Test Report

Date : 2018-03-02
No. : HM18010010

Applicant:	Huizhou Qing Teng Electron Technology Co., Ltd He-Bei Village, Lilin Town, Zhongkai Hi-tech Development Zone, Huizhou City, Guangdong, China
Manufacturer:	Huizhou Qing Teng Electron Technology Co., Ltd He-Bei Village, Lilin Town, Zhongkai Hi-tech Development Zone, Huizhou City, Guangdong, China
Description of Sample(s):	Product: Bluetooth Speaker Brand Name: Sakar Model Number: SP2-17714 FCC ID: 2AAWNSP217714BTS
Date Sample(s) Received:	2018-01-03
Date Tested:	2018-02-07 to 2018-02-14
Investigation Requested:	Perform ElectroMagnetic Interference measurement in accordance with FCC 47 CFR [Codes of Federal Regulations] Part 15: 2017 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)

CHEUNG Chi, Kenneth
Authorized Signatory
ElectroMagnetic Compatibility Department
For and on behalf of
The Hong Kong Standards and Testing Centre Ltd.

Test Report

CONTENT:

1.0 General Details

1.1 Test Laboratory

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

Telephone: (852) 26661888
Fax: (852) 26644353

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

Product:	Bluetooth Speaker
Manufacturer:	Huizhou Qing Teng Electron Technology Co., Ltd He-Bei Village, Lilin Town, Zhongkai Hi-tech Development Zone, Huizhou City, Guangdong, China
Brand Name:	Sakar
Model Number:	SP2-17714
Additional Model Number:	SP2-17717, SP2-17718
Rating:	Input: Li-ion Rechargeable battery x1: 3.7Vd.c / 110Va.c, 5Vd.c (USB Micro B), (Adaptor was not provided by manufacturer, universal adaptor was used for tests. Adaptor info: Model no., SP-12-UK, Input: 100-240Va.c, Output: 5V, 14.4VA)

1.2.1 Description of EUT Operation

The Equipment Under Test (EUT) is Bluetooth Speaker. The transmission signal is digital modulated with channel frequency range 2402-2480MHz. The R.F. signal was modulated by IC; the type of modulation used was frequency hopping spread spectrum Modulation.

1.3 Date of Order

2018-01-03

1.4 Submitted Sample(s):

2 Samples

1.5 Test Duration

2018-02-07 to 2018-02-14

1.6 Country of Origin

China

1.7 Antenna Details

Antenna Type (Bluetooth): Circuit board printed meander line antenna
Antenna Gain (Bluetooth): -0.58dBi

1.8 Channel List

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	42	2444
1	2403	43	2445
2	2404	44	2446
3	2405	45	2447
4	2406	46	2448
5	2407	47	2449
6	2408	48	2450
7	2409	…	…
8	2410	67	2469
9	2411	68	2470
…	…	69	2471
33	2435	70	2472
34	2436	71	2473
35	2437	72	2474
36	2438	73	2475
37	2439	74	2476
38	2440	75	2477
39	2441	76	2478
40	2442	77	2479
41	2443	78	2480

2.0 Technical Details

2.1 Investigations Requested

Perform Electromagnetic Interference measurements in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2017 Regulations. ANSI C63.10:2013 for FCC Certification.

2.2 Test Standards and Results Summary Tables

EMISSION (BLUETOOTH)
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

2.3 Table for Test Modes

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

Test Items

Maximum Peak Conducted Output Power	GFSK / π/4-DQPSK
Hopping Channel Separation	GFSK / π/4-DQPSK
Number of Hopping Frequency	GFSK / π/4-DQPSK
Time of Occupancy(Dwell Time)	π/4-DQPSK (DH1 / DH3 / DH5)
Radiated Spurious Emissions	GFSK / π/4-DQPSK

3.0 Test Results

3.1 Emission

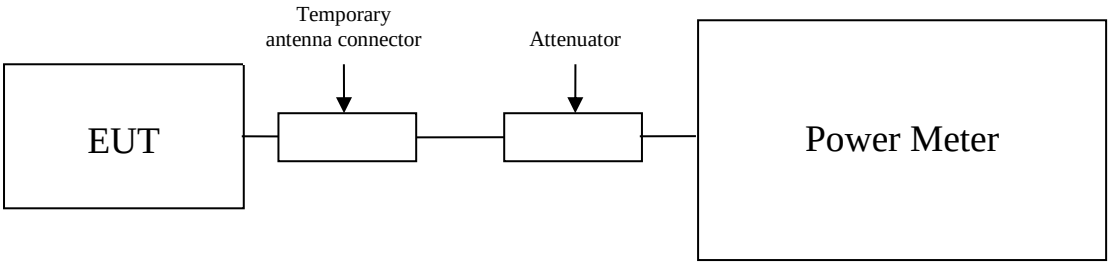
3.1.1 Maximum Peak Conducted Output Power

Test Requirement:	FCC 47CFR 15.247(b)(2)
Test Method:	ANSI C63.10:2013
Test Date:	2018-02-14
Mode of Operation:	Tx mode :GFSK/π/4-DQPSK

Test Method:

The RF output of the EUT was connected to the Power Meter. All the attenuation or cable loss will be added to the measured maximum output power. The results are recorded in dBm.

Test Setup:



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

2400–2483.5 MHz band:
The maximum peak output power shall not exceeded the following limits:
For frequency hopping systems employing at least 75 hopping channels: 1 Watt
For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 Watts
For Digital Transmission systems in 2400-2483.5 MHz Band: 1 Watt

Results of Bluetooth Communication mode (GFSK) (Fundamental Power): Pass
Maximum conducted output power

Channel	Frequency(MHz)	Output Power(Watt)
0	2402	0.000208
39	2441	0.000147
78	2480	0.000164

Results of Bluetooth Communication mode (π/4-DQPSK) (Fundamental Power): Pass
Maximum conducted output power

Channel	Frequency(MHz)	Output Power(Watt)
0	2402	0.000138
39	2441	0.000098
78	2480	0.000105

:

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.

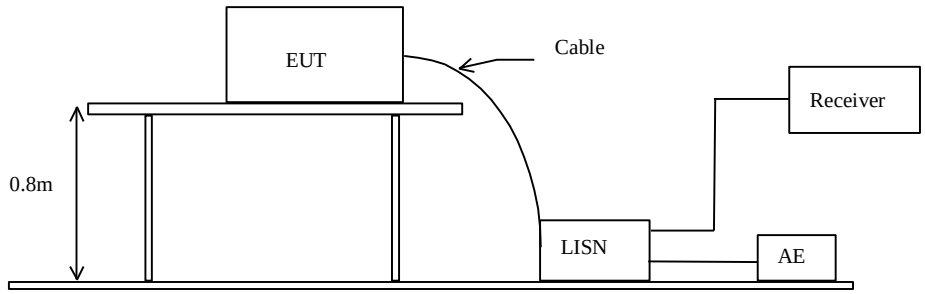
3.1.2 Conducted Emissions (0.15MHz to 30MHz)

Test Requirement:	FCC 47CFR 15.207
Test Method:	ANSI C63.10:2013
Test Date:	2018-02-07
Mode of Operation:	Tx mode

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:



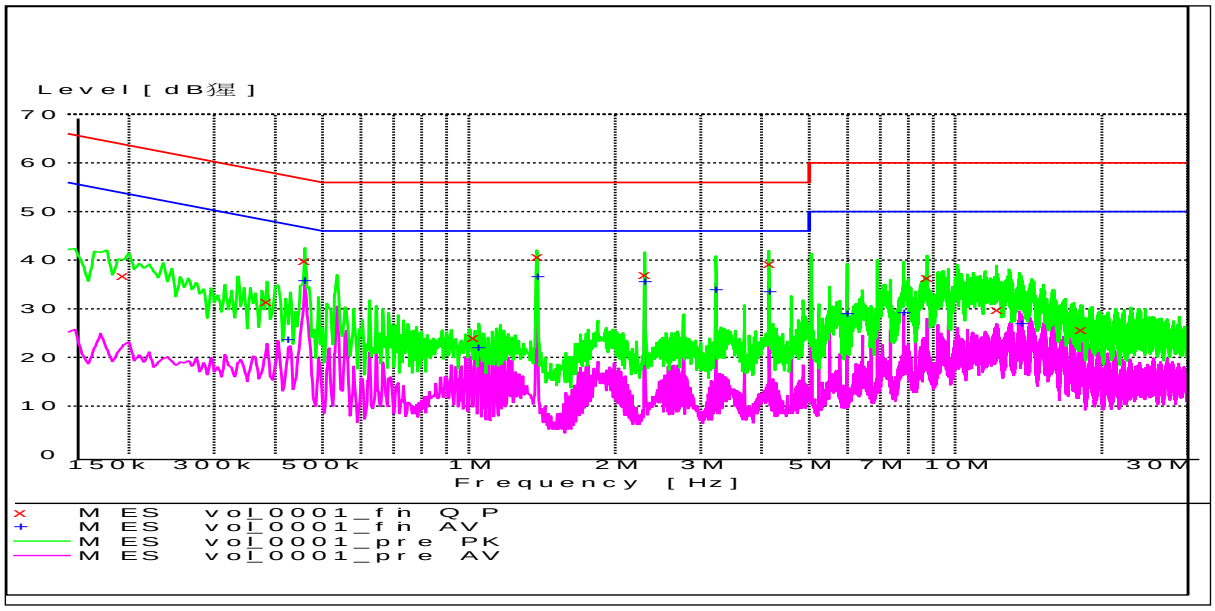
Limit for Conducted Emissions (FCC 47CFR 15.207):

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.

Results of Tx mode – Live: PASS



MEASUREMENT RESULT: "vol_0001_fin QP"

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.195000	36.80	9.9	64	27.0	L1	GND
0.385000	31.50	10.0	58	26.7	L1	GND
0.460000	39.90	10.0	57	16.8	L1	GND
1.025000	24.10	9.8	56	31.9	L1	GND
1.385000	40.80	9.9	56	15.2	L1	GND
2.305000	37.00	10.2	56	19.0	L1	GND
4.155000	39.30	10.5	56	16.7	L1	GND
8.770000	36.30	10.4	60	23.7	L1	GND
12.215000	29.80	10.6	60	30.2	L1	GND
18.200000	25.70	10.7	60	34.3	L1	GND

MEASUREMENT RESULT: "vol_0001_fin AV"

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.425000	23.50	10.0	47	23.8	L1	GND
0.460000	35.70	10.0	47	11.0	L1	GND
1.050000	21.90	9.8	46	24.1	L1	GND
1.385000	36.60	9.9	46	9.4	L1	GND
2.310000	35.50	10.2	46	10.5	L1	GND
3.230000	34.00	10.4	46	12.0	L1	GND
4.155000	33.50	10.5	46	12.5	L1	GND
6.000000	29.00	10.6	50	21.0	L1	GND
7.850000	29.10	10.5	50	20.9	L1	GND
13.695000	26.80	10.7	50	23.2	L1	GND

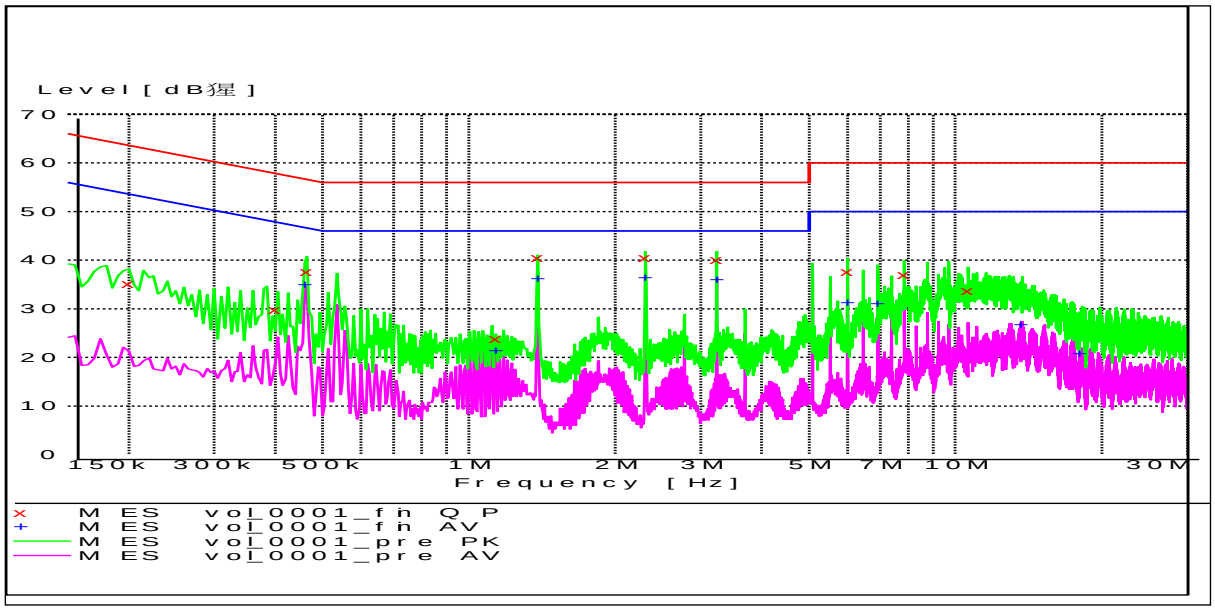
Limit for Conducted Emissions (FCC 47CFR 15.207):

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.

Results of Tx mode –Neutral: PASS



MEASUREMENT RESULT: "vol_0001_fin QP"

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.200000	35.20	9.9	64	28.4	N	GND
0.400000	29.70	10.0	58	28.2	N	GND
0.465000	37.60	10.0	57	19.0	N	GND
1.135000	23.80	9.8	56	32.2	N	GND
1.385000	40.50	9.9	56	15.5	N	GND
2.310000	40.60	10.2	56	15.4	N	GND
3.235000	40.10	10.4	56	15.9	N	GND
6.005000	37.60	10.6	60	22.4	N	GND
7.855000	37.00	10.5	60	23.0	N	GND
10.625000	33.70	10.4	60	26.3	N	GND

MEASUREMENT RESULT: "vol_0001_fin AV"

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.460000	35.00	10.0	47	11.7	N	GND
1.135000	21.30	9.8	46	24.7	N	GND
1.385000	36.10	9.9	46	9.9	N	GND
2.310000	36.40	10.2	46	9.6	N	GND
3.235000	36.00	10.4	46	10.0	N	GND
6.005000	31.20	10.6	50	18.8	N	GND
6.930000	31.10	10.6	50	18.9	N	GND
13.630000	26.70	10.7	50	23.3	N	GND
18.040000	20.80	10.7	50	29.2	N	GND

3.1.3 Radiated Spurious Emissions

Test Requirement:	FCC 47CFR 15.209
Test Method:	ANSI C63.10:2013
Test Date:	2018-02-14
Mode of Operation:	Tx mode :GFSK/π/4-DQPSK

Test Method:

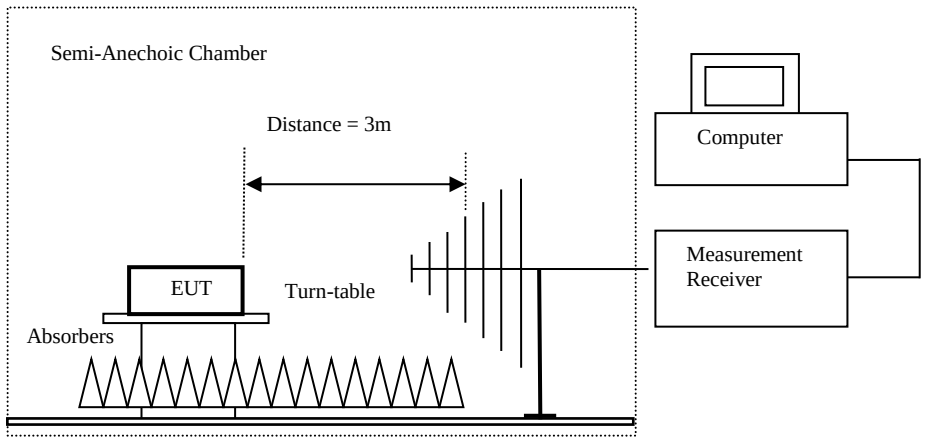
For emission measurements at or below 1 GHz, the sample was placed 0.8m above the ground plane of semi-anechoic Chamber*. For emission measurements above 1 GHz, the sample was placed 1.5m above the ground plane of semi-anechoic Chamber*. Measurements in both horizontal and vertical polarities were performed. 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 Designation Number: HK0001.

