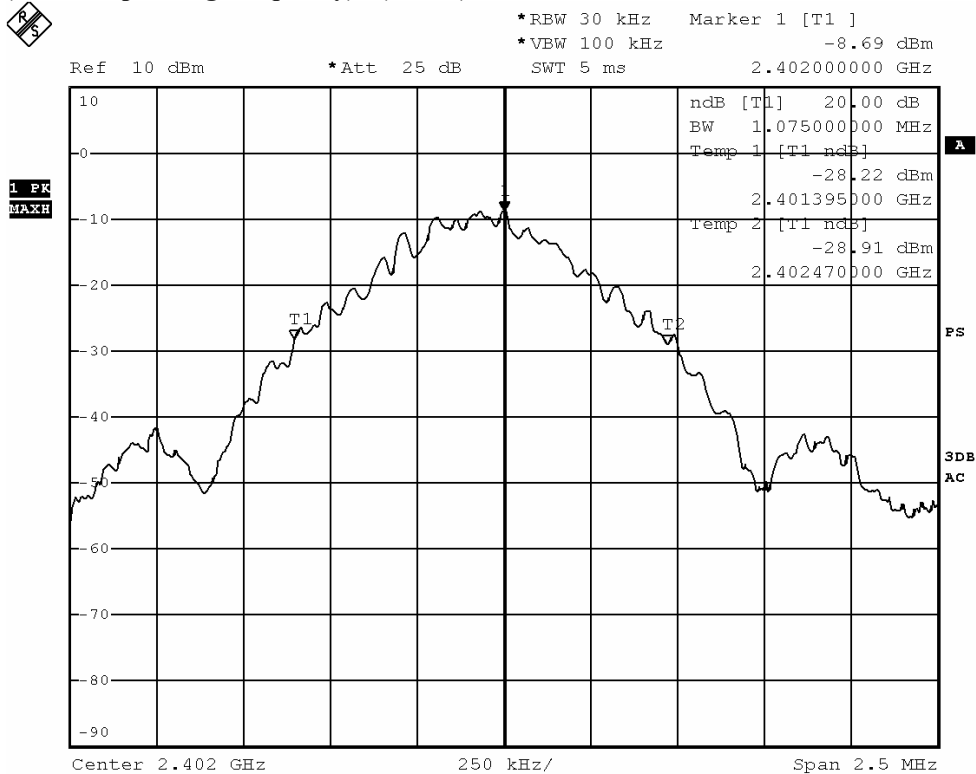
Date: 2017-07-07

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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	1.075	Within 2400-2483.5

(Lowest Operating Frequency) - (GFSK)



BMP

Date: 20.JUN.2016 12:30:00

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Test Report

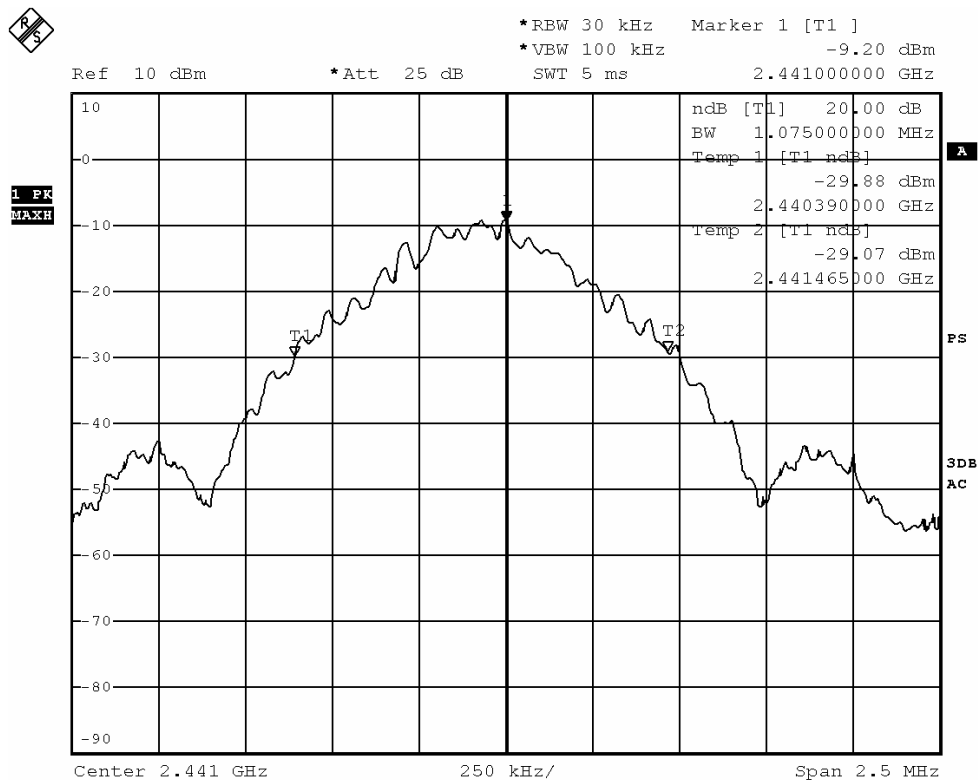
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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2441	1.075	Within 2400-2483.5

(Middle Operating Frequency) - (GFSK)



BMP

Date: 20.JUN.2016 12:30:20

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Test Report

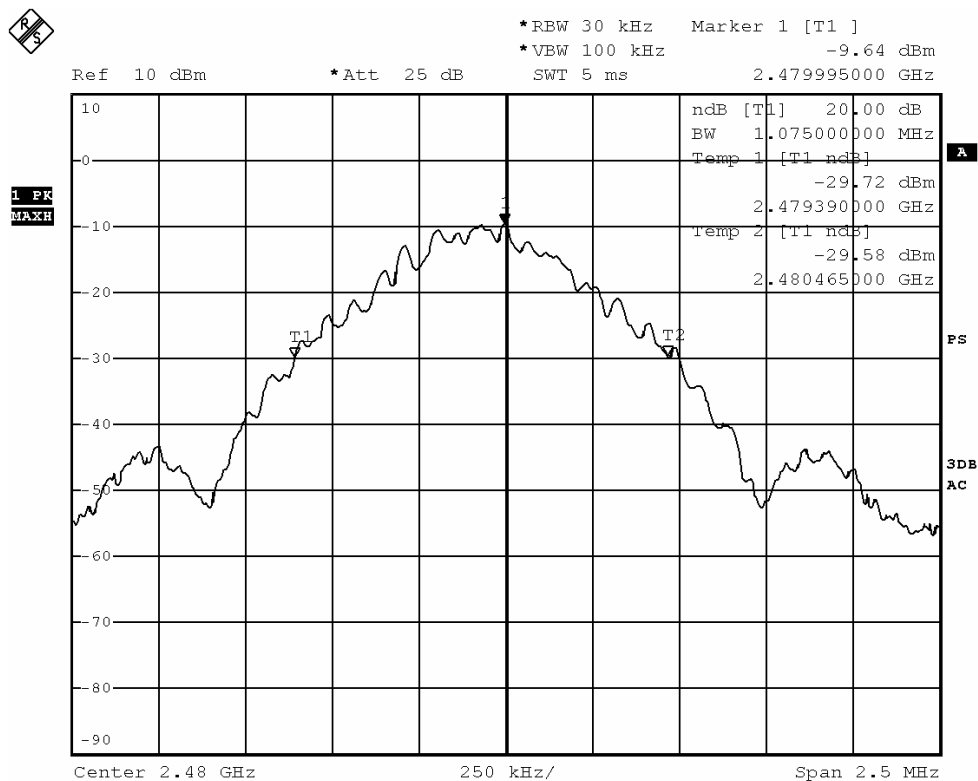
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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2480	1.075	Within 2400-2483.5

(Highest Operating Frequency) - (GFSK)



BMP

Date: 20.JUN.2016 12:30:58

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Test Report

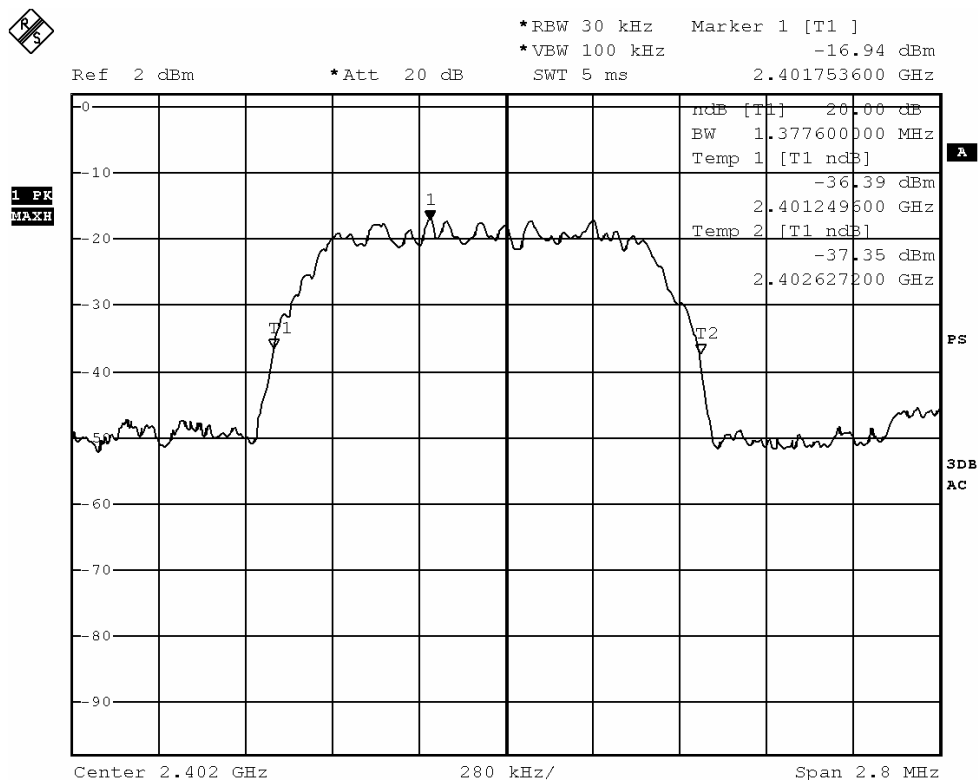
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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	1.3776	Within 2400-2483.5

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



BMP

Date: 20.JUN.2016 12:32:21

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Test Report

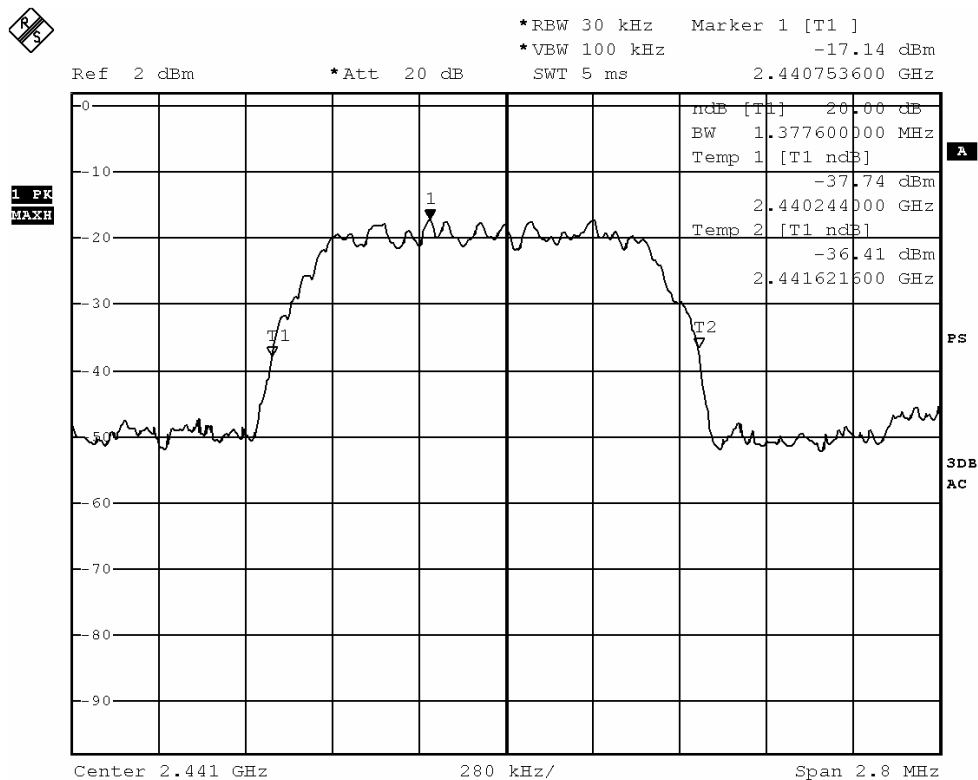
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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2441	1.3776	Within 2400-2483.5

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



BMP

Date: 20.JUN.2016 12:31:58

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Test Report

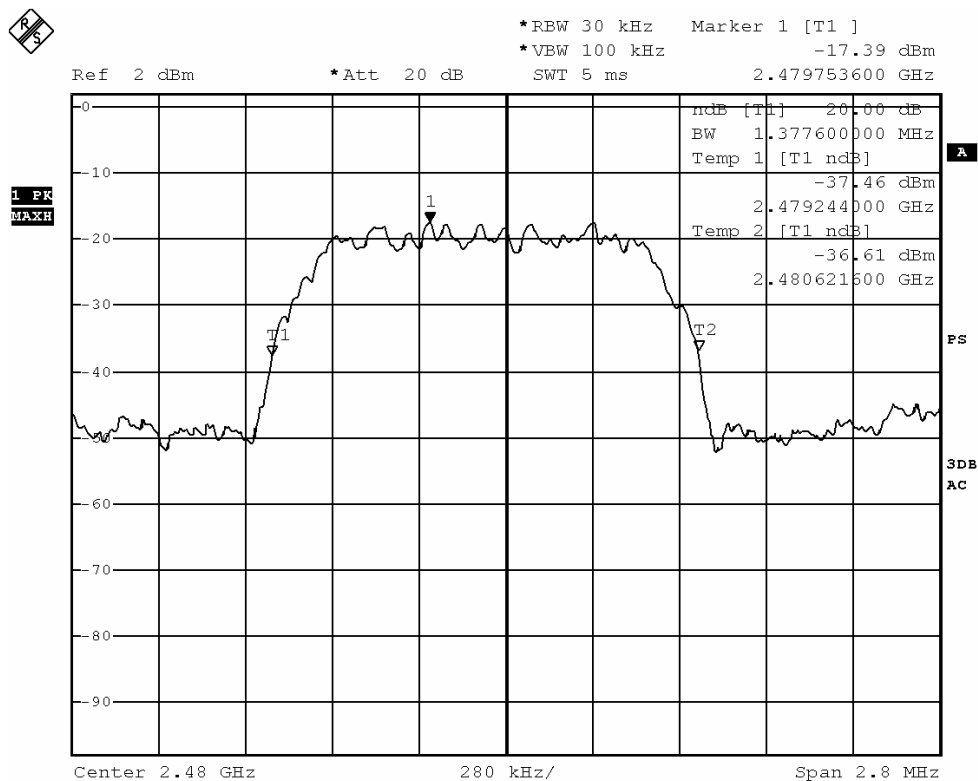
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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2480	1.3776	Within 2400-2483.5

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



BMP

Date: 20.JUN.2016 12:31:37

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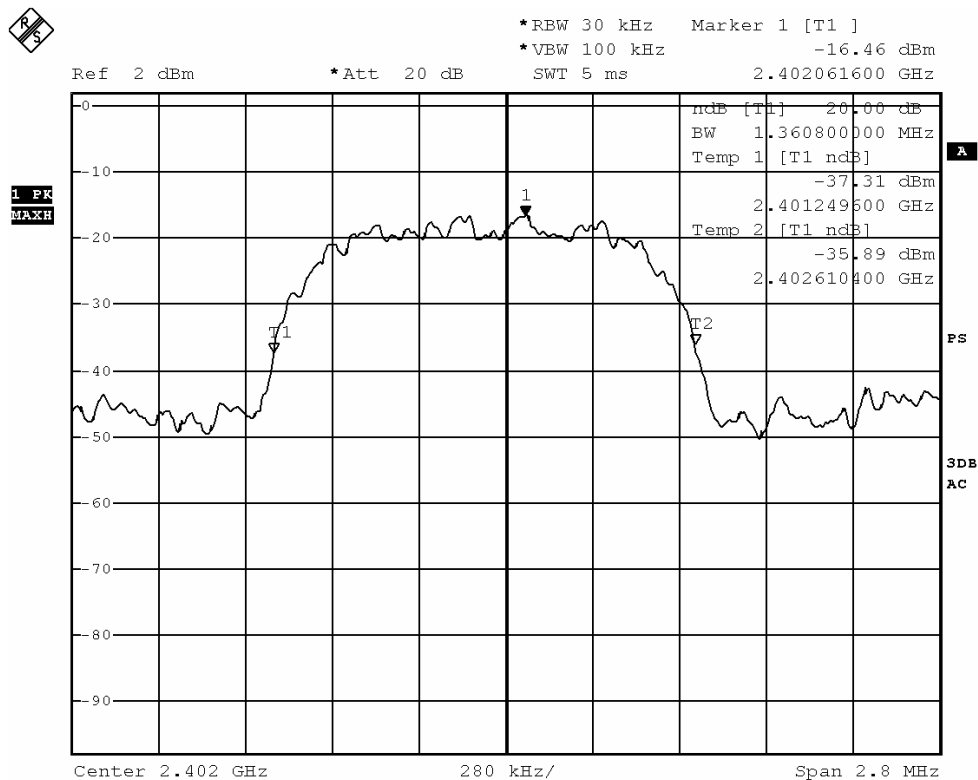
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Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	1.3608	Within 2400-2483.5

(Lowest Operating Frequency) - (8DPSK)



BMP

Date: 20.JUN.2016 12:33:06

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Test Report

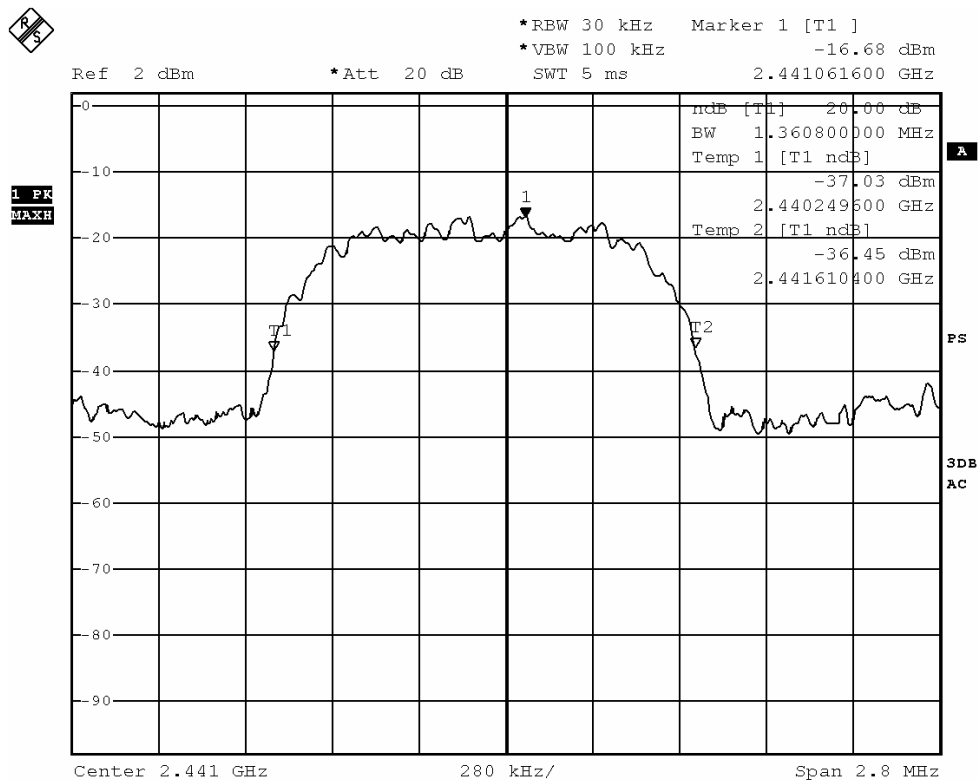
Date: 2017-07-07

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No.: DM123869

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

(Middle Operating Frequency) - (8DPSK)



BMP

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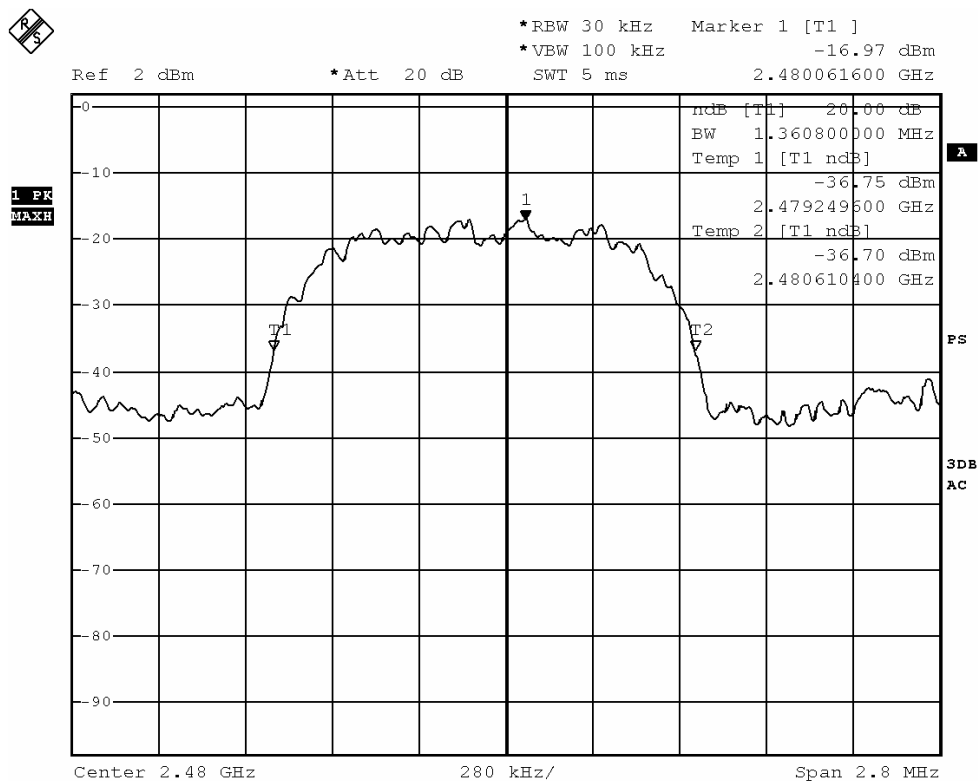
Date: 2017-07-07

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No.: DM123869

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

(Highest Operating Frequency) - (8DPSK)



BMP

Date: 20.JUN.2016 12:34:11

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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.

Spectrum Analyzer Setting:

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

Limit:

The measured maximum bandwidth * $\frac{2}{3}$ = 1.075MHz * $\frac{2}{3}$ = 716.7 kHz (GFSK)

The measured maximum bandwidth * $\frac{2}{3}$ = 1.3776MHz * $\frac{2}{3}$ = 918.4kHz ($\pi/4$ DQPSK, 8DPSK)

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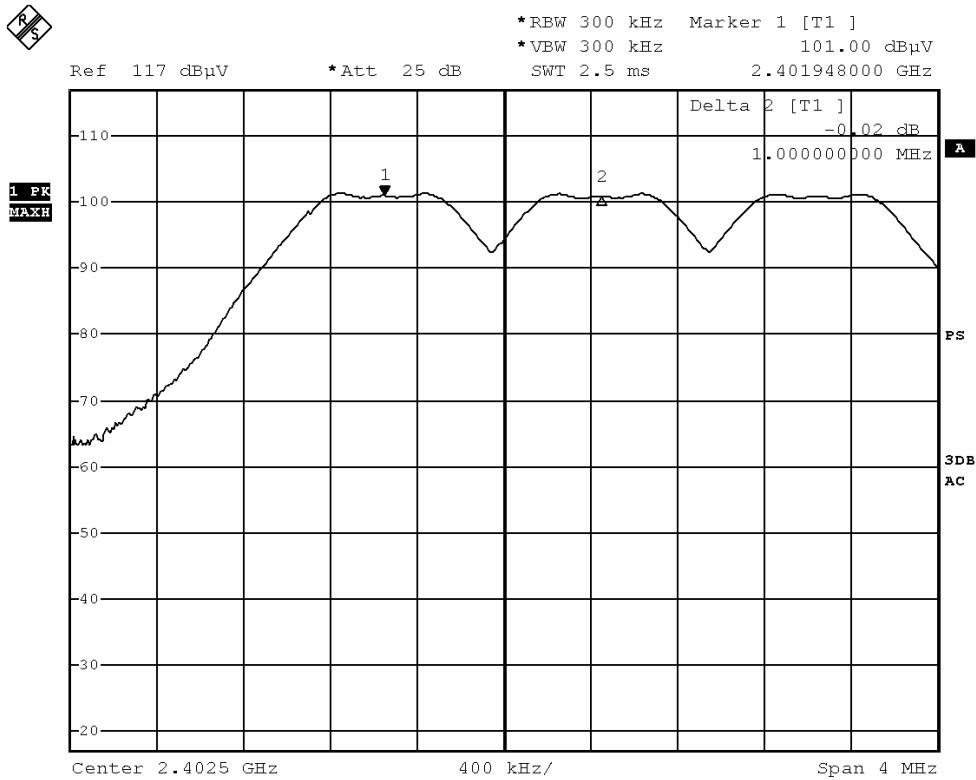
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Channel separation = 1MHz (>716.7kHz) (Lowest) (GFSK)



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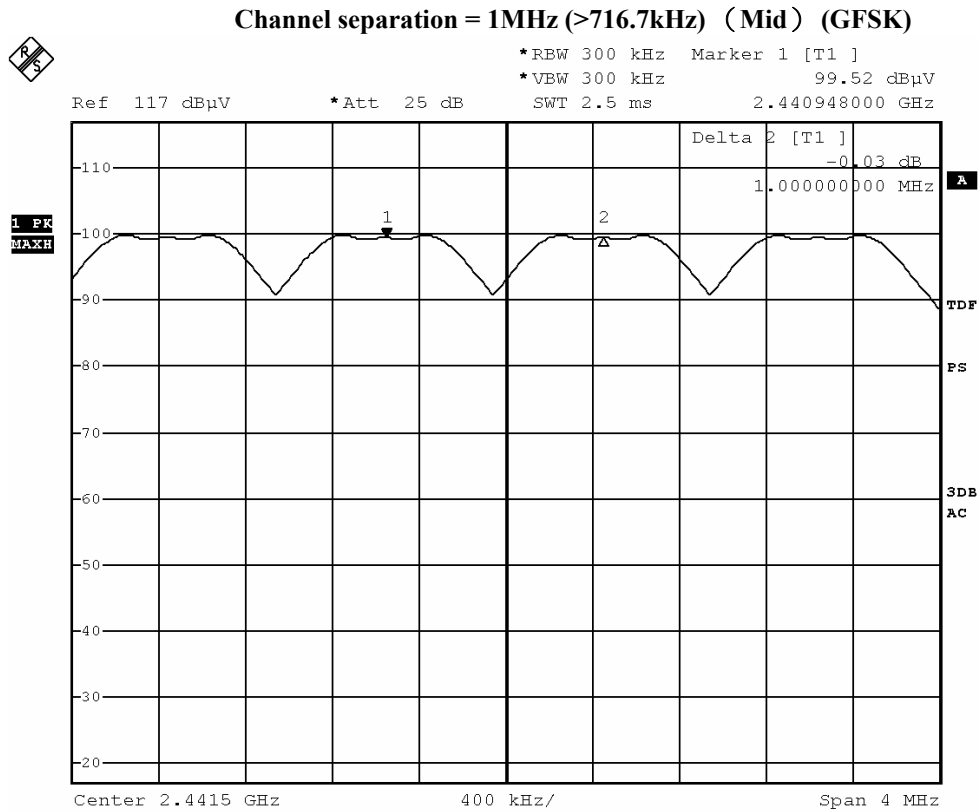


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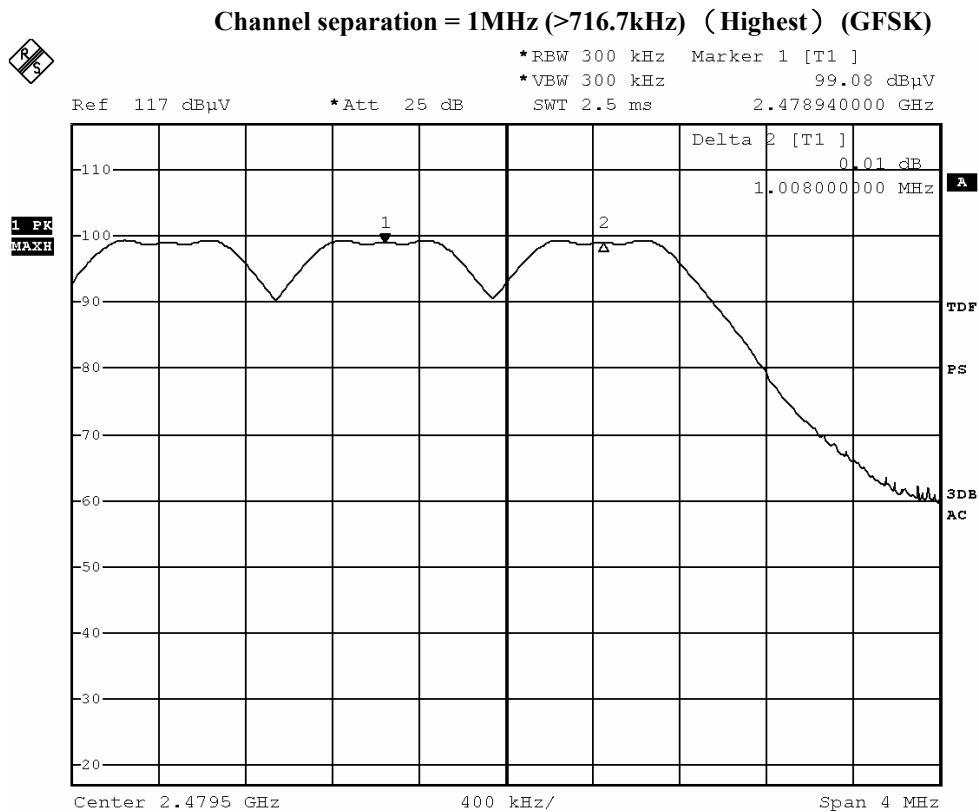