Spectrum Analyzer Setting:

9KHz – 30MHz (Pk & Av)	RBW:	10kHz
	VBW:	30kHz
	Sweep:	Auto
	Span:	Fully capture the emissions being measured
	Trace:	Max. hold
30MHz – 1GHz (QP)	RBW:	120kHz
	VBW:	120kHz
	Sweep:	Auto
	Span:	Fully capture the emissions being measured
	Trace:	Max. hold
Above 1GHz (Pk & Av)	RBW:	1MHz
	VBW:	3MHz
	Sweep:	Auto
	Span:	Fully capture the emissions being measured
	Trace:	Max. hold

Test Setup:



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

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 (GFSK: 2402.0 MHz) (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 (GFSK: 2402.0 MHz) (30MHz – 1GHz): Pass

Field Strength of Spurious Emissions Quasi-Peak Value						
Frequency MHz	Measured Level dBuV	Correction Factor dB/m	Field Strength dBuV/m	Field Strength uV/m	Limit uV/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

Result of Tx mode (GFSK: 2402.0 MHz) (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
2402.0	59.7	27.8	87.5	N/A	N/A	Vertical
4804.0	3.1	42.4	45.5	74.0	28.5	Vertical
7206.0	2.3	46.7	49.0	74.0	25.0	Vertical
9608.0	1.8	48.4	50.2	74.0	23.8	Vertical
12010.0	0.5	53.1	53.6	74.0	20.4	Vertical

Result of Tx mode (GFSK: 2402.0 MHz) (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
2402.0	48.7	27.8	76.5	N/A	N/A	Vertical
4804.0	-7.3	42.4	35.1	54.0	18.9	Vertical
7206.0	-10.7	46.7	36.0	54.0	18.0	Vertical
9608.0	-11.3	48.4	37.1	54.0	16.9	Vertical
12010.0	-11.9	53.1	41.2	54.0	12.8	Vertical

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

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level dBuV	Correction Factor dB/m	Field Strength dBuV/m	Field Strength uV/m	Limit uV/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

Results of Tx mode (GFSK: 2441.0 MHz) (30MHz – 1000MHz): PASS

Field Strength of Spurious Emissions Quasi-Peak Value						
Frequency MHz	Measured Level dBuV	Correction Factor dB/m	Field Strength dBuV/m	Field Strength uV/m	Limit uV/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

Result of Tx mode (GFSK: 2441.0 MHz) (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
2441.0	58.1	27.8	85.9	N/A	N/A	Vertical
4882.0	2.6	42.5	45.1	74.0	28.9	Vertical
7323.0	1.5	47.1	48.6	74.0	25.4	Vertical
9764.0	1.4	49.3	50.7	74.0	23.3	Vertical
12205.0	0.9	53.1	54.0	74.0	20.0	Vertical

Result of Tx mode (GFSK: 2441.0 MHz) (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
2441.0	46.3	27.8	74.1	N/A	N/A	Vertical
4882.0	-8.3	42.5	34.2	54.0	19.8	Vertical
7323.0	-9.1	47.1	38.0	54.0	16.0	Vertical
9764.0	-11.4	49.3	37.9	54.0	16.1	Vertical
12205.0	-12.0	53.1	41.1	54.0	12.9	Vertical

Result of Tx mode (GFSK: 2480.0 MHz) (9kHz – 30MHz): Pass

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level dBuV	Correction Factor dB/m	Field Strength dBuV/m	Field Strength uV/m	Limit uV/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

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

Field Strength of Spurious Emissions Quasi-Peak Value						
Frequency MHz	Measured Level dBuV	Correction Factor dB/m	Field Strength dBuV/m	Field Strength uV/m	Limit uV/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

Result of Tx mode (GFSK: 2480.0 MHz) (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
2480.0	58.4	27.8	86.2	N/A	N/A	Vertical
4960.0	2.3	43.2	45.5	74.0	28.5	Vertical
7440.0	1.3	46.2	47.5	74.0	26.5	Vertical
9920.0	1.1	50.9	52.0	74.0	22.0	Vertical
12400.0	0.9	54.3	55.2	74.0	18.8	Vertical

Result of Tx mode (GFSK: 2480.0 MHz) (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
2480.0	45.3	27.8	73.1	N/A	N/A	Vertical
4960.0	-9.3	43.2	33.9	54.0	20.1	Vertical
7440.0	-11.7	46.2	34.5	54.0	19.5	Vertical
9920.0	-11.8	50.9	39.1	54.0	14.9	Vertical
12400.0	-12.5	54.3	41.8	54.0	12.2	Vertical

Result of Tx mode (π/4-DQPSK: 2402.0 MHz) (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 (π/4-DQPSK: 2402.0 MHz) (30MHz – 1GHz): Pass

Field Strength of Spurious Emissions Quasi-Peak Value						
Frequency MHz	Measured Level dBuV	Correction Factor dB/m	Field Strength dBuV/m	Field Strength uV/m	Limit uV/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

Result of Tx mode (π/4-DQPSK: 2402.0 MHz) (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
2402.0	57.4	27.8	85.2	N/A	N/A	Vertical
4804.0	2.1	42.4	44.5	74.0	29.5	Vertical
7206.0	1.4	46.7	48.1	74.0	25.9	Vertical
9608.0	1.6	48.4	50.0	74.0	24.0	Vertical
12010.0	0.6	53.1	53.7	74.0	20.3	Vertical

Result of Tx mode (π/4-DQPSK: 2402.0 MHz) (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
2402.0	43.7	27.8	71.5	N/A	N/A	Vertical
4804.0	-8.9	42.4	33.5	54.0	20.5	Vertical
7206.0	-10.4	46.7	36.3	54.0	17.7	Vertical
9608.0	-11.3	48.4	37.1	54.0	16.9	Vertical
12010.0	-12.1	53.1	41.0	54.0	13.0	Vertical

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

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level dBuV	Correction Factor dB/m	Field Strength dBuV/m	Field Strength uV/m	Limit uV/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

Results of Tx mode (π/4-DQPSK: 2441.0 MHz) (30MHz – 1000MHz): Pass

Field Strength of Spurious Emissions Quasi-Peak Value						
Frequency MHz	Measured Level dBuV	Correction Factor dB/m	Field Strength dBuV/m	Field Strength uV/m	Limit uV/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

Result of Tx mode (π/4-DQPSK: 2441.0 MHz) (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
2441.0	57.1	27.8	84.9	N/A	N/A	Vertical
4882.0	2.2	42.5	44.7	74.0	29.3	Vertical
7323.0	1.7	47.1	48.8	74.0	25.2	Vertical
9764.0	0.9	49.3	50.2	74.0	23.8	Vertical
12205.0	0.8	53.1	53.9	74.0	20.1	Vertical

Result of Tx mode (π/4-DQPSK: 2441.0 MHz) (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
2441.0	42.1	27.8	69.9	N/A	N/A	Vertical
4882.0	-8.5	42.5	34.0	54.0	20.0	Vertical
7323.0	-10.3	47.1	36.8	54.0	17.2	Vertical
9764.0	-11.3	49.3	38.0	54.0	16.0	Vertical
12205.0	-12.2	53.1	40.9	54.0	13.1	Vertical

Result of Tx mode (π/4-DQPSK: 2480.0 MHz) (9kHz – 30MHz): Pass

Field Strength of Spurious Emissions Peak Value						
Frequency MHz	Measured Level dBuV	Correction Factor dB/m	Field Strength dBuV/m	Field Strength uV/m	Limit uV/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

Results of Tx mode (π/4-DQPSK: 2480.0 MHz) (30MHz – 1000MHz): Pass

Field Strength of Spurious Emissions Quasi-Peak Value						
Frequency MHz	Measured Level dBuV	Correction Factor dB/m	Field Strength dBuV/m	Field Strength uV/m	Limit uV/m	E-Field Polarity
Emissions detected are more than 20 dB below the FCC Limits						

Result of Tx mode (π/4-DQPSK: 2480.0 MHz) (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
2480.0	58.4	27.8	86.2	N/A	N/A	Vertical
4960.0	3.4	43.2	46.6	74.0	27.4	Vertical
7440.0	2.1	46.2	48.3	74.0	25.7	Vertical
9920.0	1.3	50.9	52.2	74.0	21.8	Vertical
12400.0	0.8	54.3	55.1	74.0	18.9	Vertical

Result of Tx mode (π/4-DQPSK: 2480.0 MHz) (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
2480.0	43.2	27.8	71.0	54.0	-17.0	Vertical
4960.0	-8.7	43.2	34.5	54.0	19.5	Vertical
7440.0	-10.8	46.2	35.4	54.0	18.6	Vertical
9920.0	-11.9	50.9	39.0	54.0	15.0	Vertical
12400.0	-12.1	54.3	42.2	54.0	11.8	Vertical

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

Frequency Range [MHz]	Quasi-Peak Limits [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, (30MHz – 1GHz): PASS

Field Strength of Fundamental and Harmonics Emissions Quasi-Peak Value						
Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
60.1	16.7	6.8	23.5	15.0	100	Vertical
300.0	19.3	13.3	32.6	42.7	150	Vertical
360.0	3.1	16.1	19.2	9.1	150	Vertical
540.0	8.4	20.0	28.4	26.3	200	Horizontal
600.0	8.6	21.0	29.6	30.2	200	Horizontal
780.0	6.9	24.5	31.4	37.2	200	Horizontal

Result of Bluetooth communication mode, (9kHz – 30MHz): PASS
Emissions detected are more than 20 dB below the FCC Limits

Result of Bluetooth communication mode, (1GHz – 26GHz): PASS
Emissions detected are more than 20 dB below the FCC Limits

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

Correction Factor included Antenna Factor and Cable Attenuation.

Calculated measurement uncertainty: (9kHz - 30MHz): 2.4dB
(30MHz - 18GHz): 5.0dB
(18GHz - 26GHz): 5.24dB

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

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:

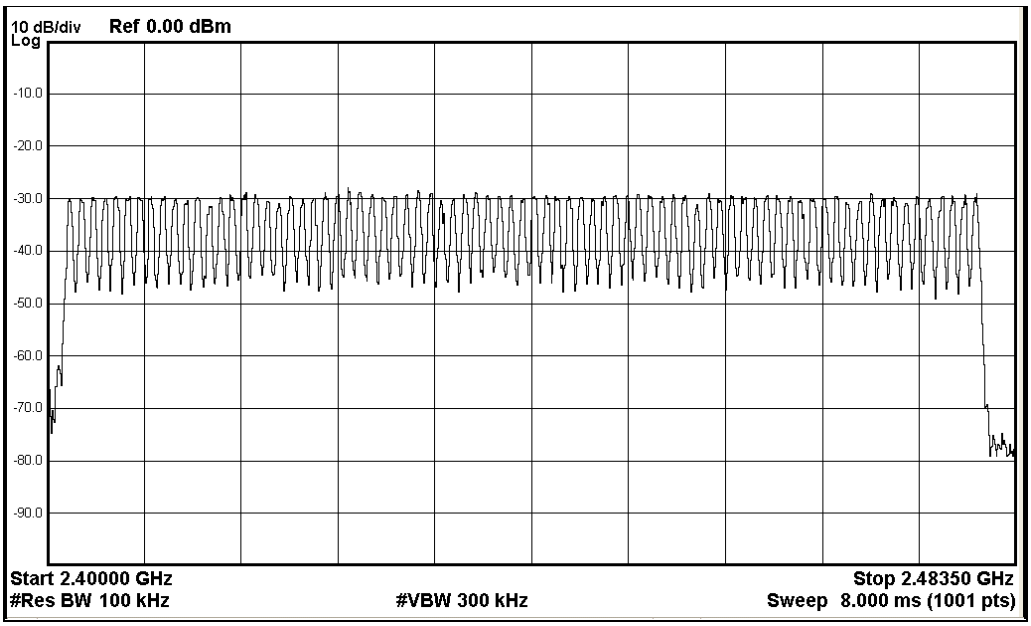
The RF output of the EUT was connected to the spectrum analyzer by a low loss cable.

Spectrum Analyzer Setting:

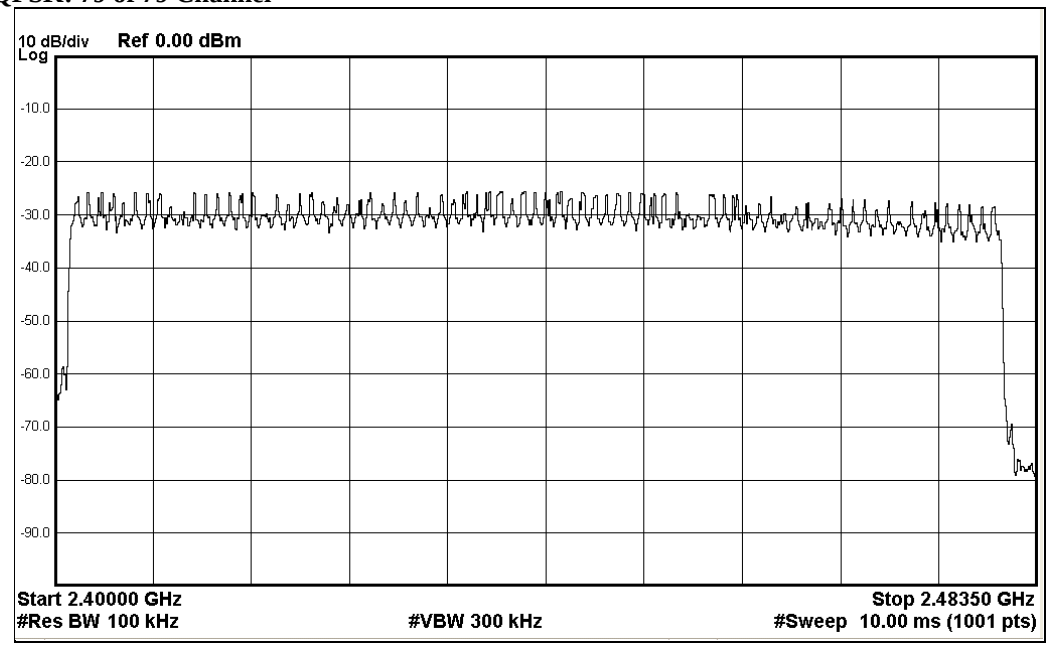
RBW = 100kHz, VBW ≥ RBW, Sweep = Auto, Span = the frequency band of operation
Detector = Peak, Trace = Max. hold

Test Setup:
As Test Setup of clause 3.1.1 in this test report.