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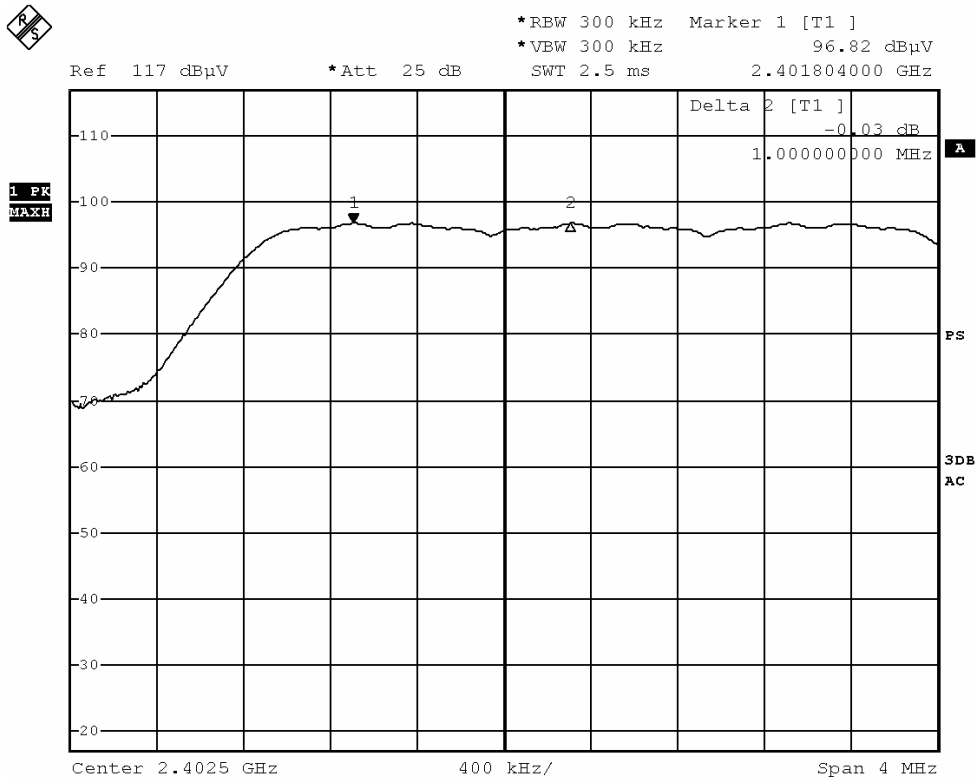
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Channel separation = 1MHz (>918.4kHz) (Lowest) ($\pi/4$ DQPSK)



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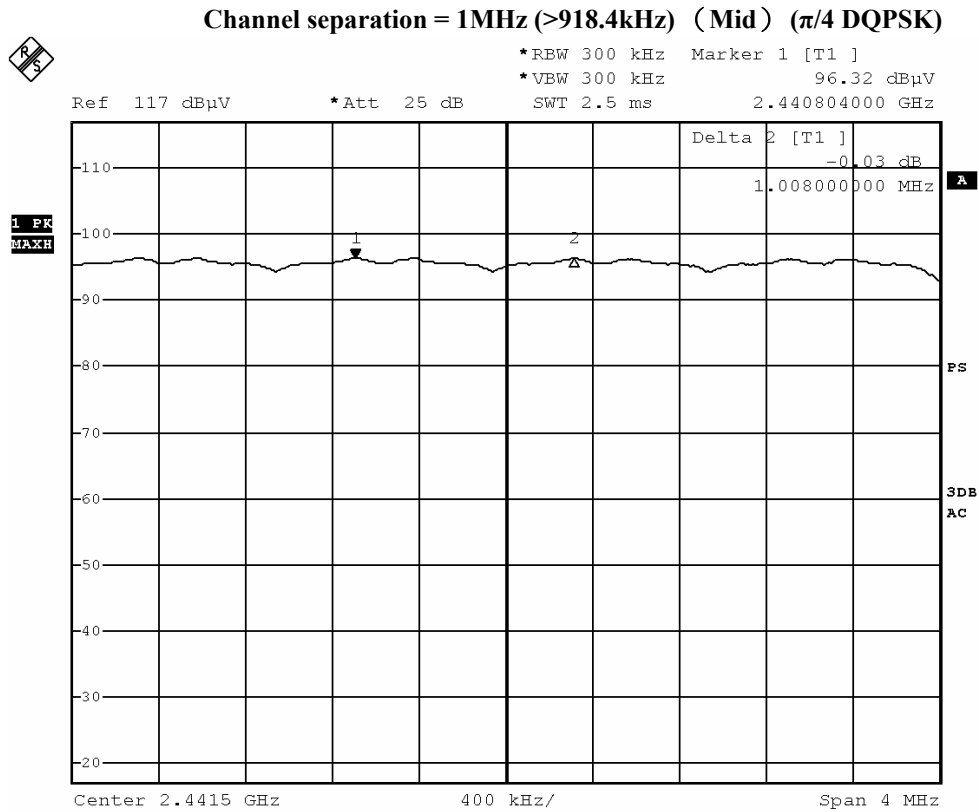


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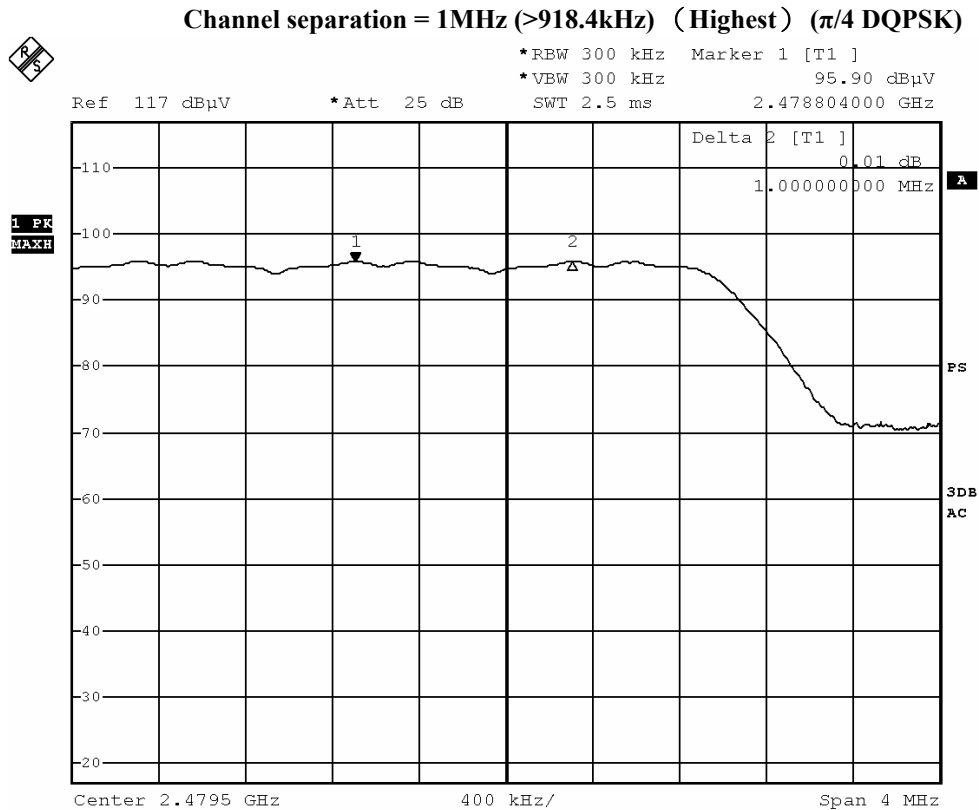


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BMP

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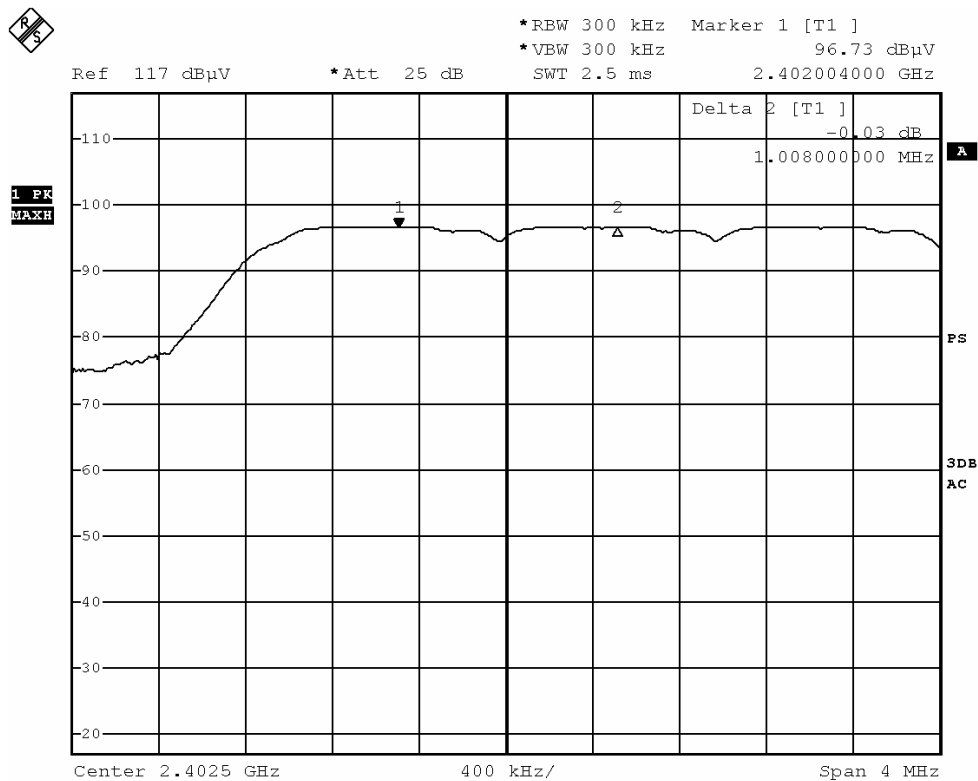
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Channel separation = 1MHz (>918.4kHz) (Lowest) (8DPSK)



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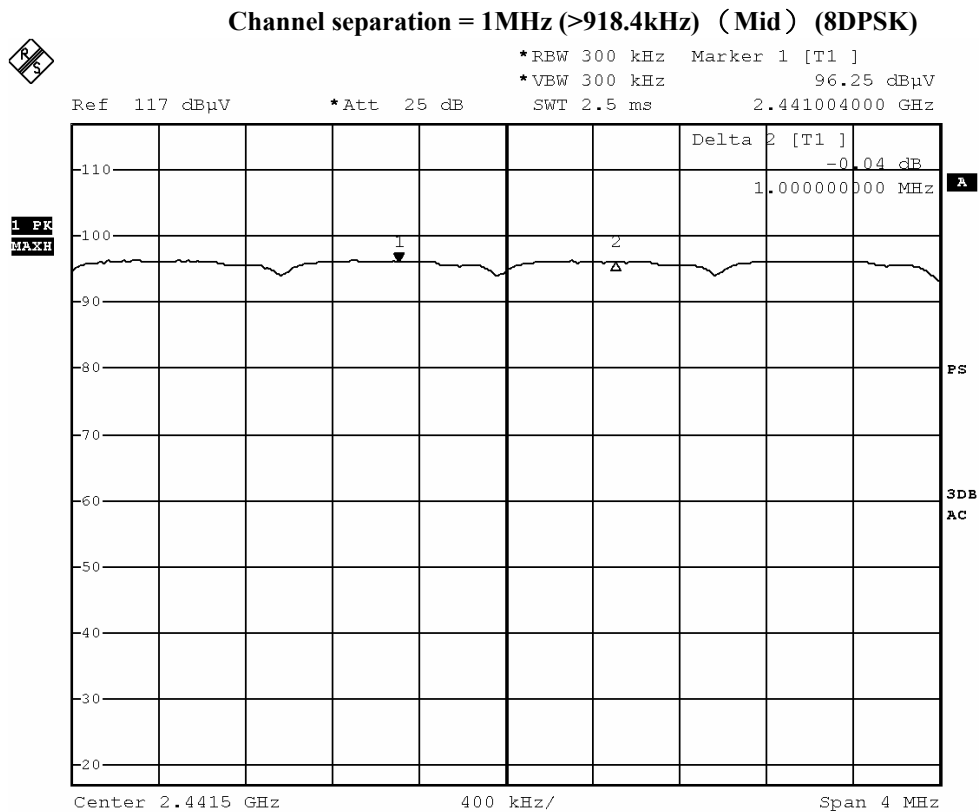


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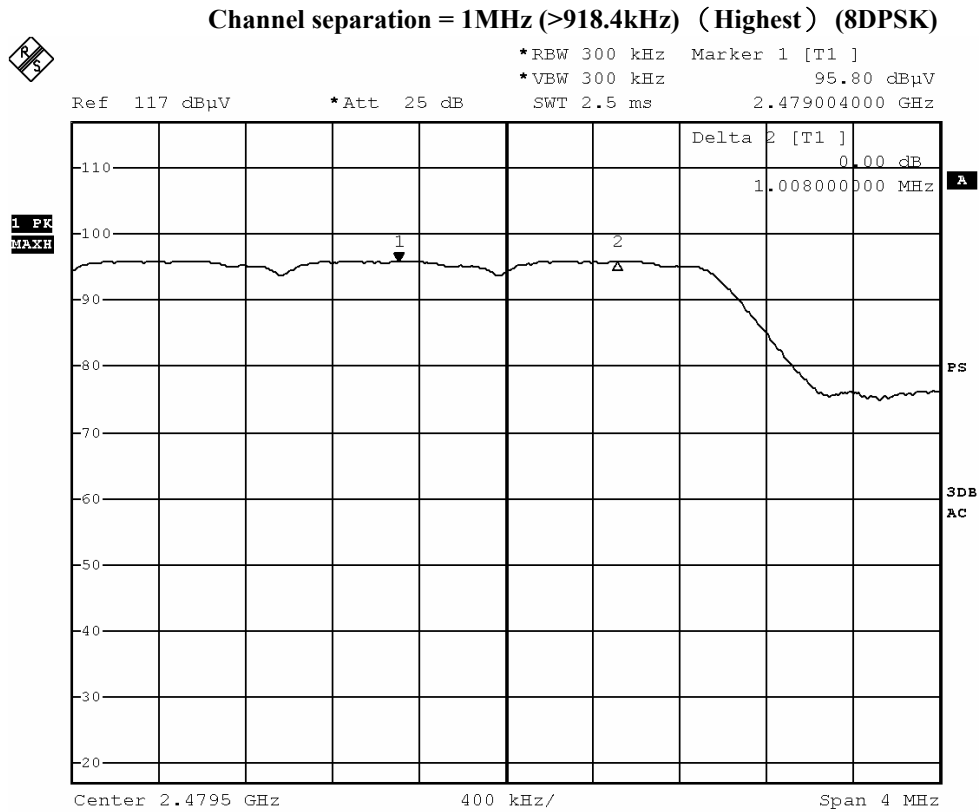


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3.1.7 Band-edge Compliance of RF Conducted Emissions Measurement:

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.

Spectrum Analyzer Setting:

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

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

Detector = Peak, Trace = Max. hold

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

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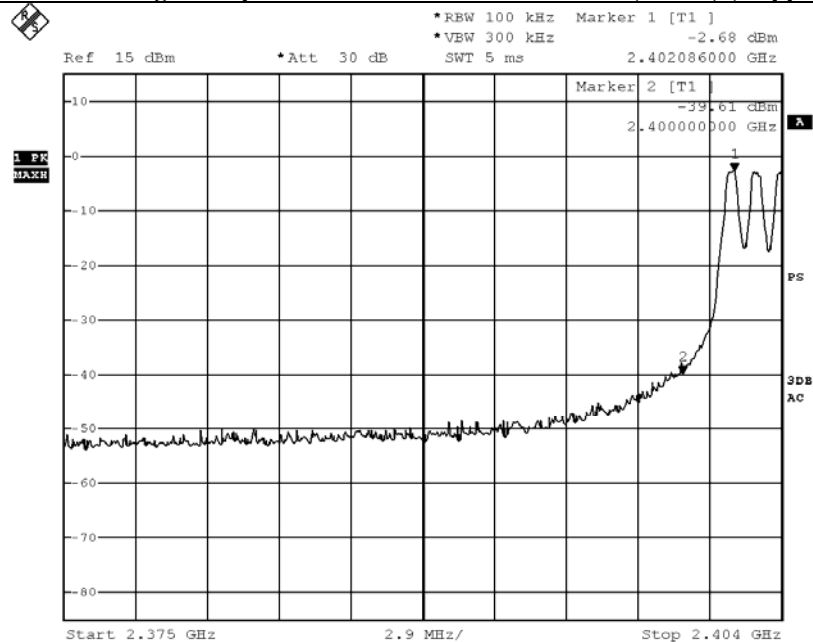
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Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	36.93

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



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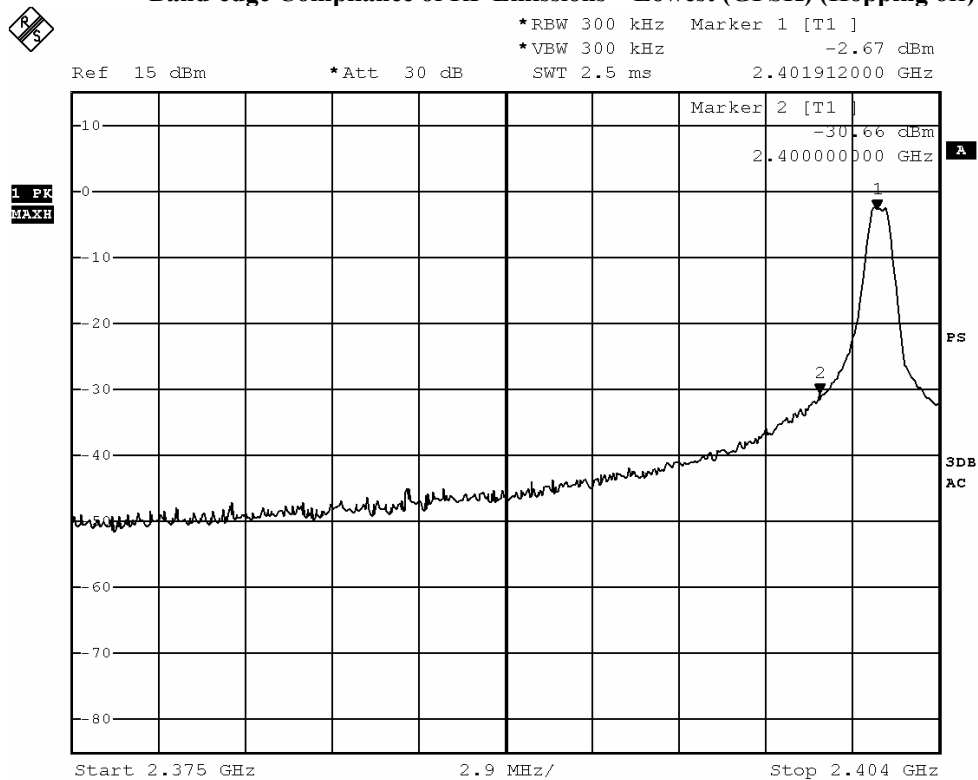
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Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	27.99

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



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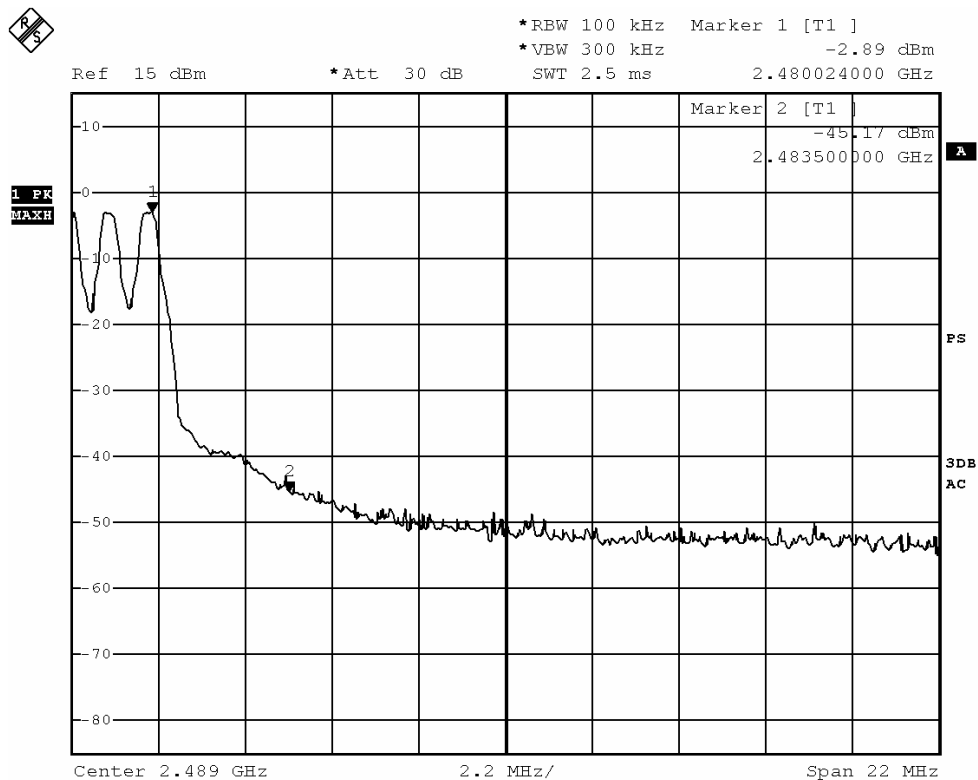
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Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2483.5 - Highest Fundamental (2480)	42.28

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



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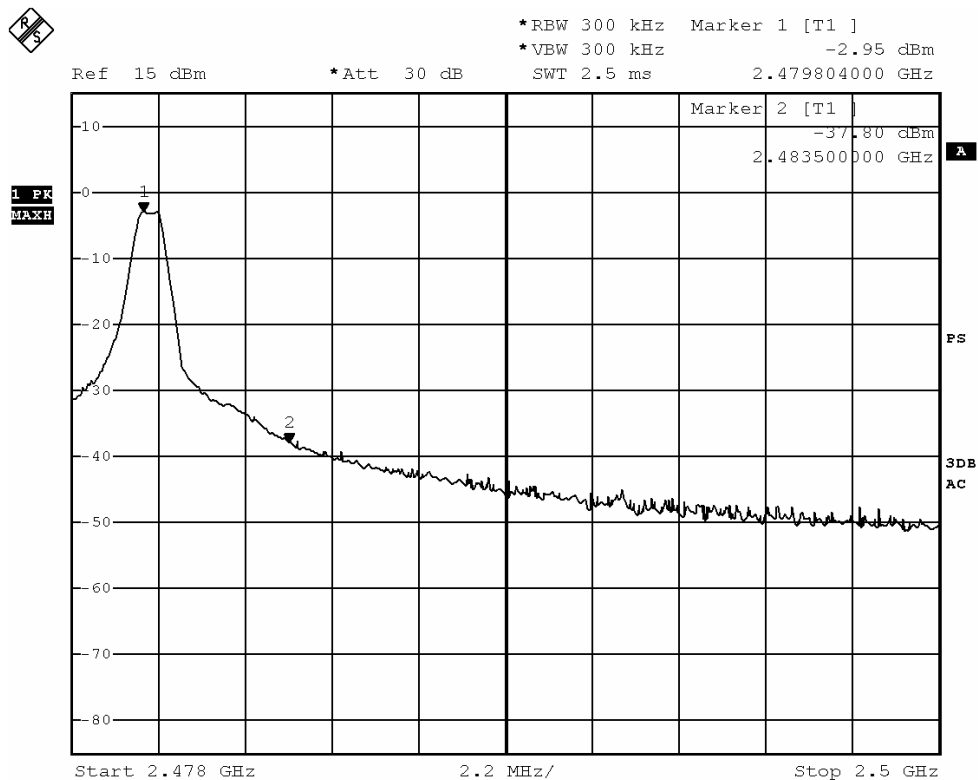
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No.: DM123869

Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2483.5 - Highest Fundamental (2480)	34.85

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



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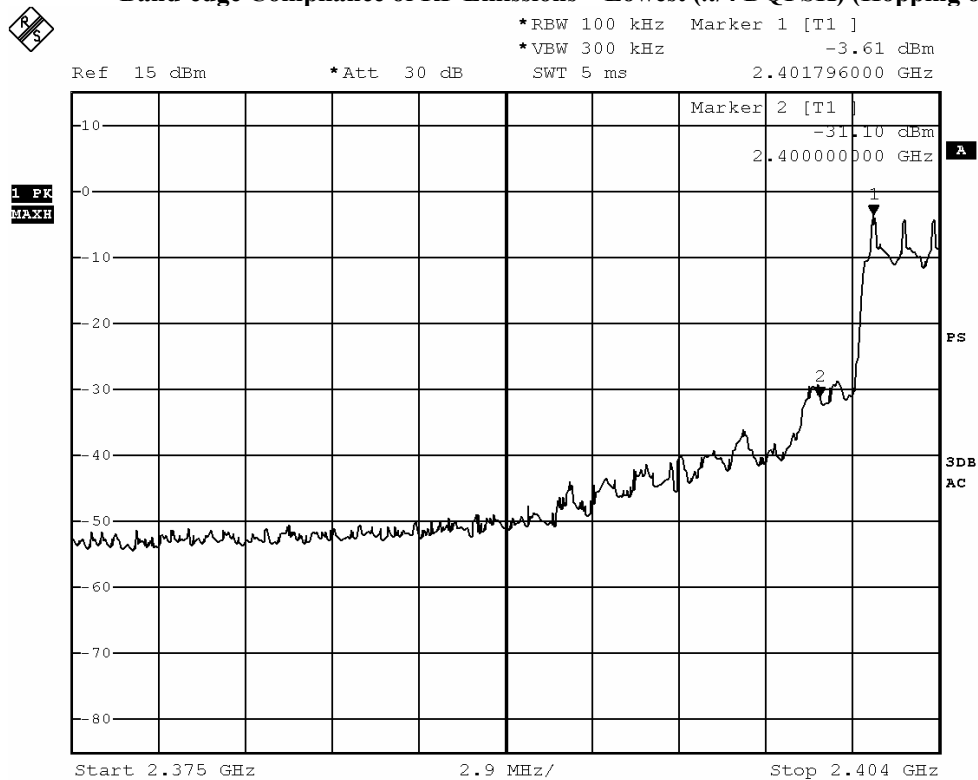
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Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	27.49

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



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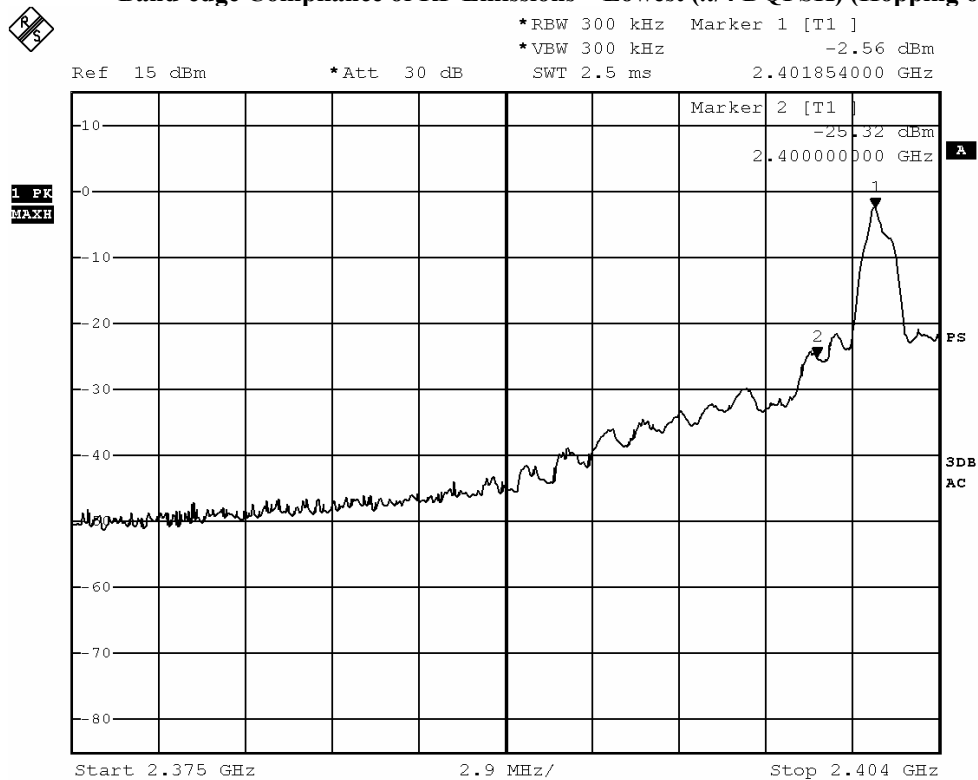
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Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	2276