Measurement Data:
GFSK: 79 of 79 Channel



π/4-DQPSK: 79 of 79 Channel



3.1.5 20dB Bandwidth

Test Requirement:	FCC 47CFR 15.247(a)(1)
Test Method:	ANSI C63.10:2013
Test Date:	2018-02-14
Mode of Operation:	Tx mode :GFSK/π/4-DQPSK

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:

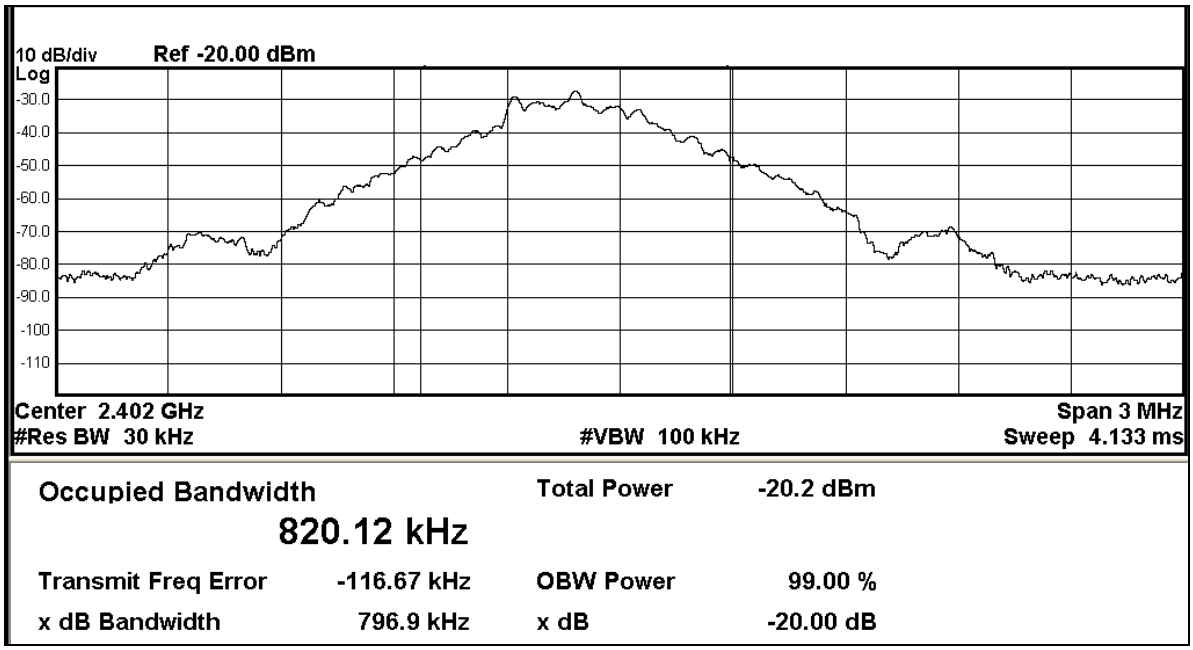
RBW = 30kHz, VBW ≥ RBW, Sweep = Auto, Span = two times and five times the OBW
Detector = Peak, Trace = Max. hold

Test Setup:

As Test Setup of clause 3.1.1 in this test report.

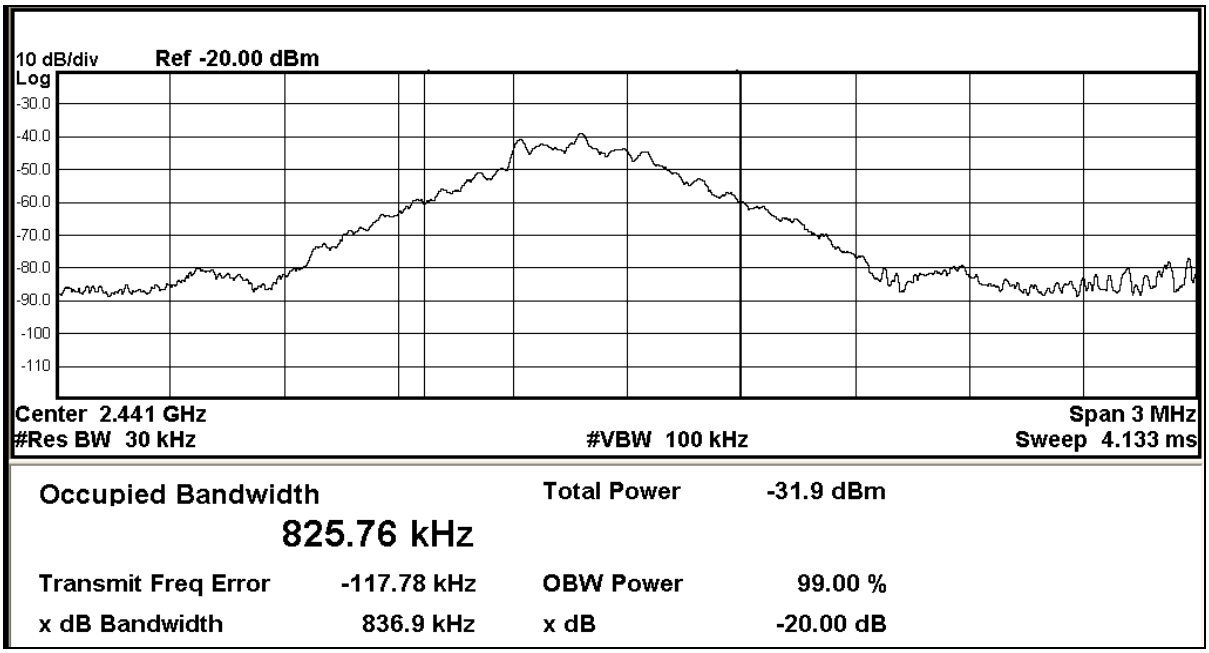
Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	0.80	Within 2400-2483.5

(Lowest Operating Frequency) - (GFSK)



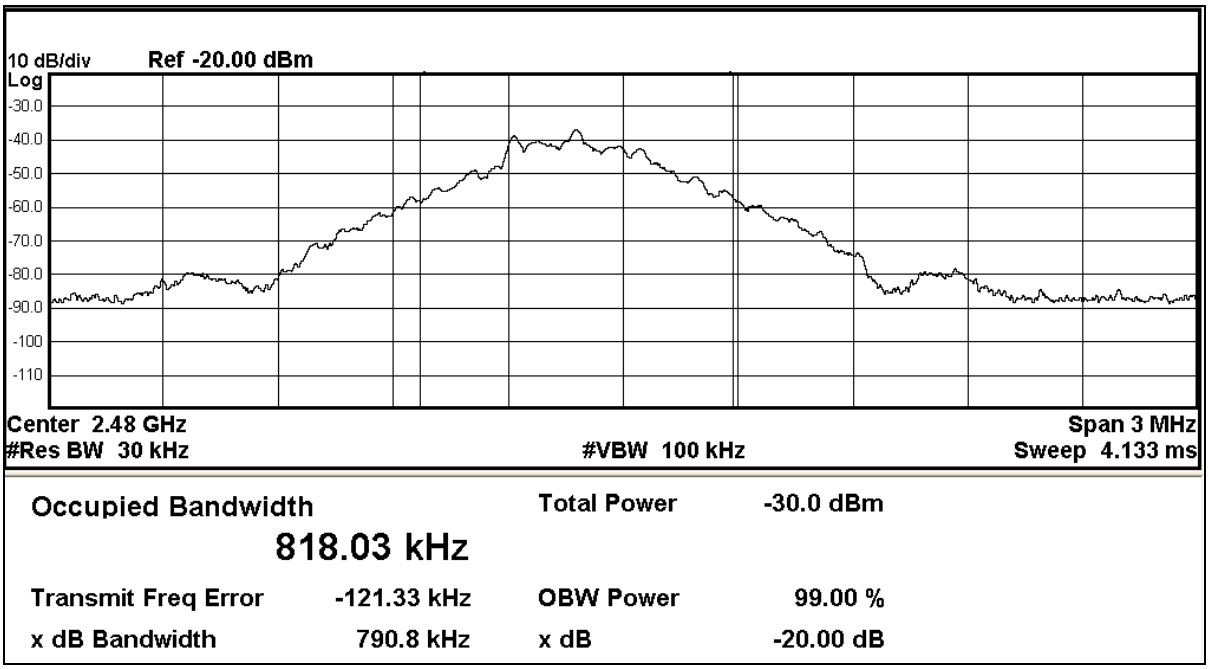
Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2441	0.84	Within 2400-2483.5

(Middle Operating Frequency) - (GFSK)



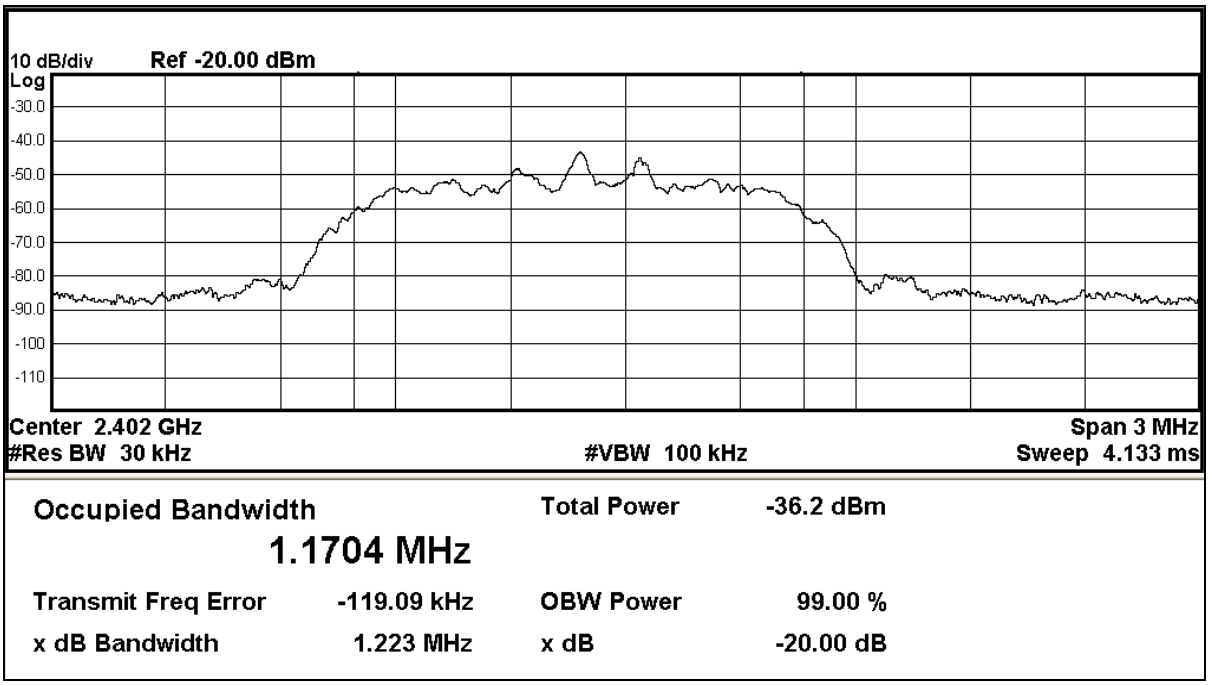
Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2480	0.79	Within 2400-2483.5

(Highest Operating Frequency) - (GFSK)



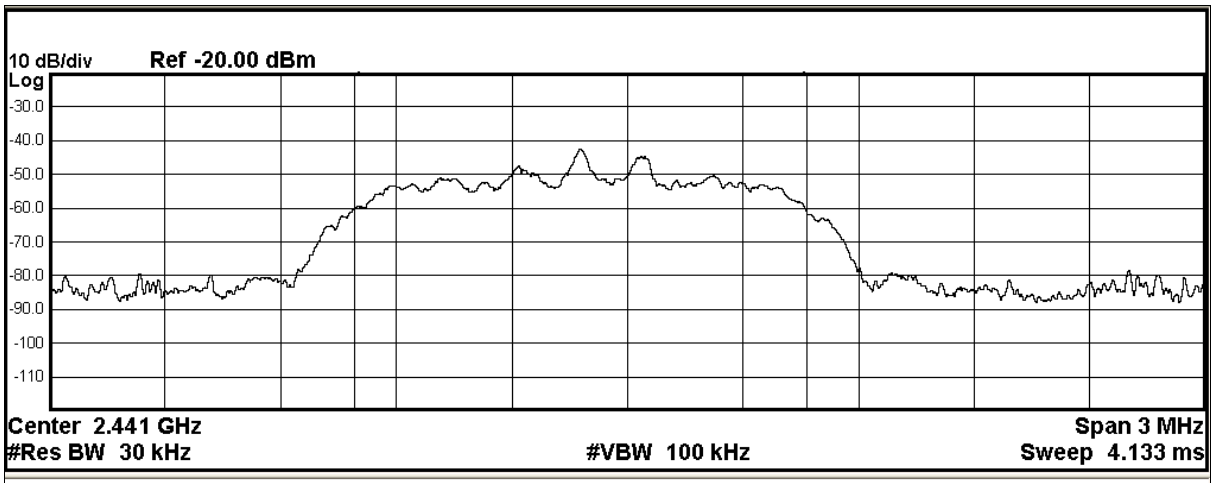
Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	1.22	Within 2400-2483.5

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



Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2441	1.22	Within 2400-2483.5