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



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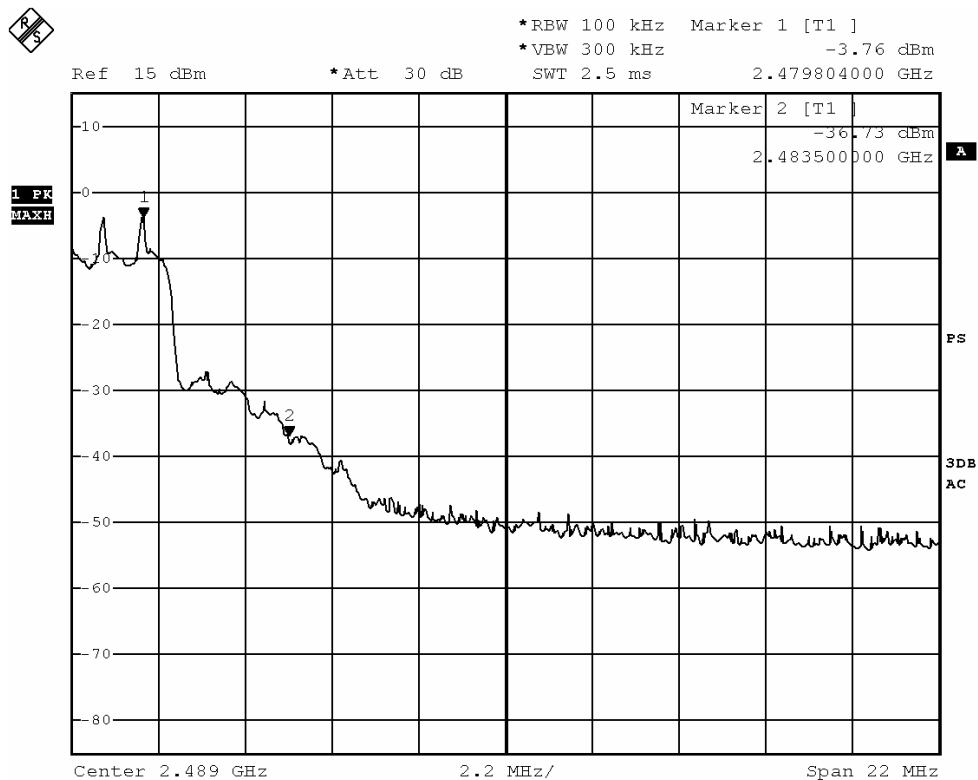
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Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2483.5 - Highest Fundamental (2480)	32.97

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



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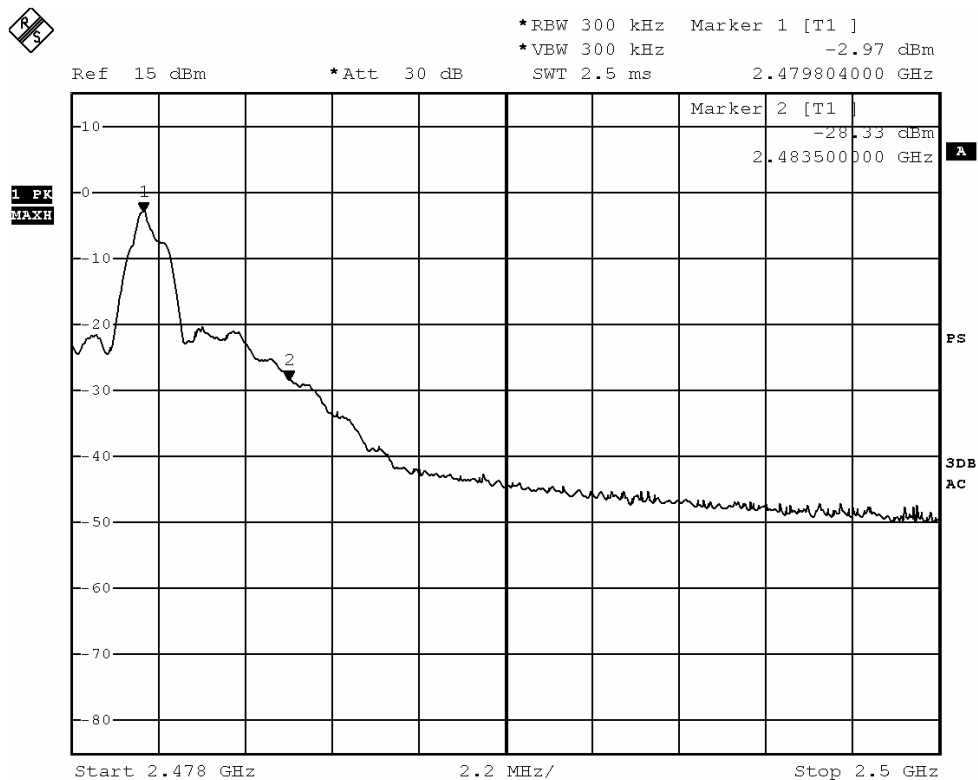
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Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2483.5 - Highest Fundamental (2480)	25.36

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



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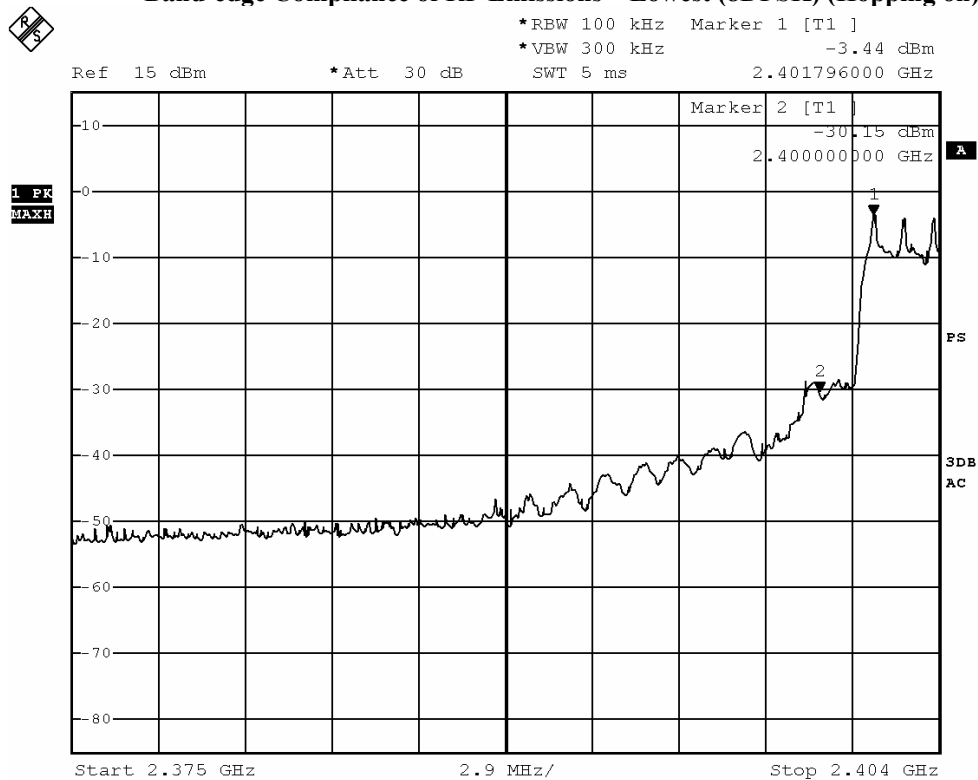
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Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	26.71

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



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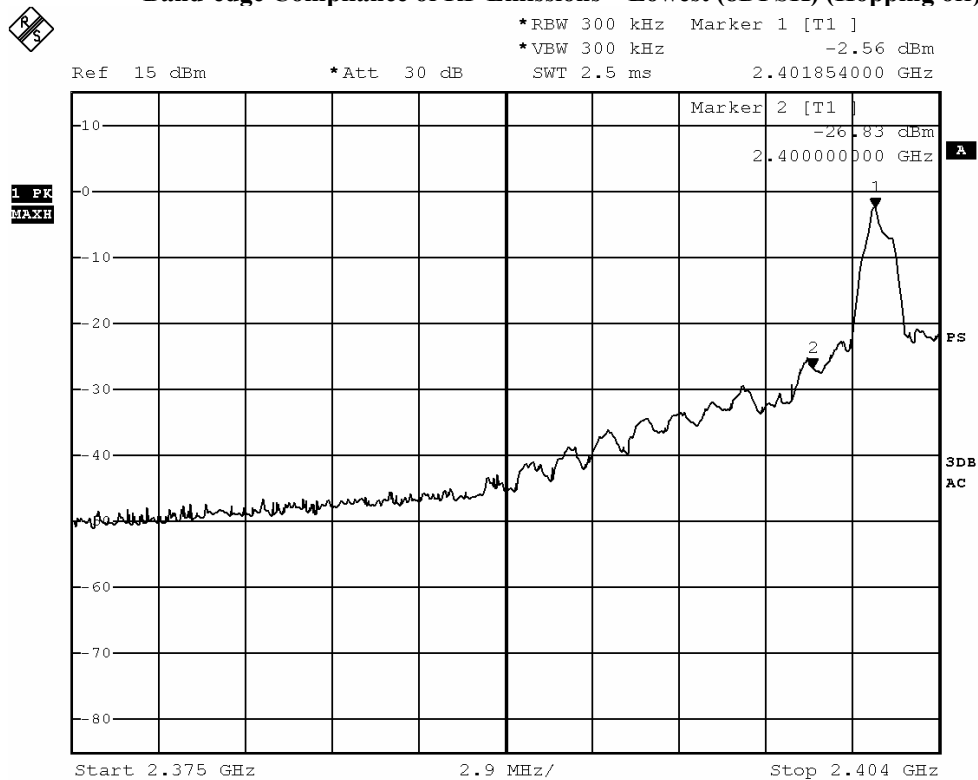
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Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	24.27

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



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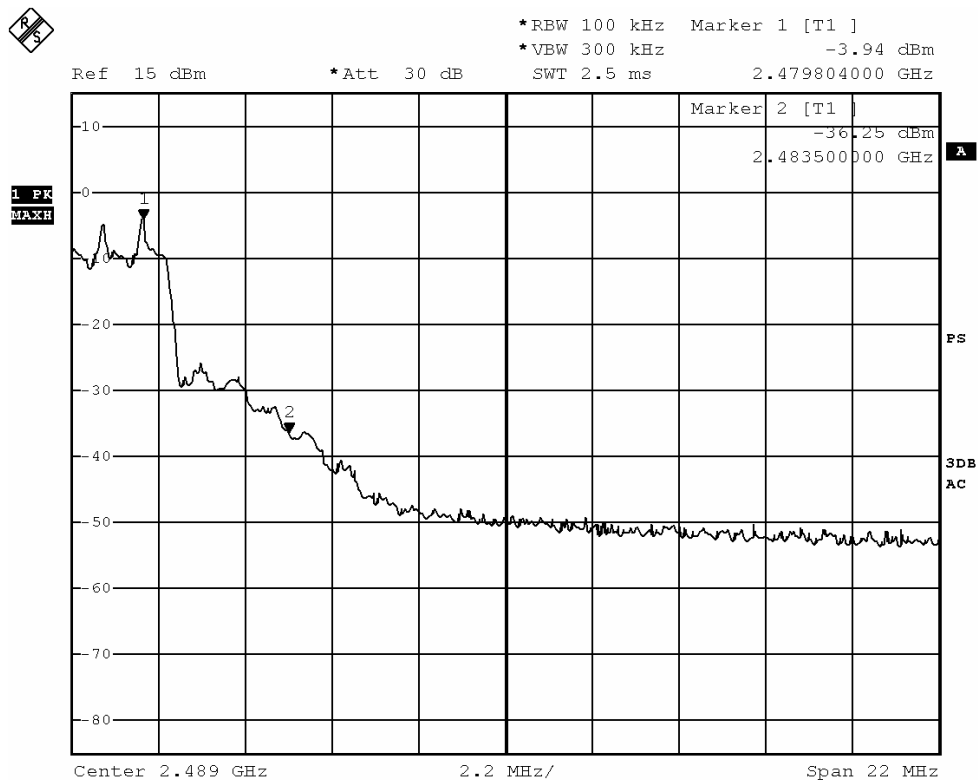
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Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2483.5 - Highest Fundamental (2480)	32.31

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



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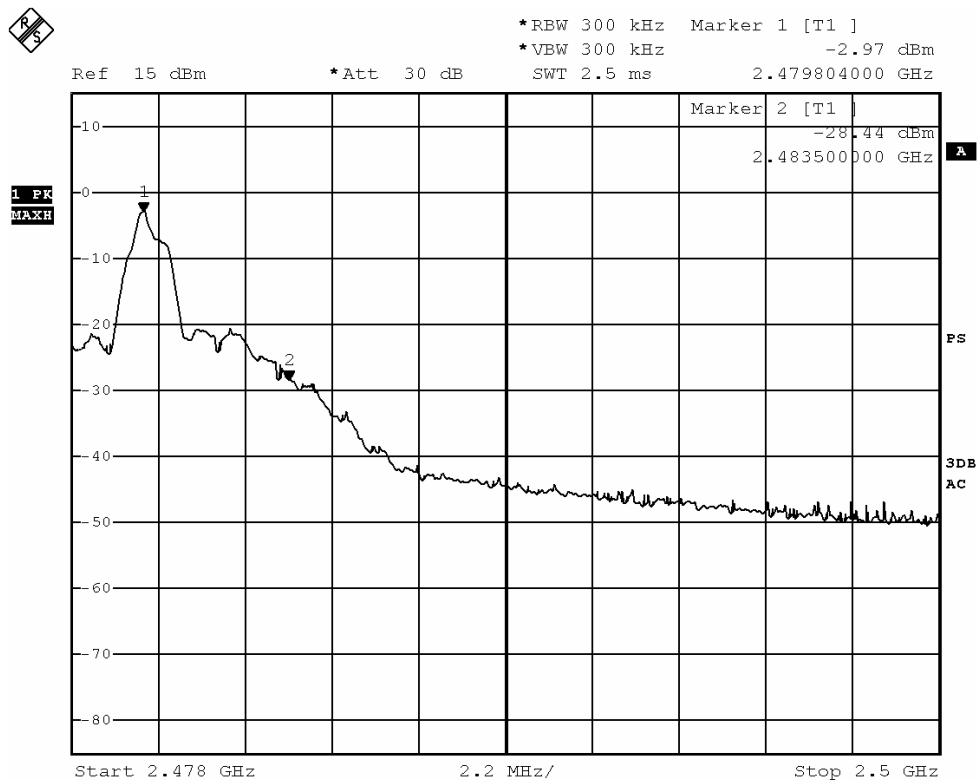
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Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2483.5 - Highest Fundamental (2480)	25.47

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



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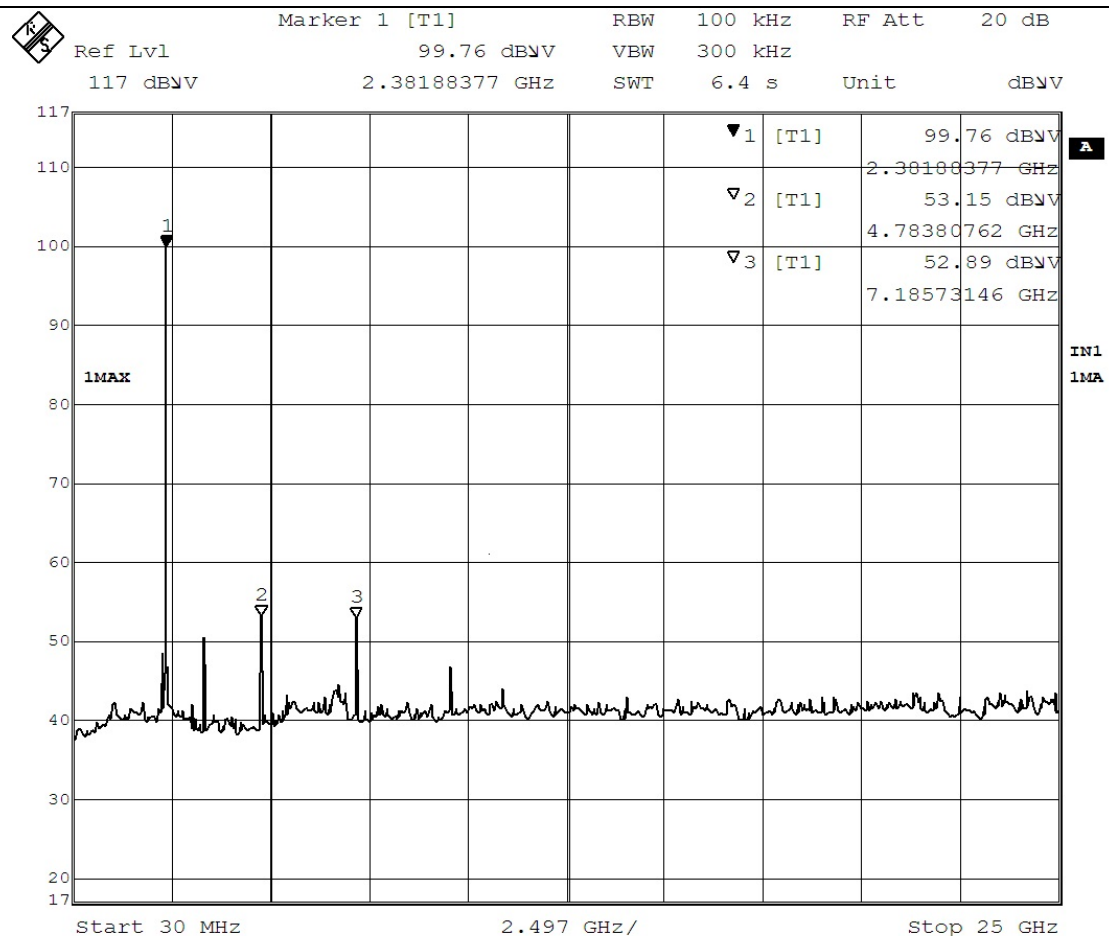
Out of Band emissions of RF Conducted Emissions Measurement:

Limit :

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

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

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



Date: 21.JUN.2016 02:17:05

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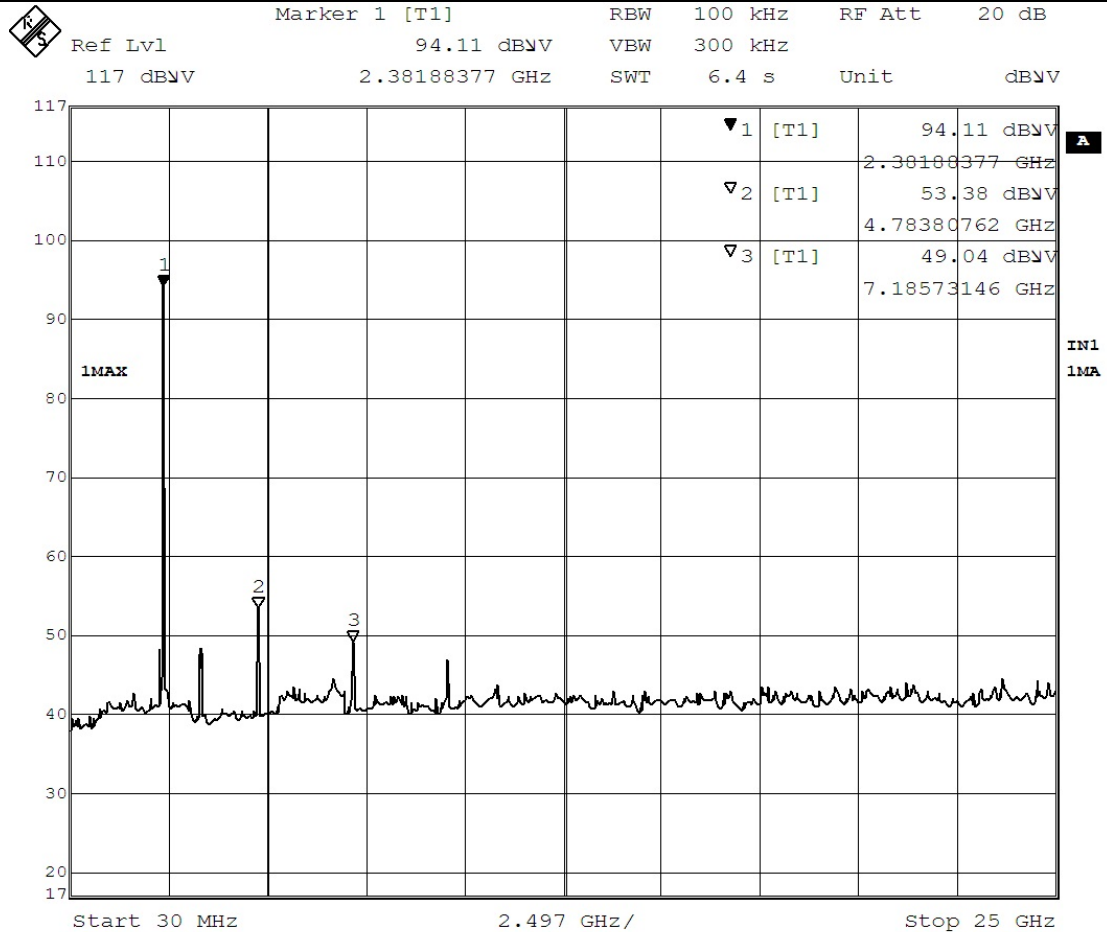
Test Report

Date: 2017-07-07

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



Date: 21.JUN.2016 02:15:50

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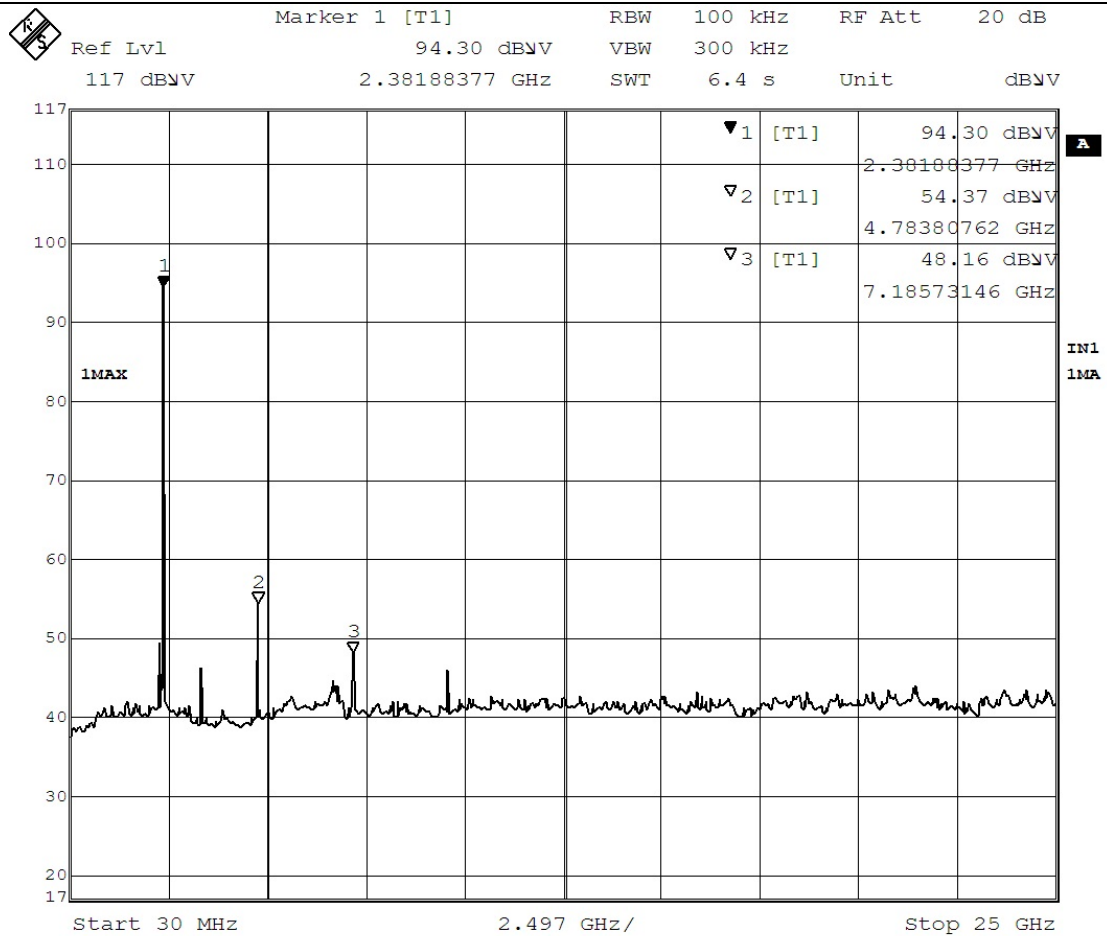
Test Report

Date: 2017-07-07

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No.: DM123869

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



Date: 21.JUN.2016 02:17:53

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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.

Spectrum Analyzer Setting:

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

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

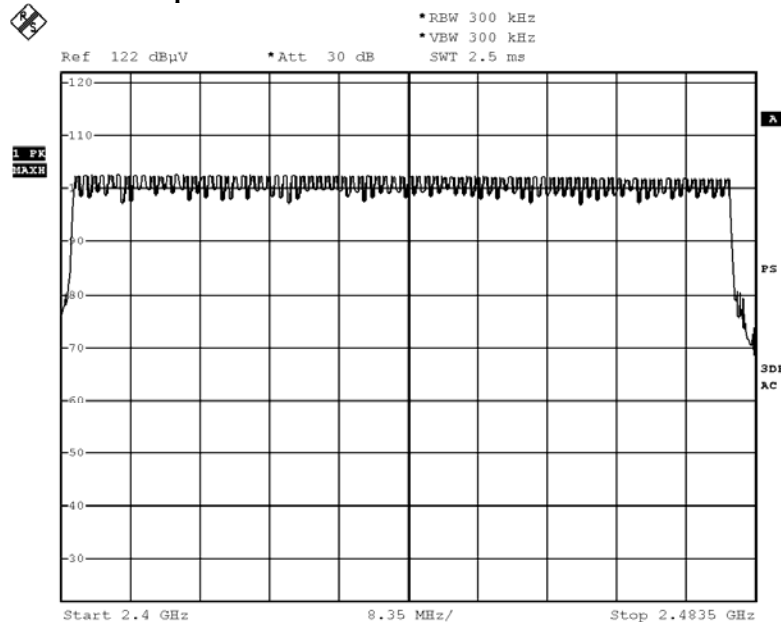
Span = Zero, Detector = Peak, Trace = Max. hold

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

Observed duration: 0.4s x 79 = 31.6s

Measurement Data:

Channel Occupied in 8DPSK: 79 of 79 Channel



BMP

Date: 20.JUN.2016 15:10:35

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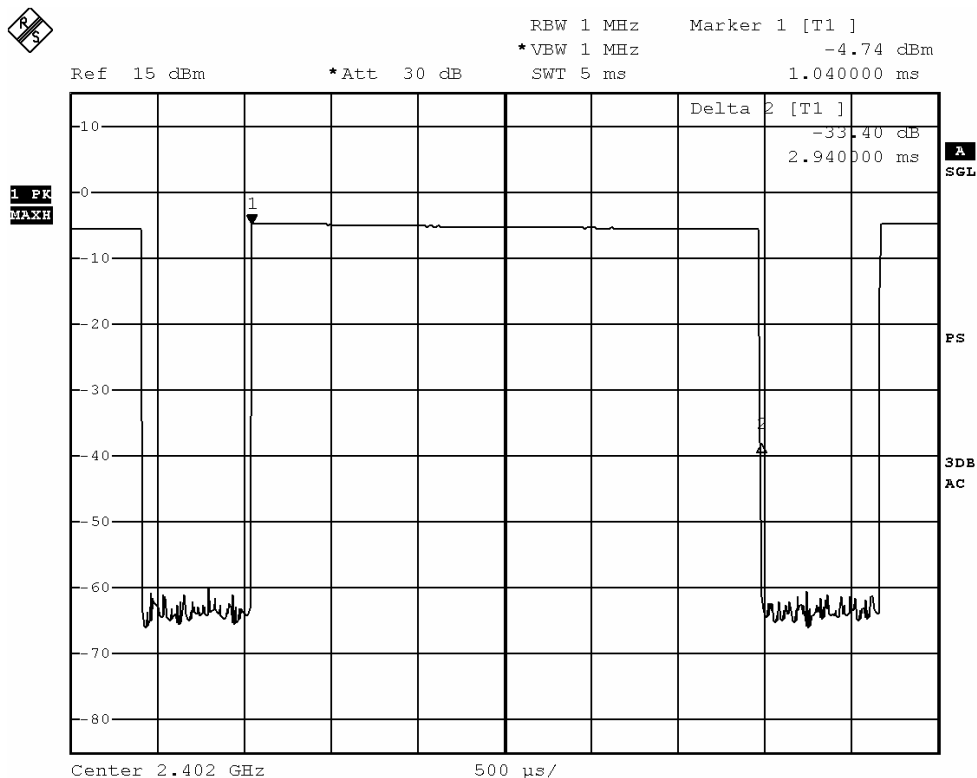
No.: DM123869

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DH5 Packet:

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

Fig. A
[Pulse duration of Lowest Channel]