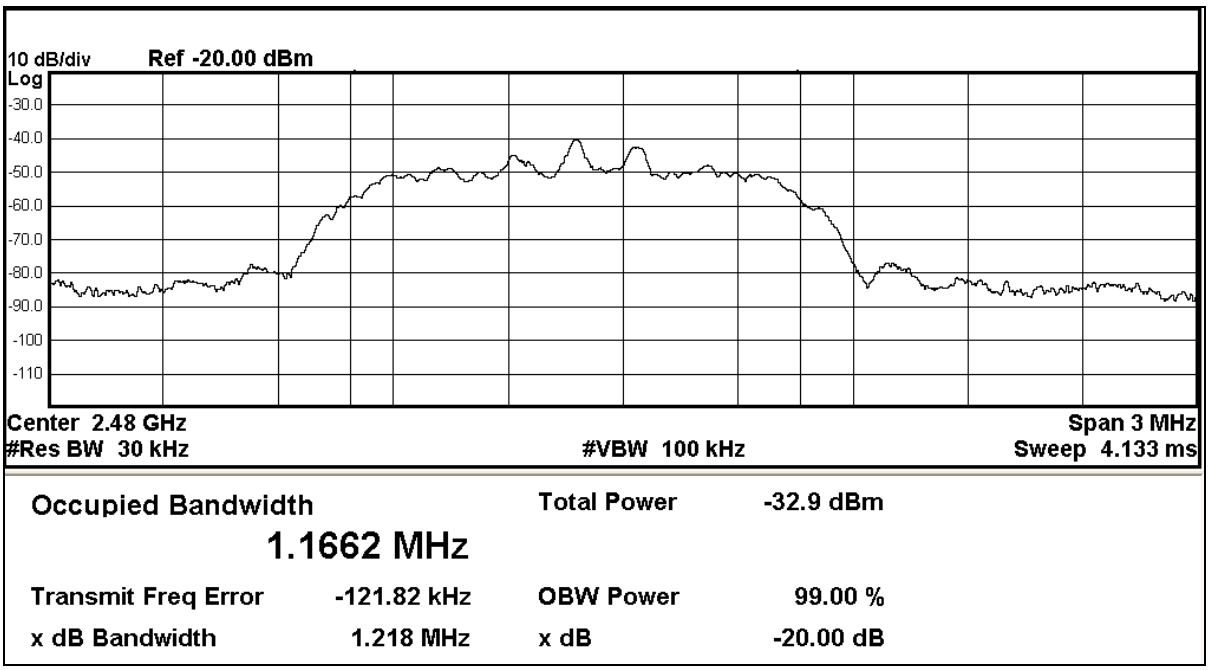
(Middle Operating Frequency) - (π/4 DQPSK)



Occupied Bandwidth	1.1701 MHz	Total Power	-35.5 dBm
Transmit Freq Error	-120.69 kHz	OBW Power	99.00 %
x dB Bandwidth	1.223 MHz	x dB	-20.00 dB

Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2480	1.22	Within 2400-2483.5

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



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:

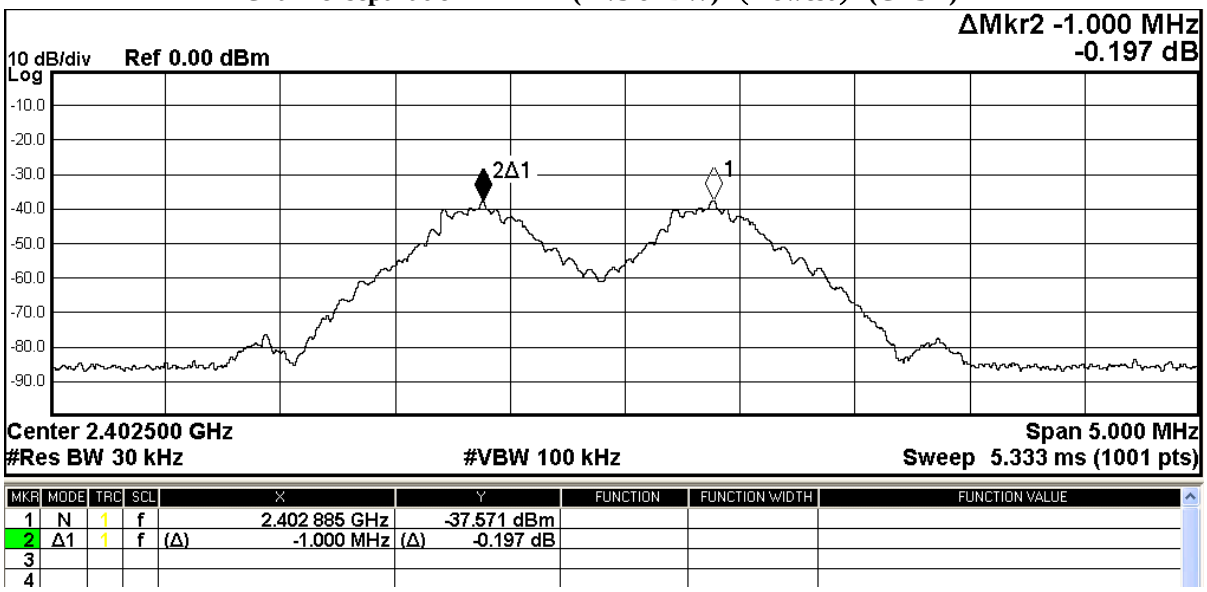
RBW = 30kHz, VBW ≥ RBW, Sweep = Auto,
Span = Wide enough to captur the peaks of two adjacent channels
Detector = Peak, Trace = Max. hold

Limit:

GFSK: The measured maximum bandwidth* 2/3 =0.84MHz * 2/3 = 560kHz

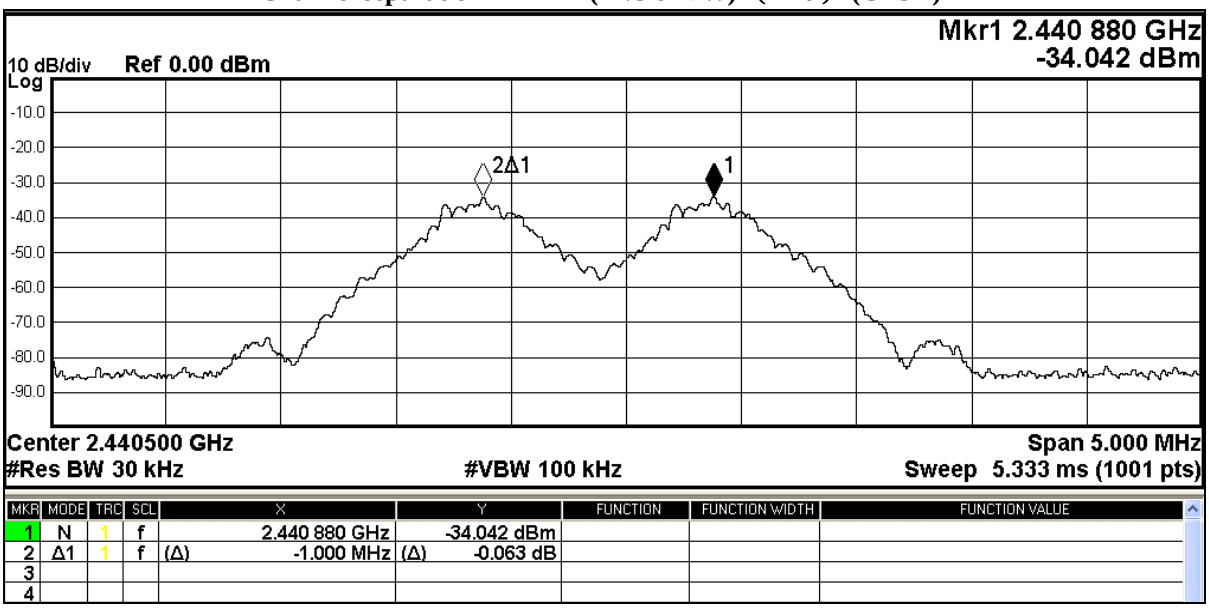
π/4 DQPSK: The measured maximum bandwidth * 2/3 =1.22MHz * 2/3 = 780kHz

Channel separation = 1MHz (>2/3 of BW) （Lowest） (GFSK)



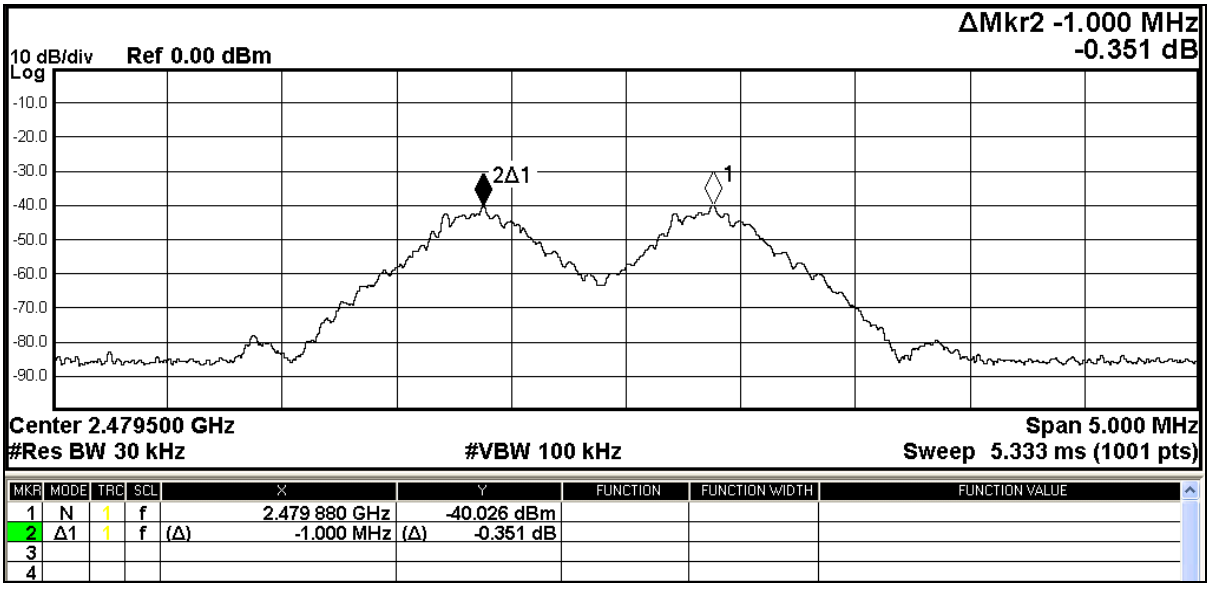
MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.402 885 GHz	-37.571 dBm			
2	Δ1	1	f	(Δ) -1.000 MHz	(Δ) -0.197 dB			
3								
4								

Channel separation = 1MHz (>2/3 of BW) （Mid） (GFSK)



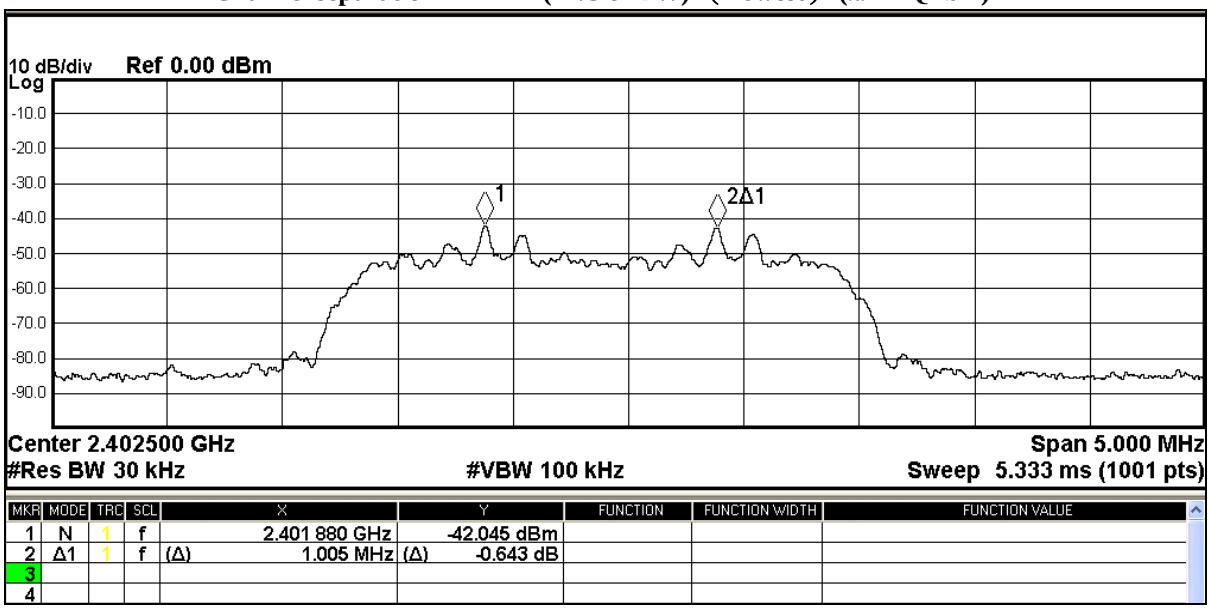
MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.440 880 GHz	-34.042 dBm			
2	Δ1	1	f	(Δ) -1.000 MHz	(Δ) -0.063 dB			
3								
4								

Channel separation = 1MHz (>2/3 of BW) （Highest） (GFSK)



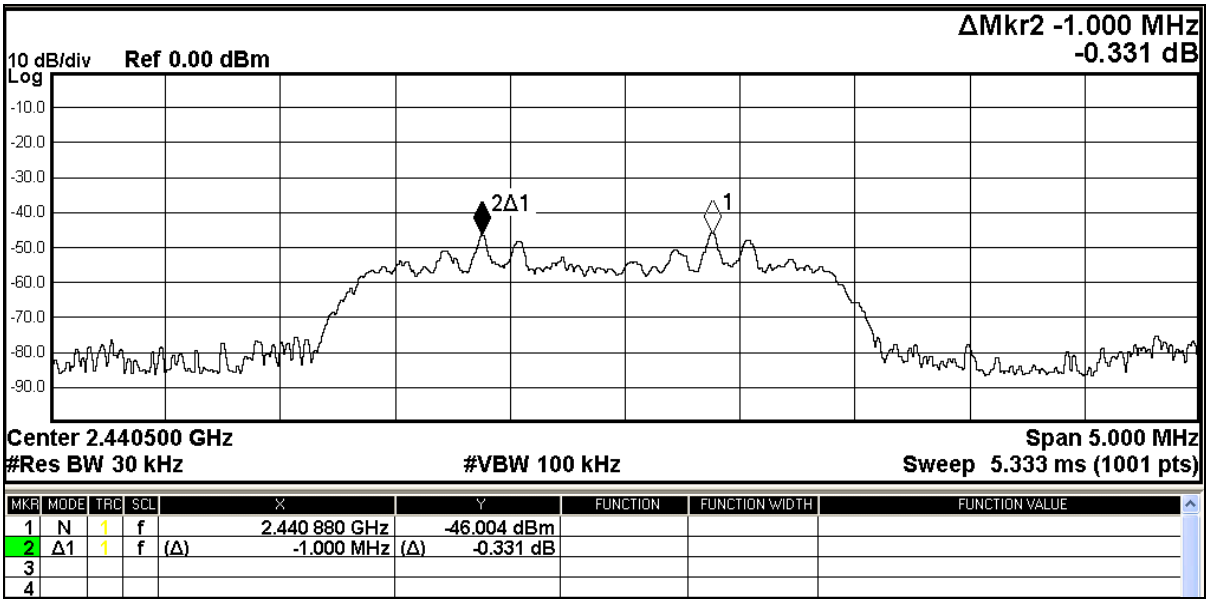
MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.479 880 GHz	-40.026 dBm			
2	Δ1	1	f	(Δ) -1.000 MHz	(Δ) -0.351 dB			
3								
4								

Channel separation = 1MHz (>2/3 of BW) （Lowest） (π/4 DQPSK)



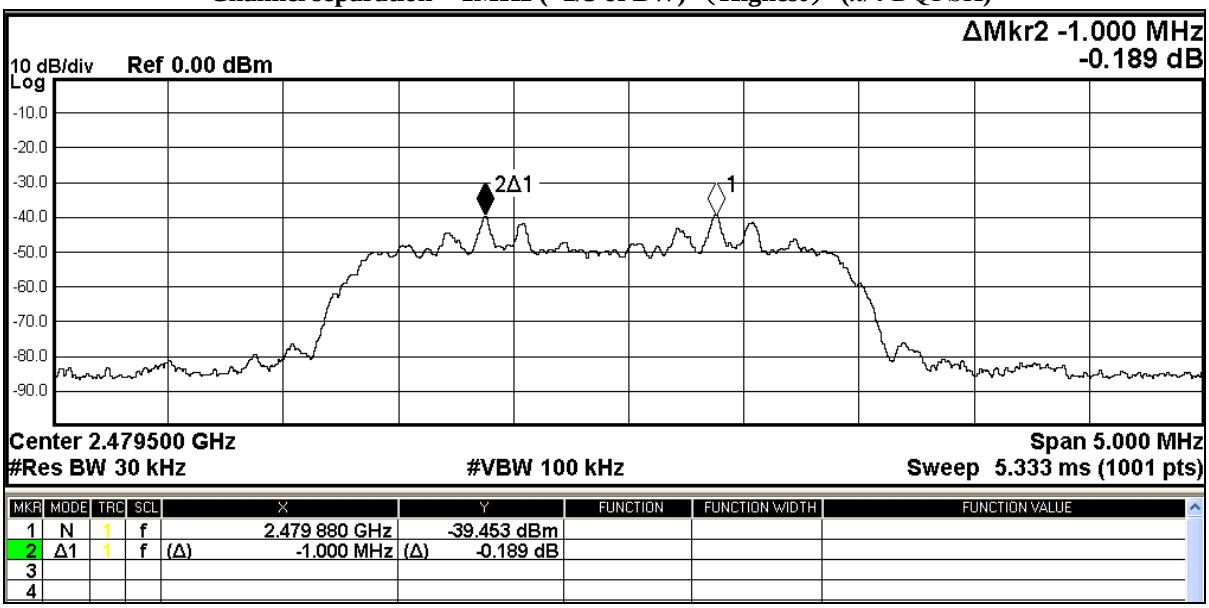
MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.401 880 GHz	-42.045 dBm			
2	Δ1	1	f	(Δ) 1.005 MHz	(Δ) -0.643 dB			
3								
4								

Channel separation = 1MHz (>2/3 of BW) （Mid） (π/4 DQPSK)



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.440 880 GHz	-46.004 dBm			
2	Δ1	1	f	(Δ) -1.000 MHz	(Δ) -0.331 dB			
3								
4								

Channel separation = 1MHz (>2/3 of BW) （Highest） (π/4 DQPSK)



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.479 880 GHz	-39.453 dBm			
2	Δ1	1	f	(Δ) -1.000 MHz	(Δ) -0.189 dB			
3								
4								

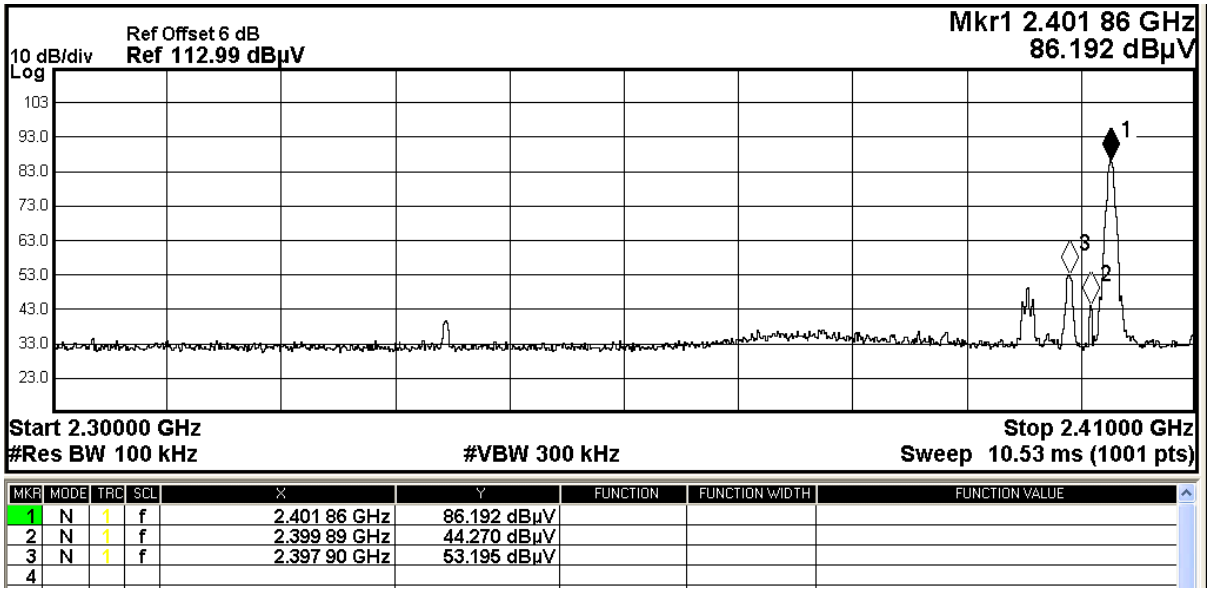
3.1.7 Band-edge Emissions Measurement:

Limit：

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

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	41.9

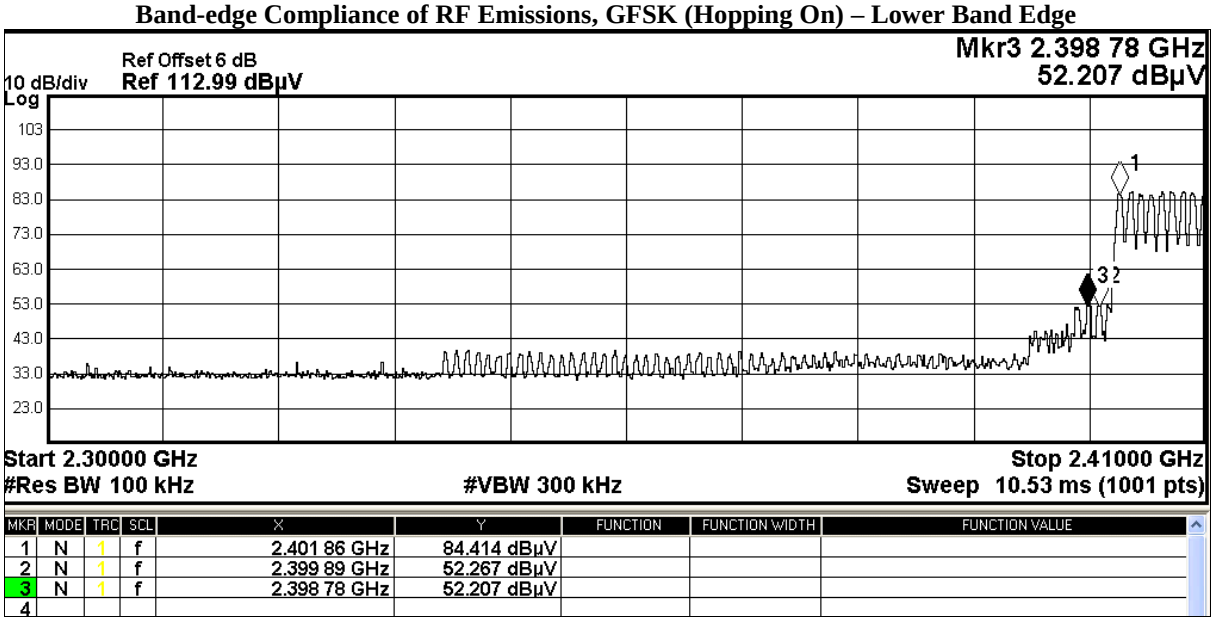
Band-edge Compliance of RF Emissions, GFSK (Hopping Off) – Lower Band Edge



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.401 86 GHz	86.192 dBµV			
2	N	1	f	2.399 89 GHz	44.270 dBµV			
3	N	1	f	2.397 90 GHz	53.195 dBµV			
4								

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	32.2

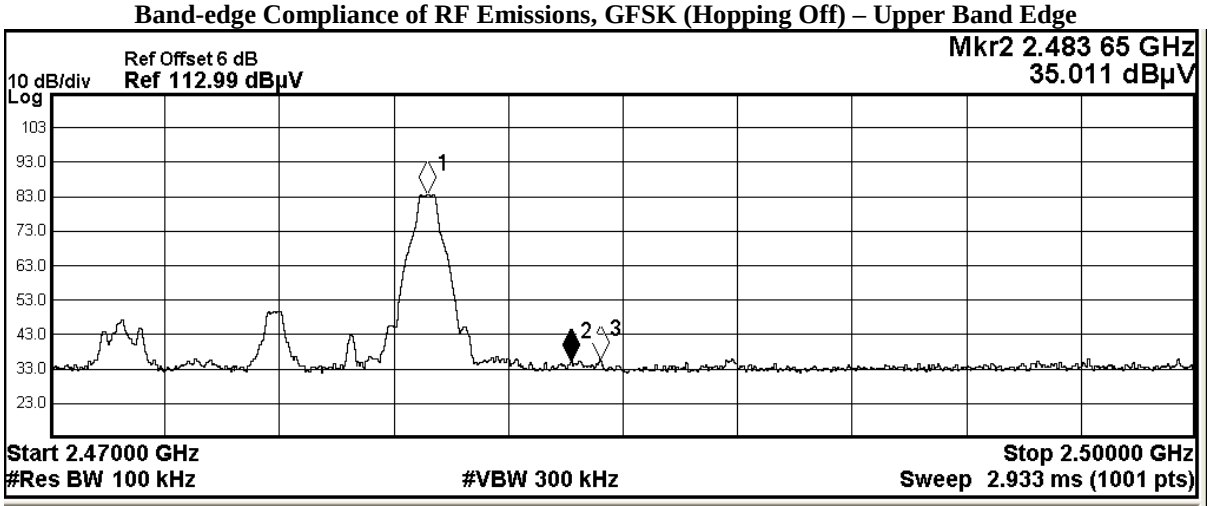
Band-edge Compliance of RF Emissions, GFSK (Hopping On) – Lower Band Edge



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.401 86 GHz	84.414 dBµV			
2	N	1	f	2.399 89 GHz	52.267 dBµV			
3	N	1	f	2.398 78 GHz	52.207 dBµV			
4								

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2483.5 - Highest Fundamental (2480)	48.6

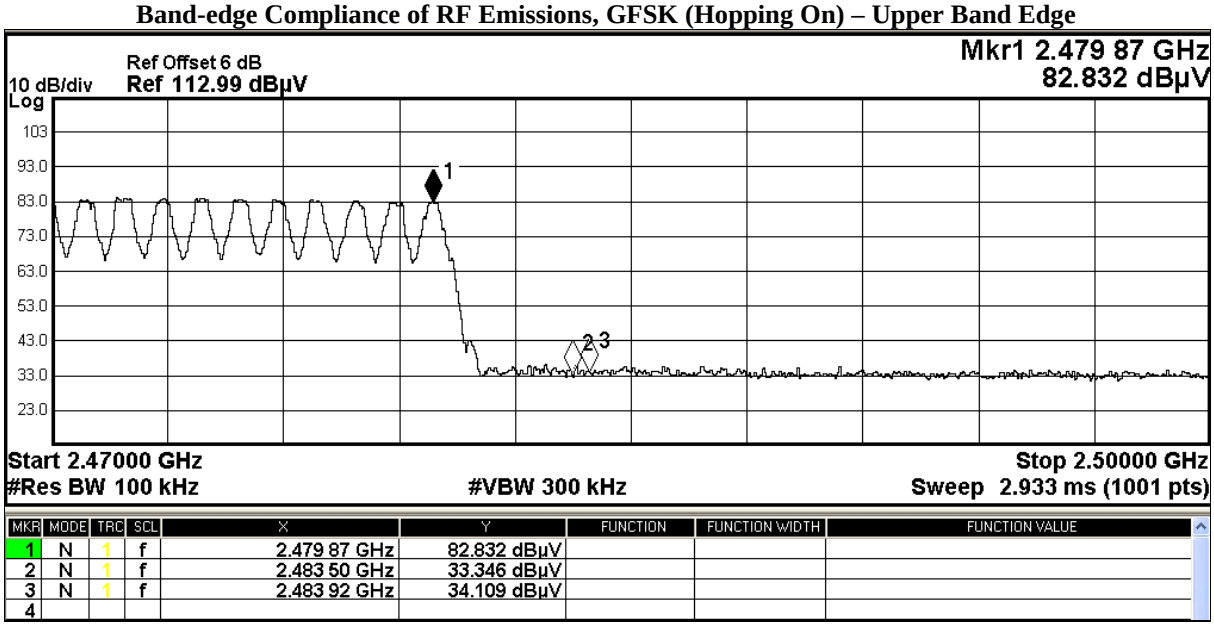
Band-edge Compliance of RF Emissions, GFSK (Hopping Off) – Upper Band Edge



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.479 87 GHz	83.612 dBµV			
2	N	1	f	2.483 65 GHz	35.011 dBµV			
3	N	1	f	2.484 40 GHz	35.807 dBµV			
4								

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2483.5 - Highest Fundamental (2480)	49.5

Band-edge Compliance of RF Emissions, GFSK (Hopping On) – Upper Band Edge



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.479 87 GHz	82.832 dBµV			
2	N	1	f	2.483 50 GHz	33.346 dBµV			
3	N	1	f	2.483 92 GHz	34.109 dBµV			
4								

Band-edge Emissions Measurement:

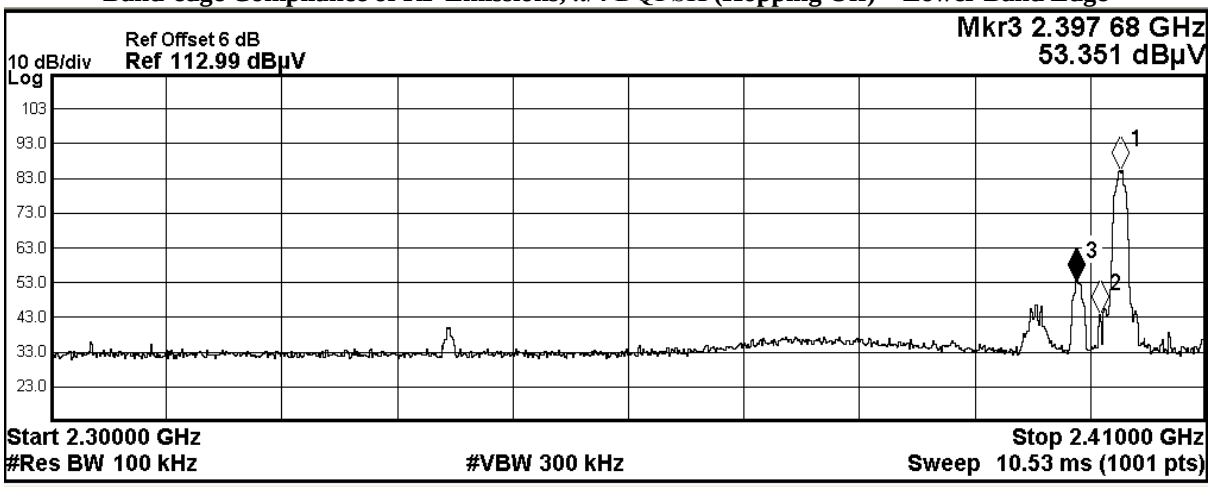
Result： RF Radiated Emissions - GFSK

Field Strength of Band-edge Compliance 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
2397.9	27.4	27.8	55.2	74.0	18.8	Vertical
2398.8	27.8	27.8	55.6	74.0	18.4	Vertical
2484.0	8.5	27.9	36.4	74.0	37.6	Vertical
2483.9	7.8	27.9	35.7	74.0	38.3	Vertical

Field Strength of Band-edge Compliance AverageValue						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dB	E-Field Polarity
2397.9	6.7	27.8	34.5	54.0	19.5	Vertical
2398.8	7.3	27.8	35.1	54.0	18.9	Vertical
2484.0	-2.1	27.9	25.8	54.0	28.2	Vertical
2483.9	-2.3	27.9	25.6	54.0	28.4	Vertical

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	50.9

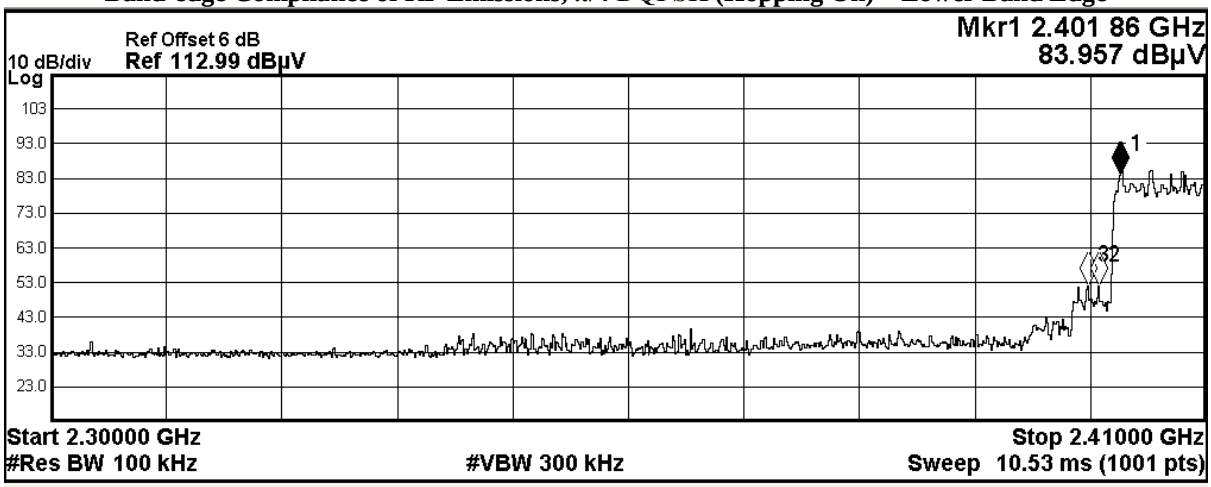
Band-edge Compliance of RF Emissions, π/4 DQPSK (Hopping Off) – Lower Band Edge



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.401 86 GHz	85.262 dBµV			
2	N	1	f	2.399 89 GHz	43.823 dBµV			
3	N	1	f	2.397 68 GHz	53.351 dBµV			
4								

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2400 – Lowest Fundamental (2402)	48.1

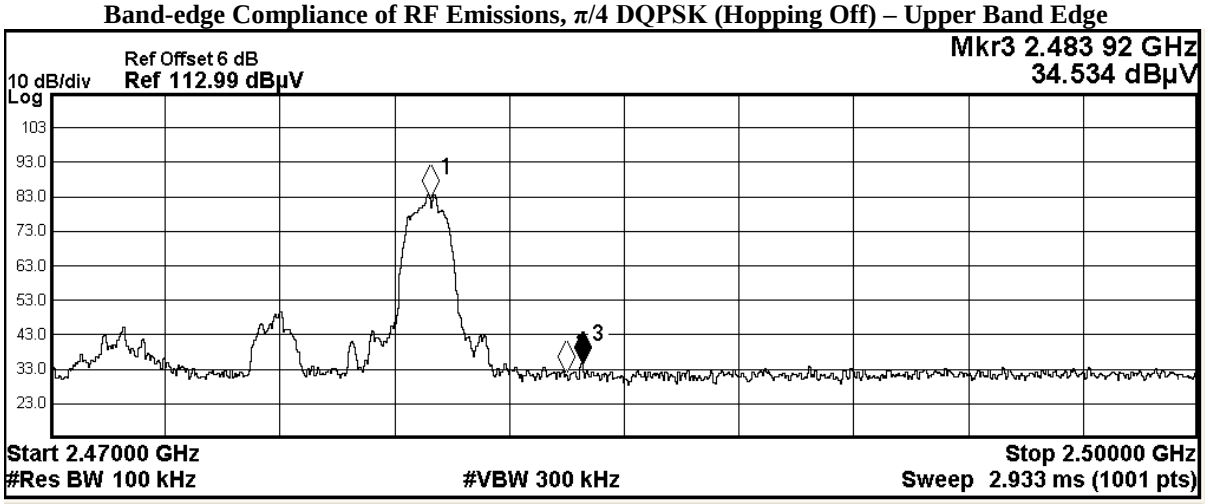
Band-edge Compliance of RF Emissions, π/4 DQPSK (Hopping On) – Lower Band Edge



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.401 86 GHz	83.957 dBµV			
2	N	1	f	2.399 78 GHz	52.155 dBµV			
3	N	1	f	2.398 78 GHz	52.188 dBµV			
4								

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2483.5 - Highest Fundamental (2480)	58.2

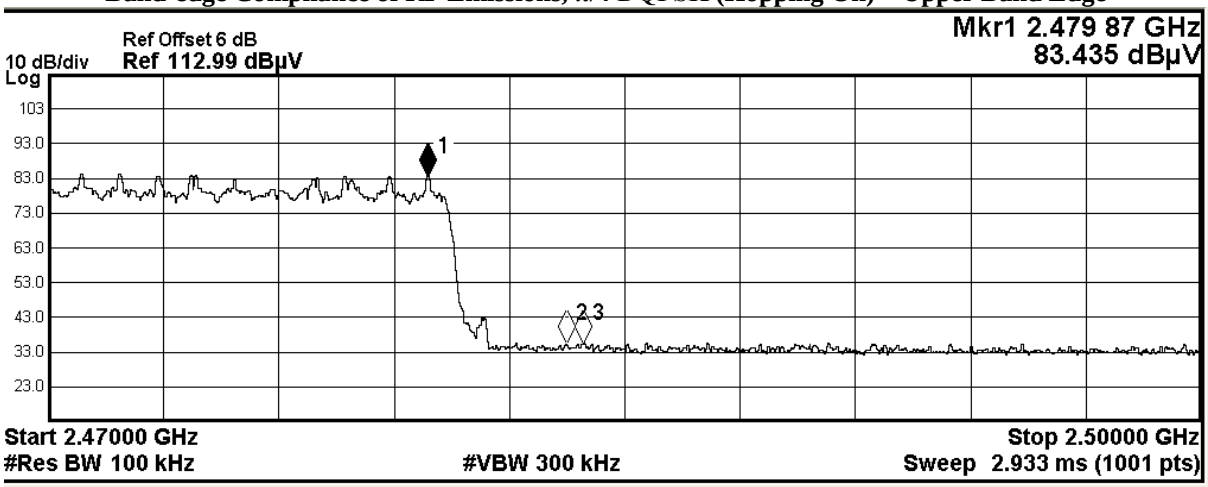
Band-edge Compliance of RF Emissions, π/4 DQPSK (Hopping Off) – Upper Band Edge



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.479 93 GHz	82.513 dBµV			
2	N	1	f	2.483 50 GHz	31.489 dBµV			
3	N	1	f	2.483 92 GHz	34.534 dBµV			
4								

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
2483.5 - Highest Fundamental (2480)	50.3

Band-edge Compliance of RF Emissions, π/4 DQPSK (Hopping On) – Upper Band Edge



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.479 87 GHz	83.435 dBµV			
2	N	1	f	2.483 50 GHz	35.406 dBµV			
3	N	1	f	2.483 92 GHz	35.314 dBµV			
4								

Band-edge Emissions Measurement:

Result： RF Radiated Emissions -π/4 DQPSK

Field Strength of Band-edge Compliance 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
2397.9	26.4	27.8	54.2	74.0	19.8	Vertical
2398.8	26.3	27.8	54.1	74.0	19.9	Vertical
2483.9	8.2	27.9	36.1	74.0	37.9	Vertical
2483.9	7.5	27.9	35.4	74.0	38.6	Vertical

Field Strength of Band-edge Compliance AverageValue						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dB	E-Field Polarity
2397.9	6.3	27.8	34.1	54.0	19.9	Vertical
2398.8	6.8	27.8	34.6	54.0	19.4	Vertical
2483.9	-2.3	27.9	25.6	54.0	28.4	Vertical
2483.9	-2.4	27.9	25.5	54.0	28.5	Vertical

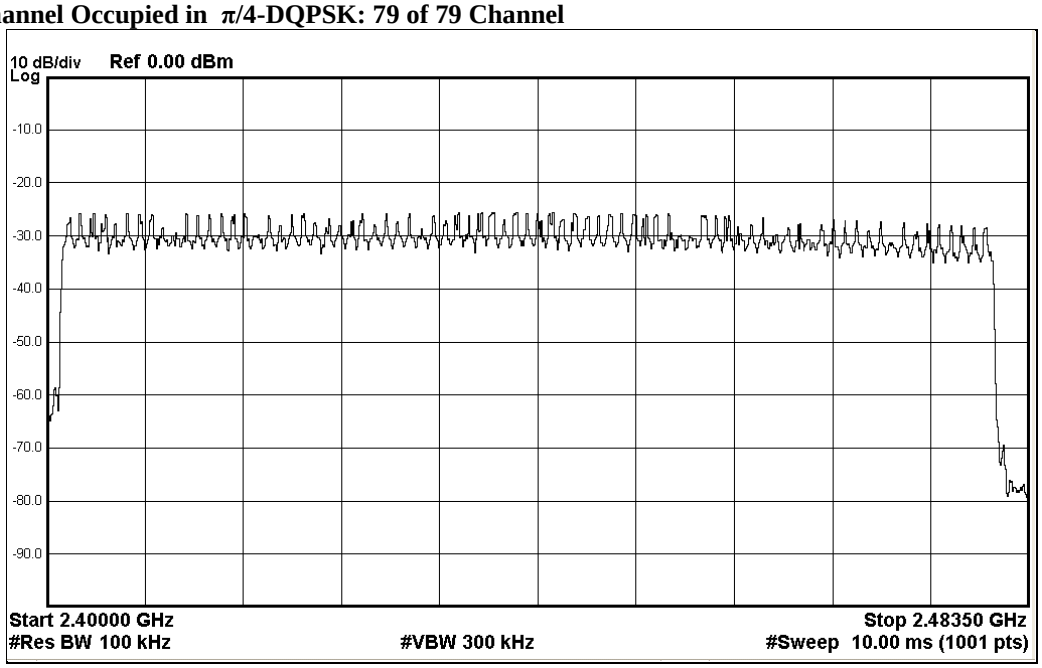
3.1.8 Time of Occupancy (Dwell Time)

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≥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 π/4-DQPSK: 79 of 79 Channel



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]

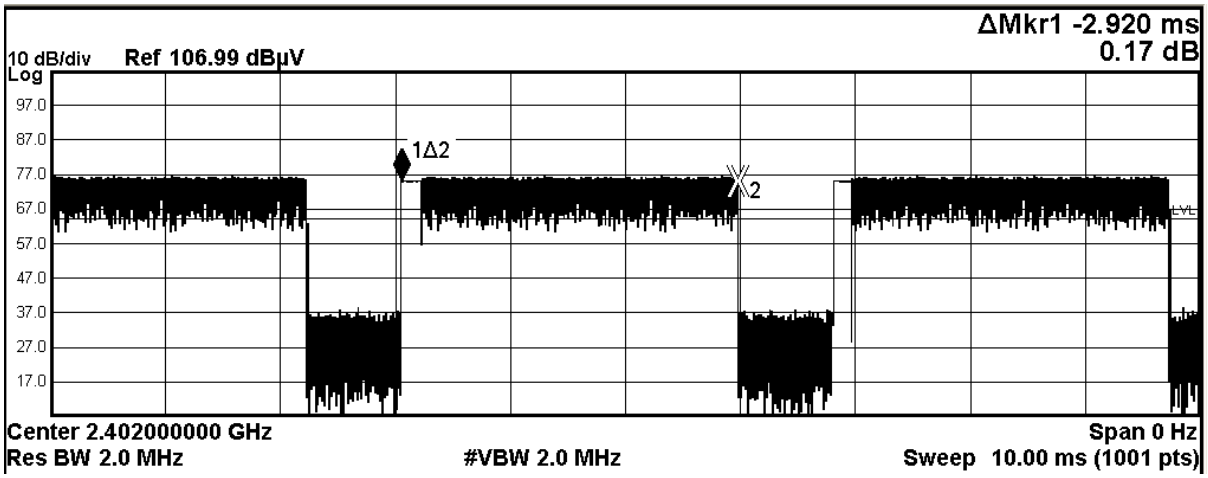


Fig. B
[Pulse duration of Middle Channel]