BMP

Date: 20.JUN.2016 12:43:37

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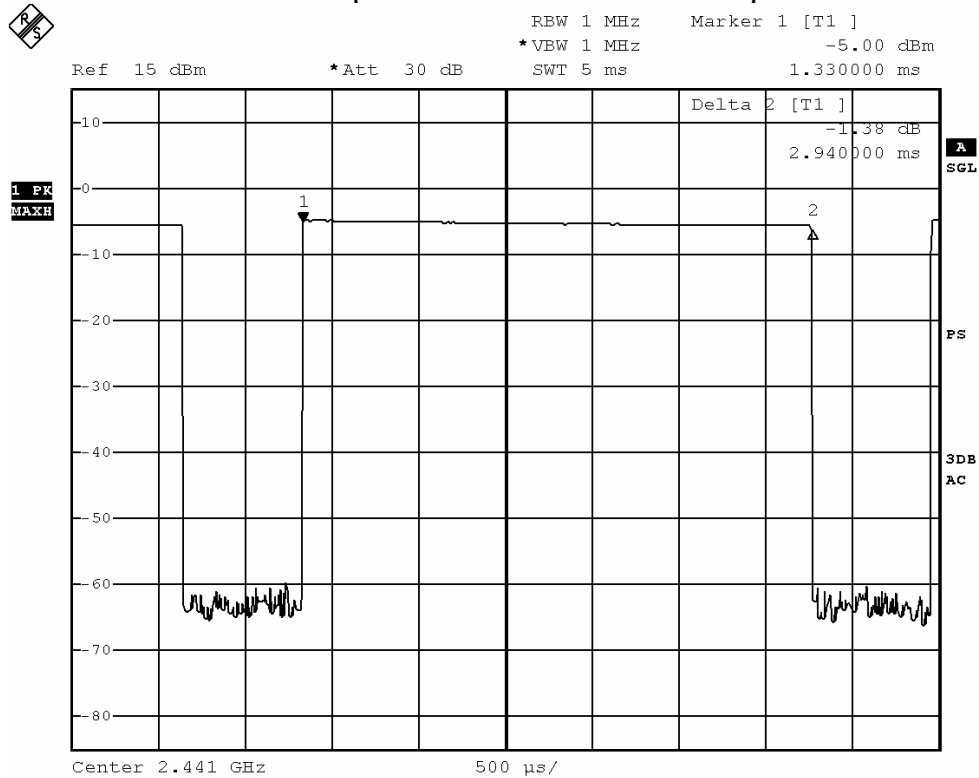
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Fig. B
[Pulse duration of Middle Channel]



BMP

Date: 20.JUN.2016 12:43:11

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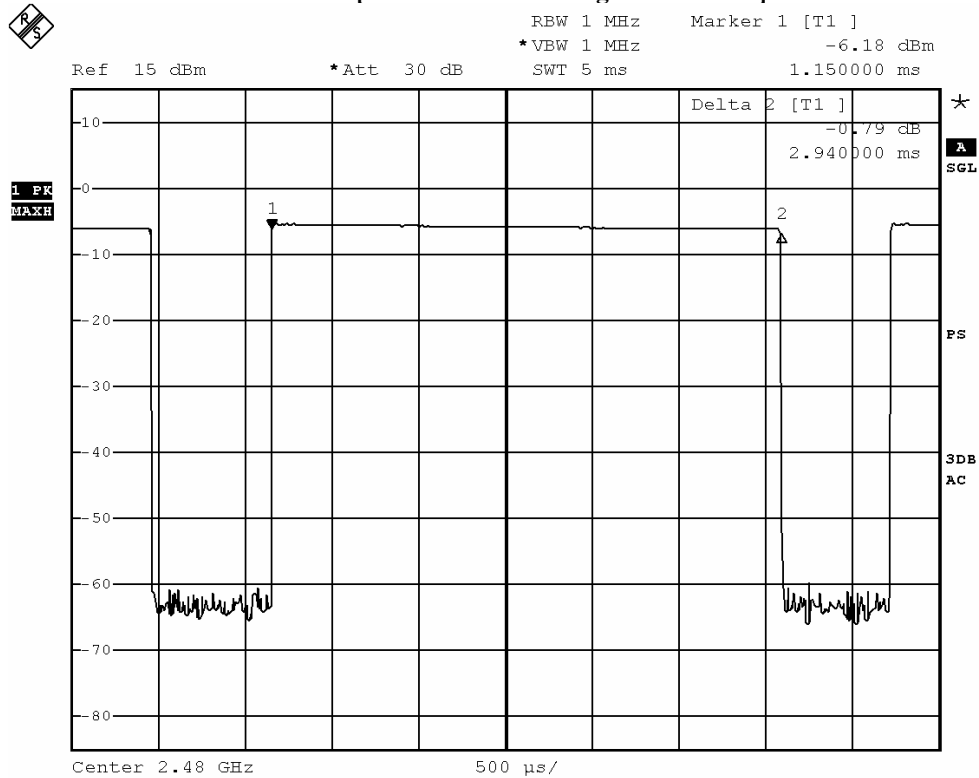
Test Report

Date: 2017-07-07

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Fig. C
[Pulse duration of Highest Channel]



BMP

Date: 20.JUN.2016 12:42:37

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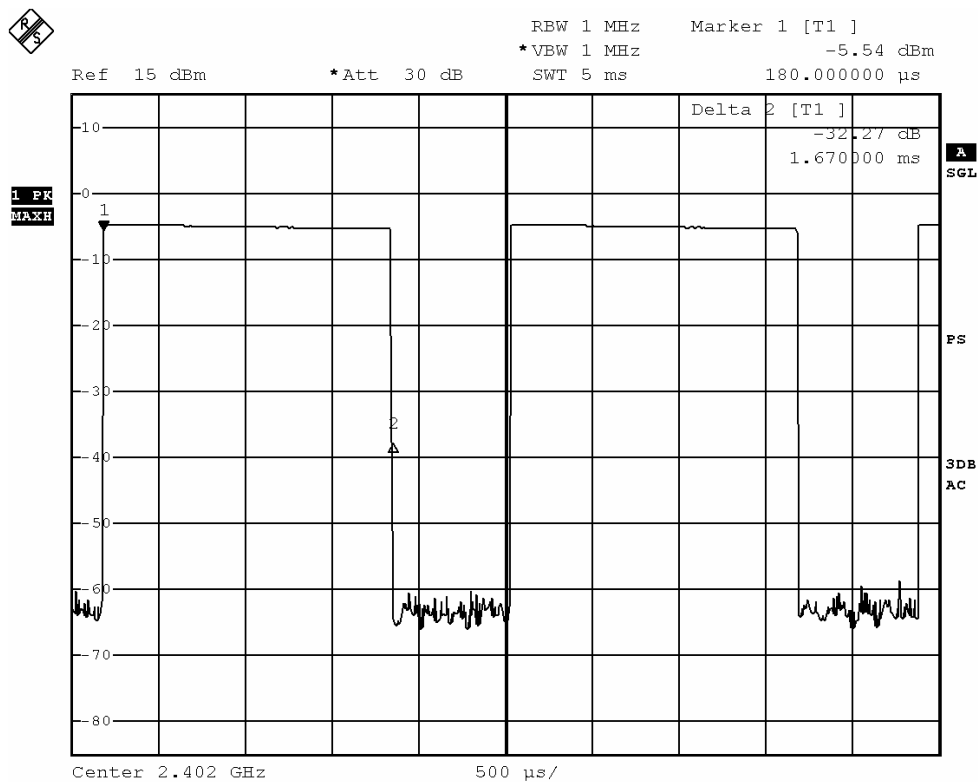
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DH3 Packet:

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

Fig. D
[Pulse duration of Lowest Channel]



BMP

Date: 20.JUN.2016 12:44:02

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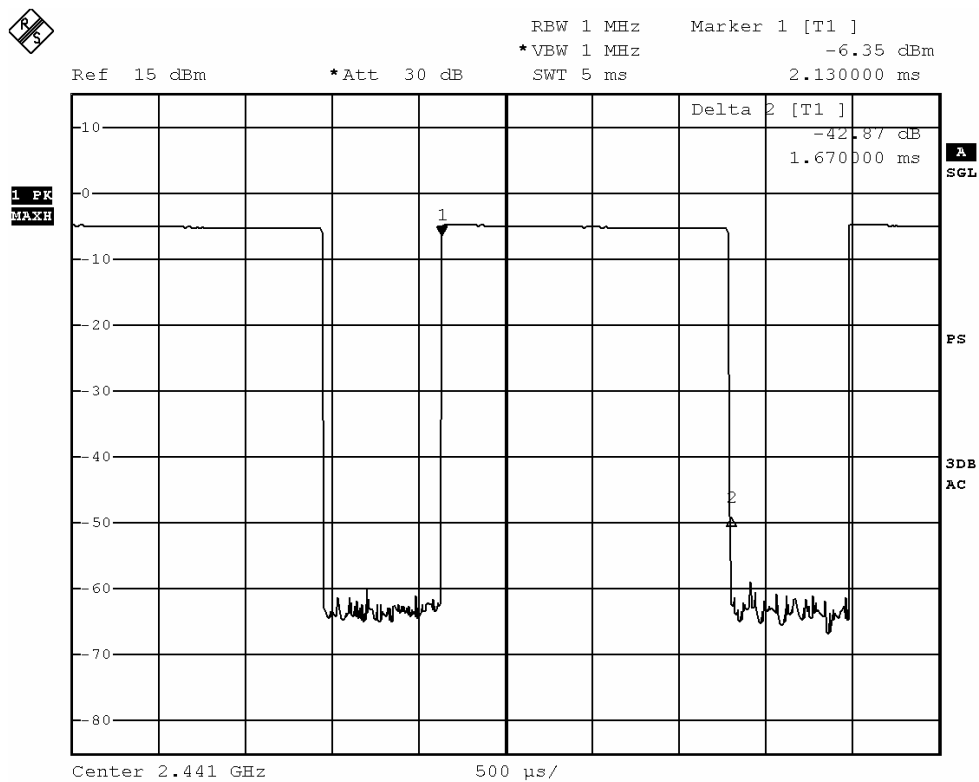
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Fig. E
[Pulse duration of Middle Channel]



BMP

Date: 20.JUN.2016 12:44:42

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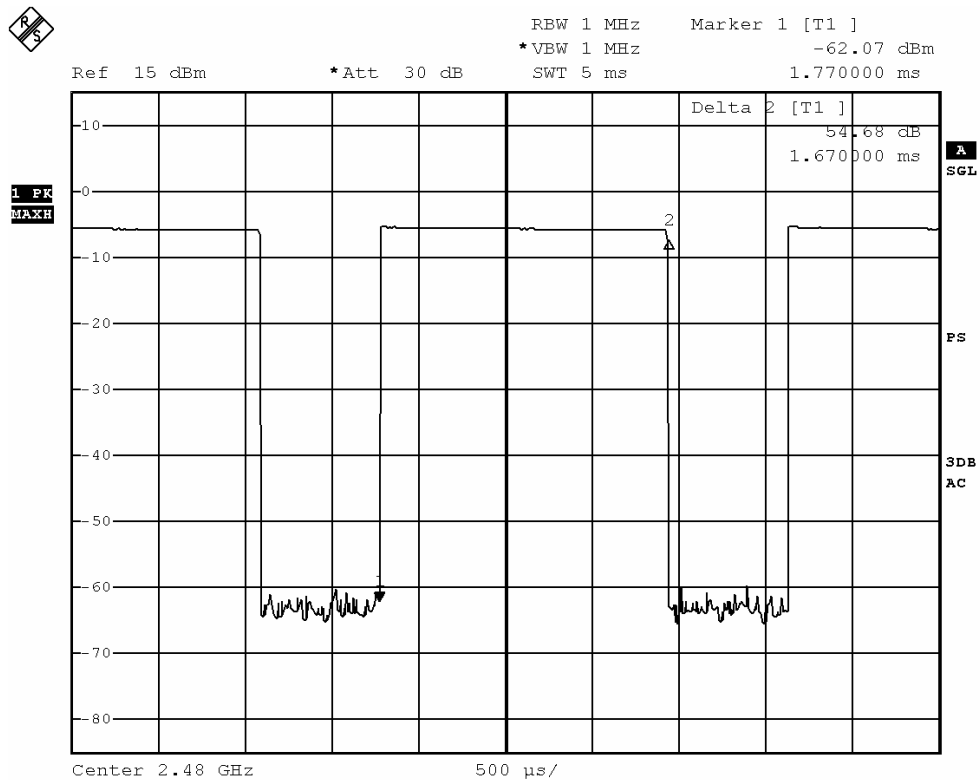
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Fig. F
[Pulse duration of Highest Channel]



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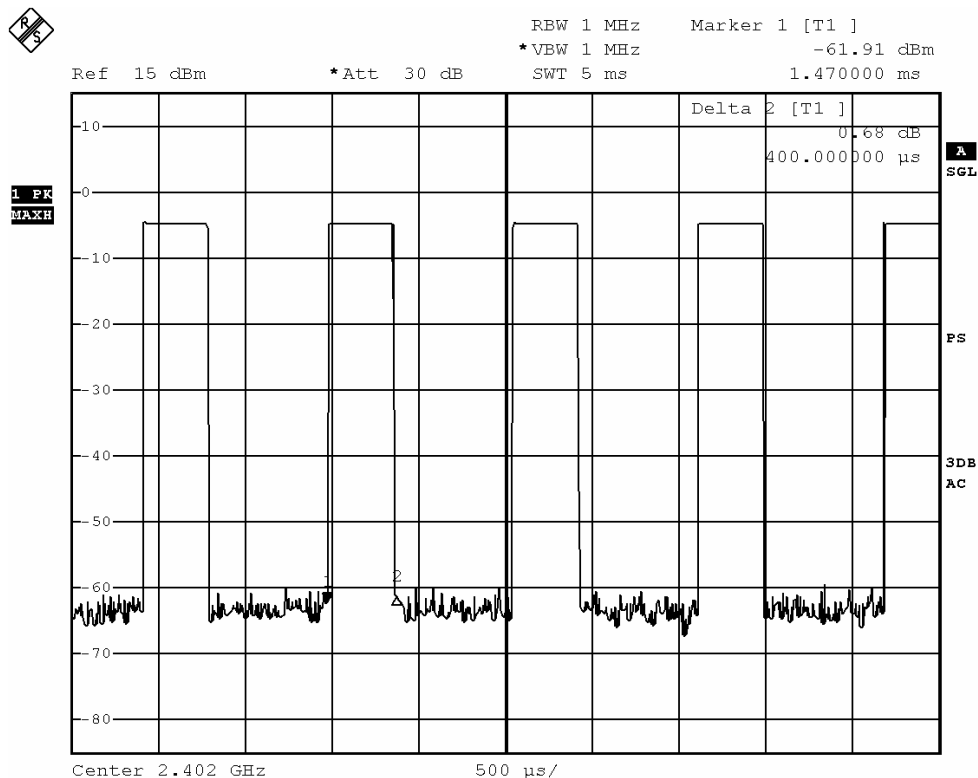
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DH1 Packet:

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

Fig. G
[Pulse duration of Lowest Channel]