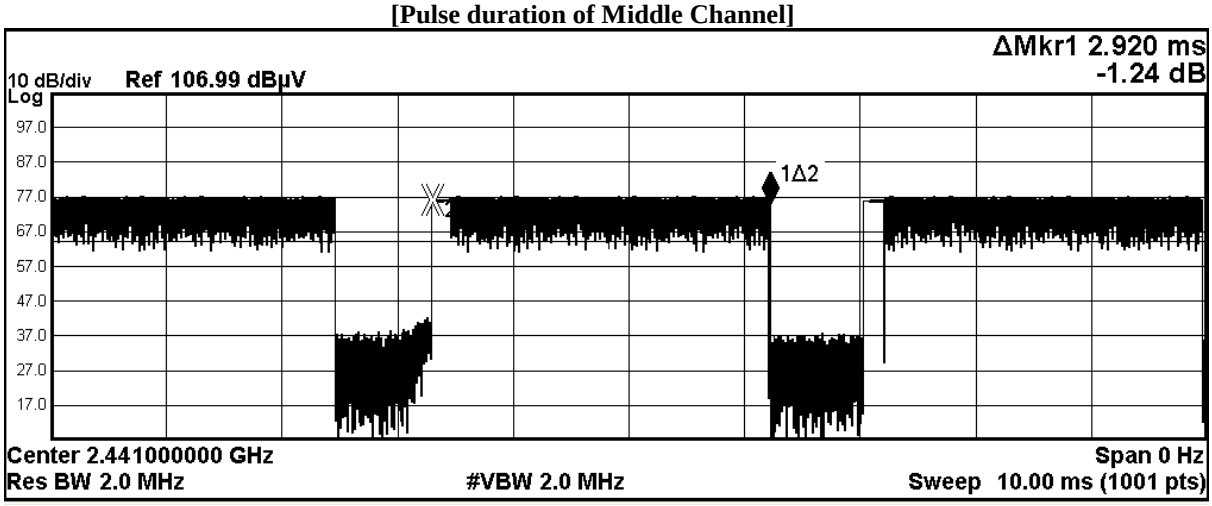
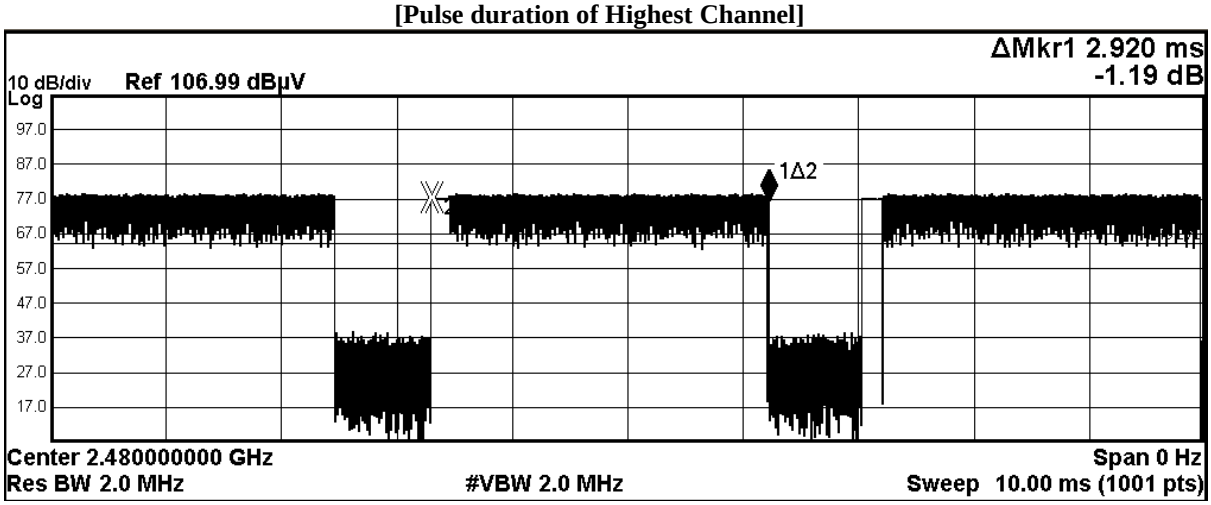


Fig. C
[Pulse duration of Highest Channel]



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]

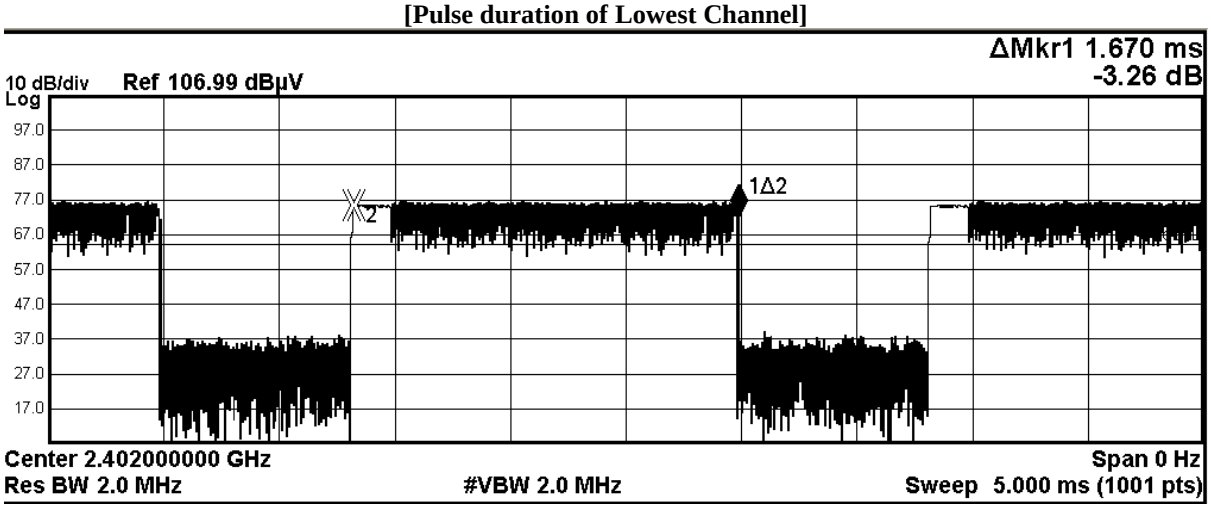


Fig. E
[Pulse duration of Middle Channel]

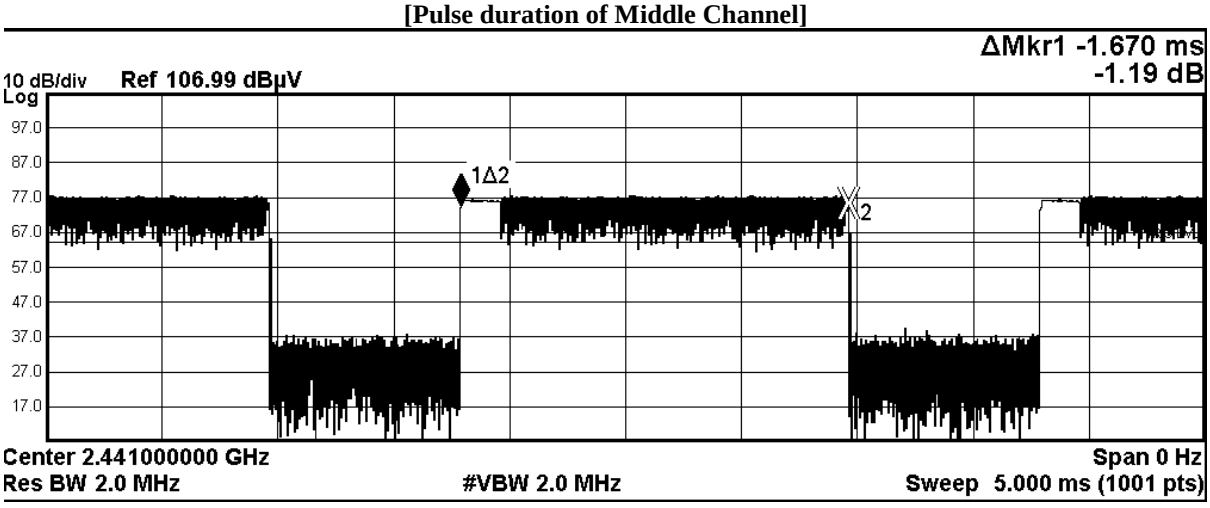
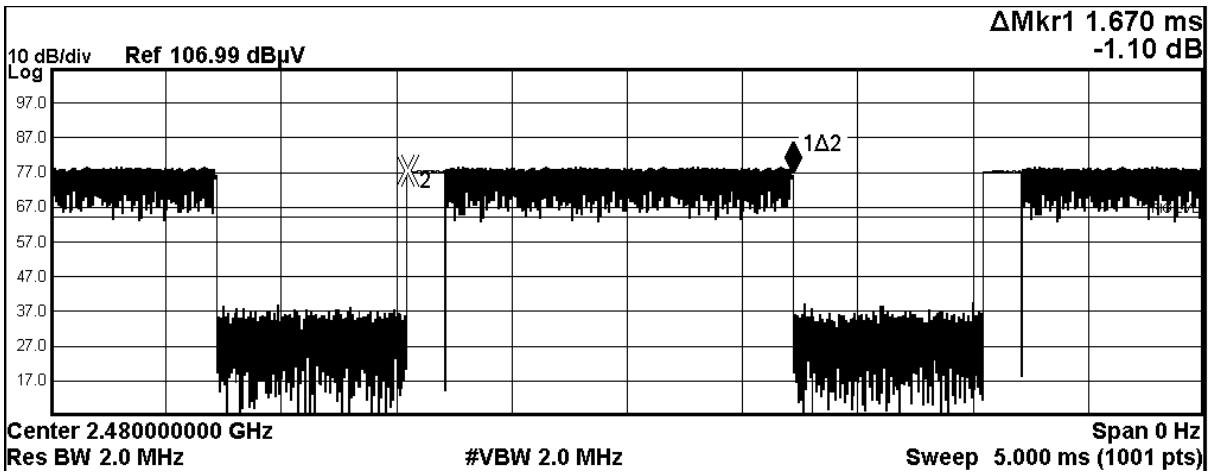


Fig. F
[Pulse duration of Highest Channel]



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]

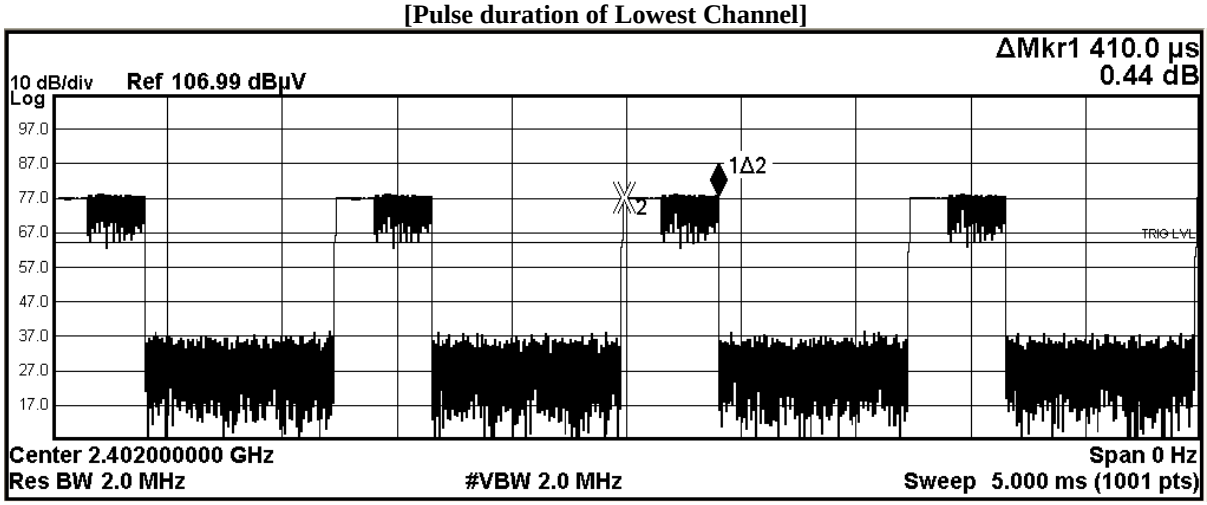


Fig. H
[Pulse duration of Middle Channel]

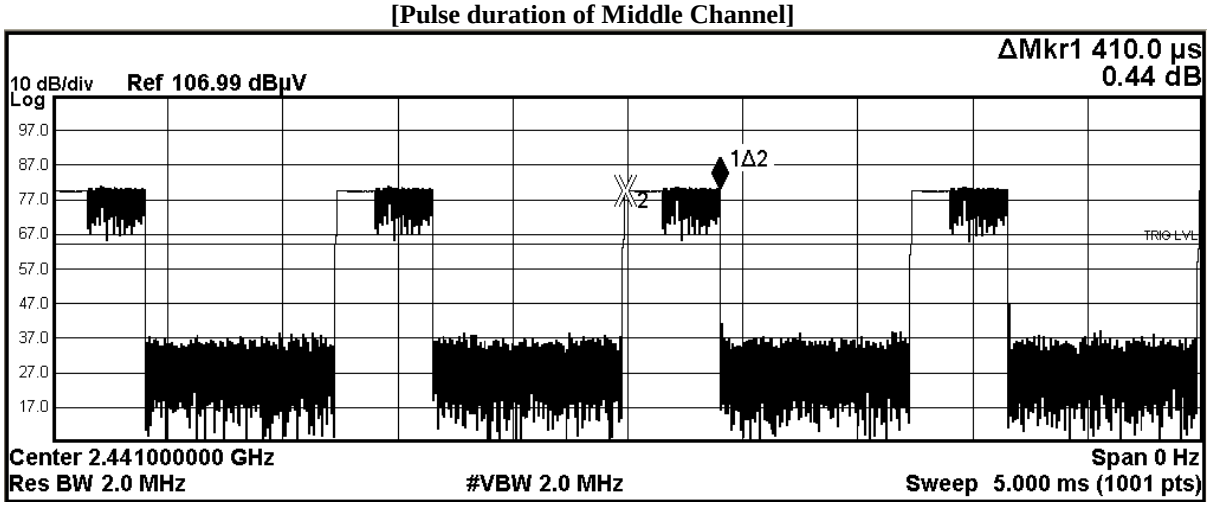
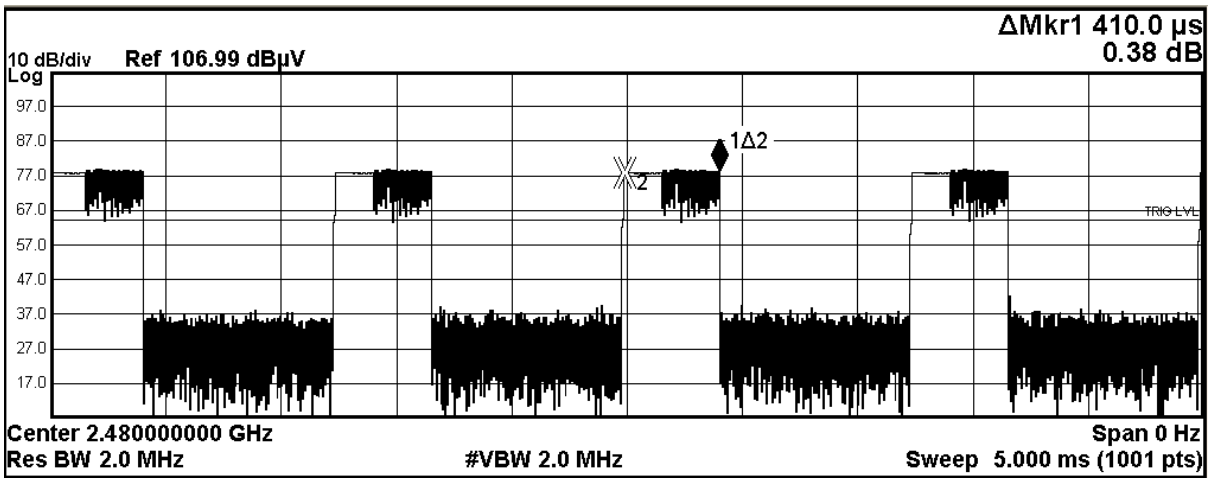


Fig. I
[Pulse duration of Highest Channel]



Time of occupancy (Dwell Time):

Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (s)	Limits (s)	Test Results
DH5	2402	2.920	0.312	0.400	Complies
DH5	2441	2.920	0.312	0.400	Complies
DH5	2480	2.920	0.312	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	0.410	0.131	0.400	Complies
DH1	2441	0.410	0.131	0.400	Complies
DH1	2480	0.410	0.131	0.400	Complies

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)

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.