BMP

Date: 20.JUN.2016 12:46:53

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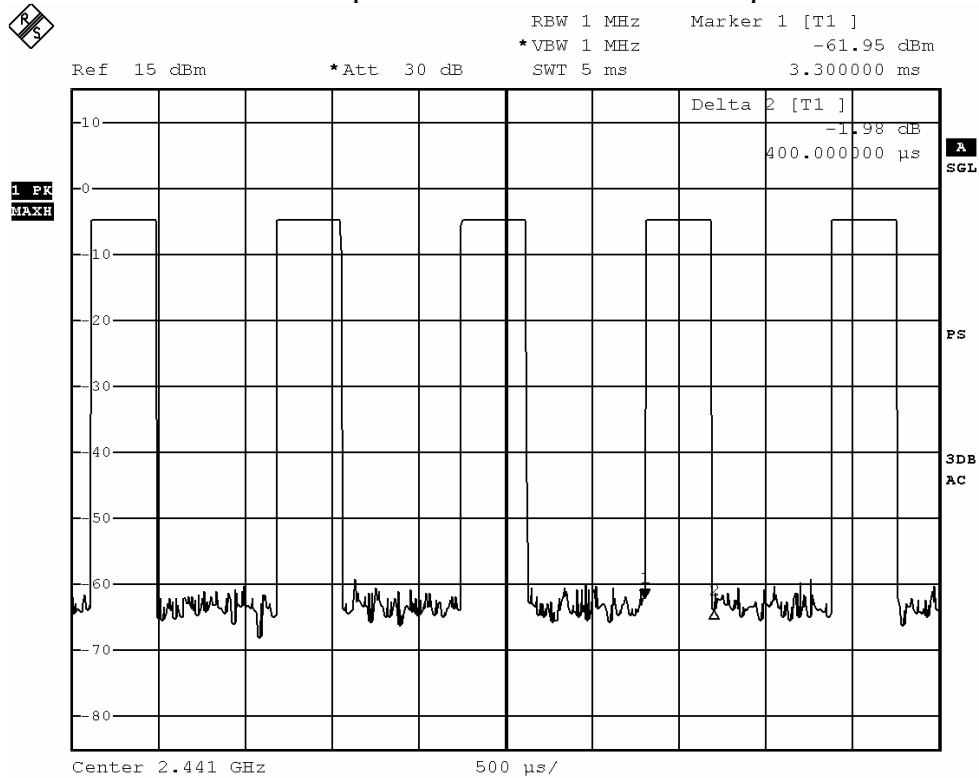
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Fig. H
[Pulse duration of Middle Channel]



BMP

Date: 20.JUN.2016 12:46:15

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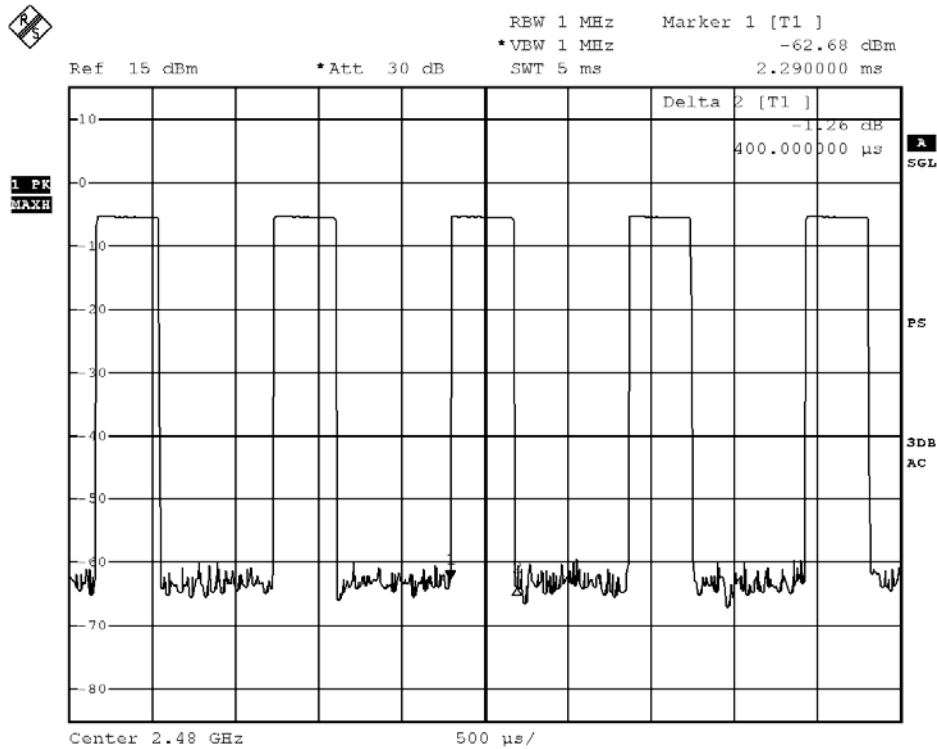
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Fig. I
[Pulse duration of Highest Channel]



BMP

Date: 20.JUN.2016 12:45:46

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	1.670	0.267	0.400	Complies
DH3	2441	1.670	0.267	0.400	Complies
DH3	2480	1.670	0.267	0.400	Complies
DH1	2402	0.400	0.128	0.400	Complies
DH1	2441	0.400	0.128	0.400	Complies
DH1	2480	0.400	0.128	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 Inverted F antenna. There is no external antenna, the antenna gain = -0.68dBi. User is unable to remove or changed the Antenna.

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Appendix A

List of Measurement Equipment

Radiated Emission

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EM299	Double-Ridged Waveguide Horn Antenna	ETS-Lindgren	3115	00114120	2016/04/27	2018/04/27
EM300	Pyramidal Standard Gain Horn Antenna	ETS-Lindgren	3160-09	00130130	2016/05/13	2018/05/13
EM301	Pyramidal Standard Gain Horn Antenna	ETS-Lindgren	3160-10	00130988	2016/05/13	2018/05/13
EM215	MULTIDEVICE CONTROLLER	EMCO	2090	00024676	N/A	N/A
EM216	MINI MAST SYSTEM	EMCO	2075	00026842	N/A	N/A
EM217	ELECTRIC POWERED TURNTABLE	EMCO	2088	00029144	N/A	N/A
EM218	ANCHOIC CHAMBER	ETS-LINDGREN	FACT-3	--	2017/04/20	2018/04/20
EM355	Biconilog Antenna	ETS-Lindgren	3143B	00094856	2016/03/03	2018/03/03
EM353	LOOP ANTENNA	ETS LINDGREN	6502	00206533	2016/03/16	2018/03/16
EM293	Spectrum Analyzer	Agilent Technologies	N9020A	MY50510152	2016/08/22	2017/08/22

Line Conducted

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EM119	LISN	R & S	ESH3-Z5	0831.5518.52	2016/11/29	2017/11/29
EM145	EMI TEST RECEIVER	R & S	ESCS 30	830245/021	2017/06/01	2018/06/01
EM179	IMPULSE LIMITER	ROHDE & SCHWARZ	ESH3-Z2	357-8810.52/54	2017/01/11	2018/01/11
EM154	SHIELDING ROOM	SIEMENS MATSUSHITA COMPONENTS	N/A	803-740-057-99A	2017/02/02	2022/02/02

Remarks:-

CM Corrective Maintenance

N/A Not Applicable

TBD To Be Determined

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Appendix B

Photographs of EUT

Front View of the product



Rear View of the product



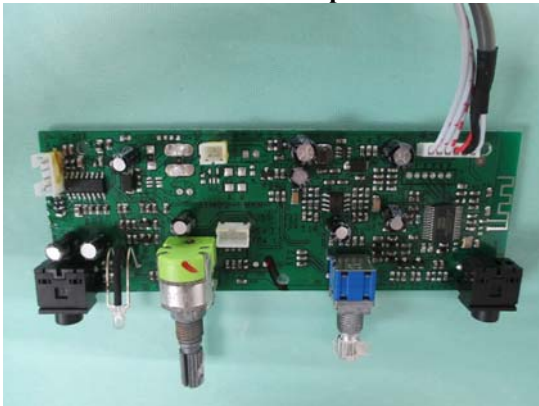
Inside View of the product



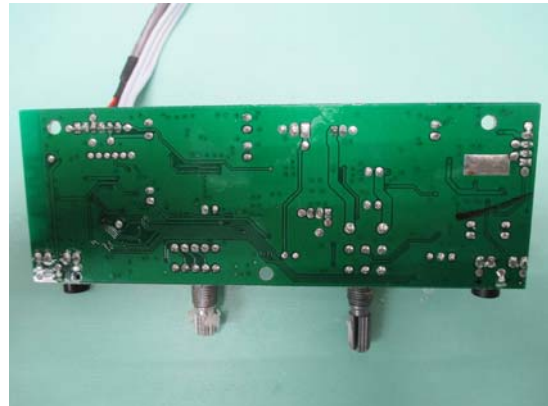
Inside View of the product



Inner Circuit Top View



Inner Circuit Bottom View



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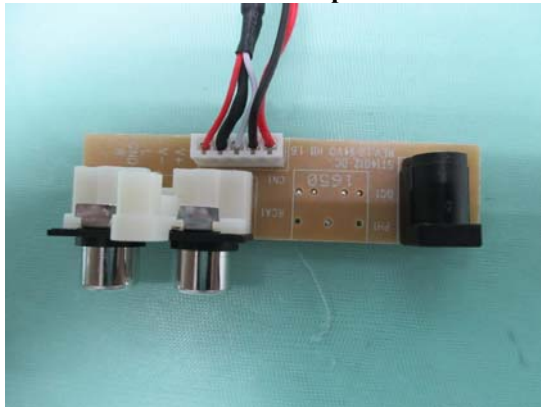
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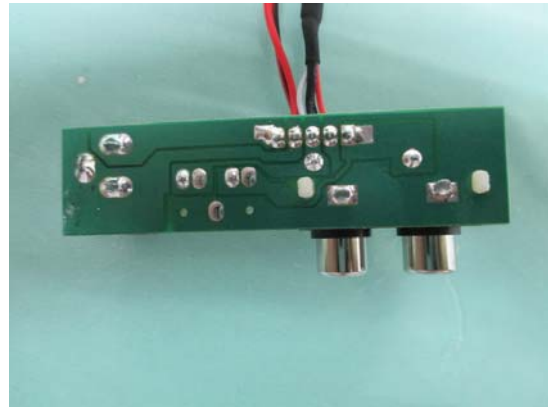
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Photographs of EUT

Inner Circuit Top View



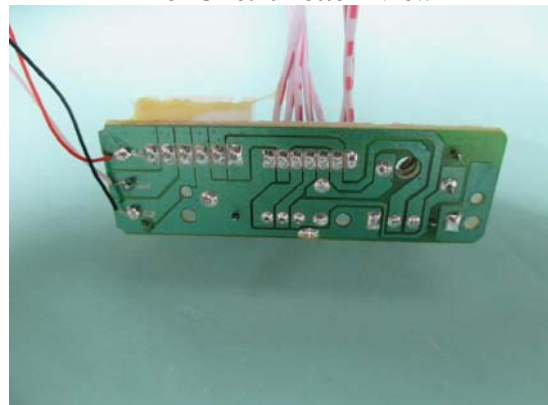
Inner Circuit Bottom View



Inner Circuit Top View



Inner Circuit Bottom View



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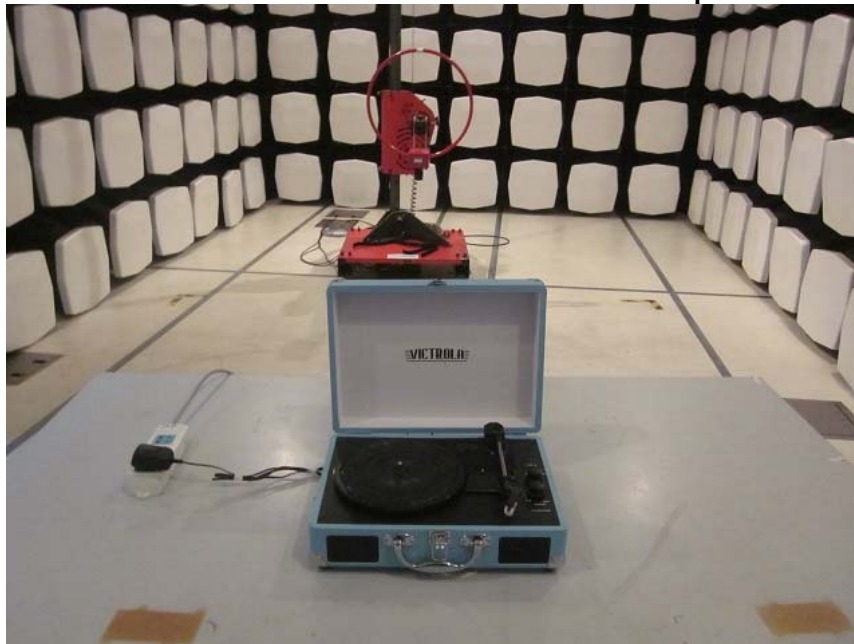
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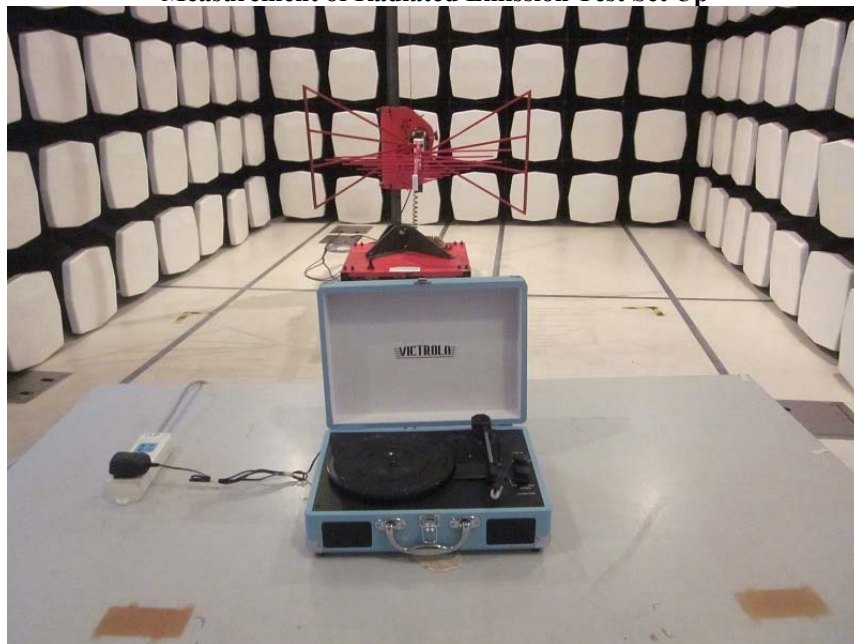
No.: DM123869

Photographs of EUT

Measurement of Radiated Emission Test Set Up



Measurement of Radiated Emission Test Set Up



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Measurement of Radiated Emission Test Set Up



Measurement of Conducted Emission Test Set Up



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

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