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 Circuit printed meander line antenna. There is no external antenna, the antenna gain = -0.58dBi. User is unable to remove or changed the Antenna.

3.1.12 RF Exposure

Test Requirement:	FCC 47CFR 15.247(i)
Test Date:	2018-02-14
Mode of Operation:	On mode

Requirements:
In 15.247(i), an equipment shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the limits in §§ 1.1310 and 2.1093 of this chapter.
Applications to the Commission for construction permits, licenses to transmit or renewals thereof, equipment authorizations or modifications in existing facilities must contain a statement confirming compliance with the limits unless the facility, operation, or transmitter is categorically excluded, as discussed below. Technical information showing the basis for this statement must be submitted to the Commission upon request.

According to KDB447498 D01 General RF Exposure Guidance v06, unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Exclusion Threshold condition.

RF Exposure Evaluation

The Maximum tune-up power = -5.12dBm (0.308mW)

SAR Test Exclusion Thresholds=0.1≤ 3.0 for 1-g SAR,

The test separation distances is ≤5 mm
The power tune up tolerance is -6.82±1.70dBm
Max. duty factor is 100%

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
EM215	MULTIDEVICE CONTROLLER	EMCO	2090	00024676	N/A	N/A
EM217	ELECTRIC POWERED TURNTABLE	EMCO	2088	00029144	N/A	N/A
EM218	ANECHOIC CHAMBER	ETS-LINDGREN	FACT-3	--	2017/04/20	2018/04/20
EM356	ANTENNA POSITIONING TOWER	ETS-LINDGREN	2171B	00150346	N/A	N/A
EM355	BICONILOG ANTENNA	ETS-LINDGREN	3143B	00094856	2016/03/03	2018/03/03
EM229	EMI TEST RECEIVER	R&S	ESIB40	100248	2017/06/01	2018/06/01
EM353	LOOP ANTENNA	ETS_LINDGREN	6502	00206533	2016/03/16	2018/03/16
EM302	PRECISION OMNIDIRECTIONAL DIPOLE (1 – 6GHZ)	SEIBERSDORF LABORATORIES	POD 16	161806/L	2016/05/11	2018/05/11
EM303	PRECISION OMNIDIRECTIONAL DIPOLE (6 – 18GHZ)	SEIBERSDORF LABORATORIES	POD 618	6181908/L	2016/05/11	2018/05/11

Line Conducted

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EM119	LISN	R & S	ESH3-Z5	0831.5518.52	2017/11/29	2018/11/29
EM181	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB7	100072	2017/06/01	2018/06/01
EM179	IMPULSE LIMITER	ROHDE & SCHWARZ	ESH3-Z2	357-8810.52/54	2018/01/11	2019/01/11
EM154	SHIELDING ROOM	SIEMENS MATSUSHITA COMPONENTS	N/A	803-740-057-99A	2017/02/02	2022/02/02
N/A	MEASUREMENT AND EVALUATION SOFTWARE	ROHDE & SCHWARZ	ESIB-K1	V1.20	N/A	N/A

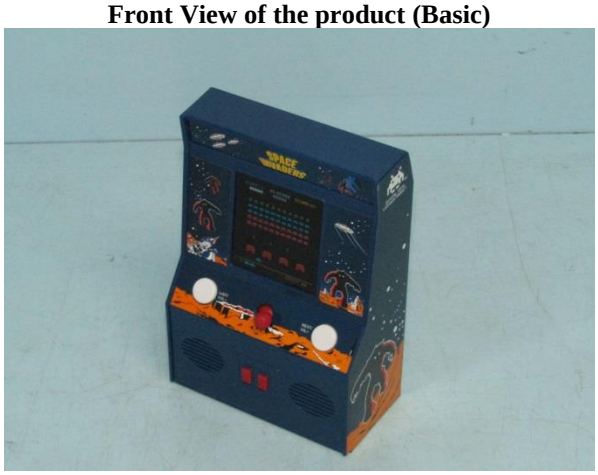
Remarks:-

CM Corrective Maintenance
N/A Not Applicable or Not Available
TBD To Be Determined

Appendix B

Photographs of EUT

Front View of the product (Basic)

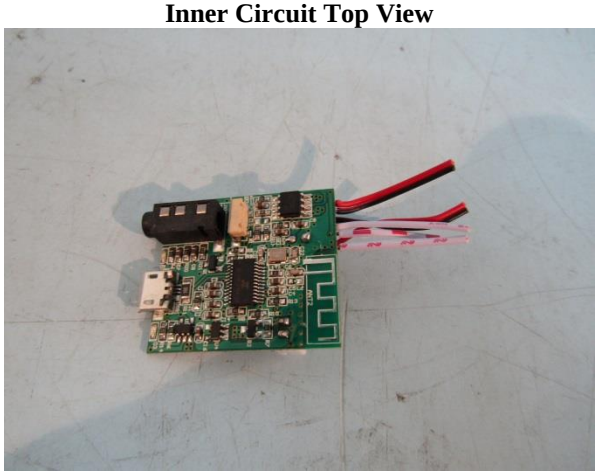


Rear View of the product (Basic)

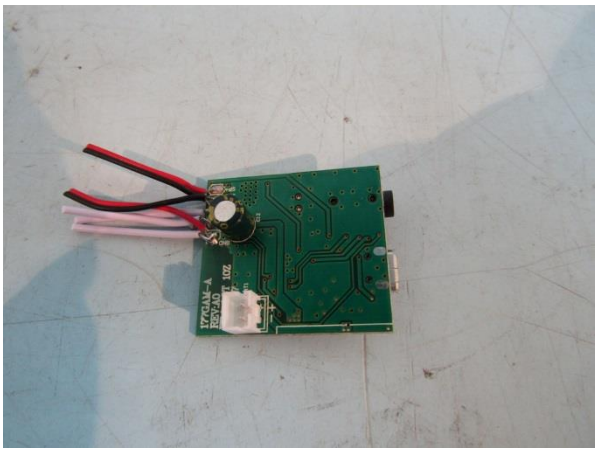
Front View of the product (Additional)

Rear View of the product (Additional)

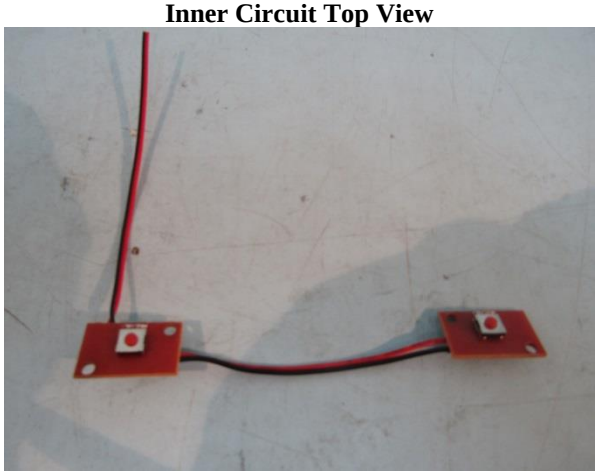
Inner Circuit Top View



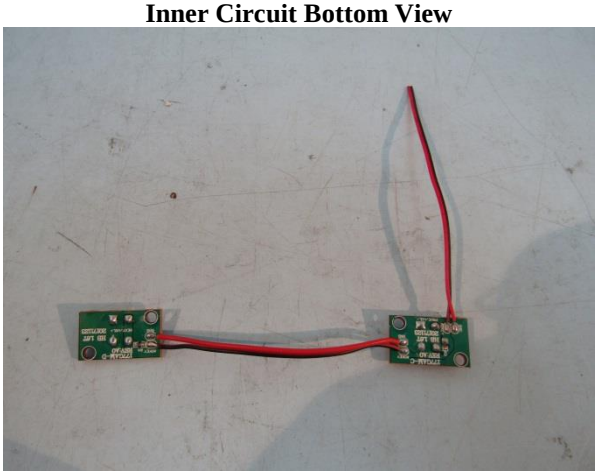
Inner Circuit Bottom View



Inner Circuit Top View

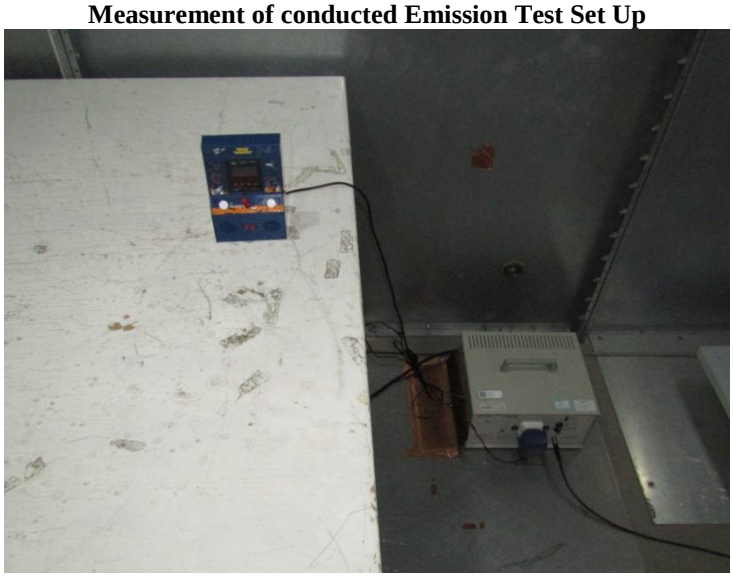


Inner Circuit Bottom View

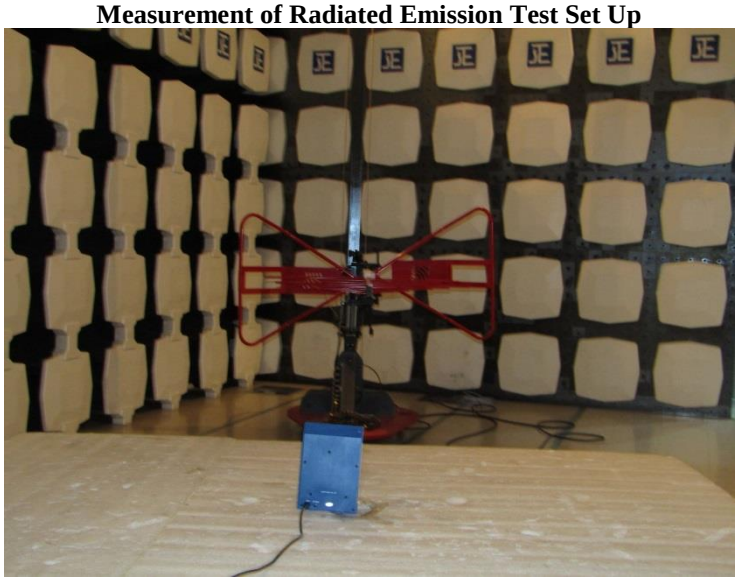


Photographs of EUT

Measurement of conducted Emission Test Set Up

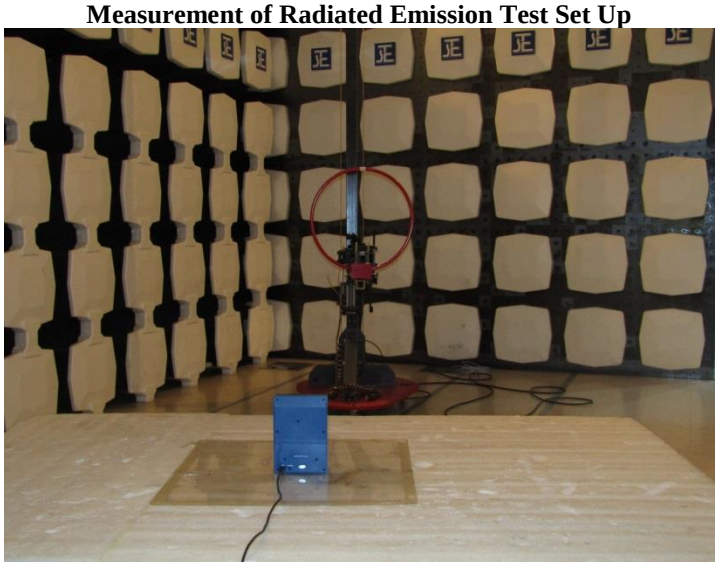


Measurement of Radiated Emission Test Set Up

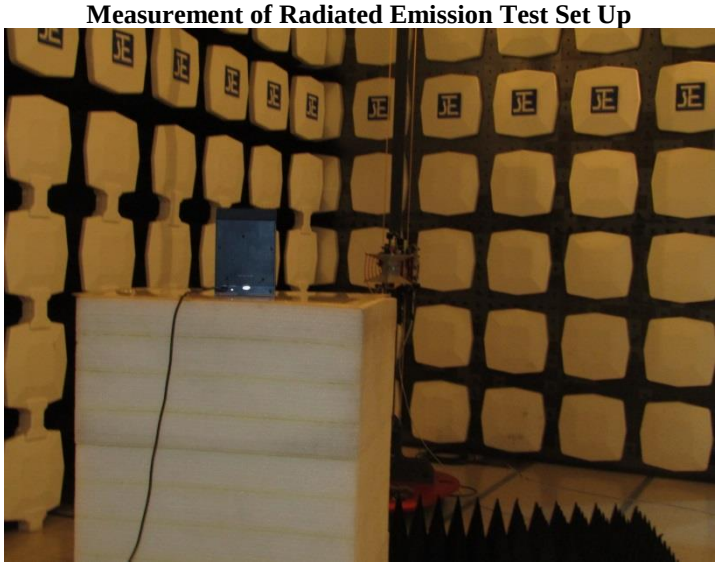


Photographs of EUT

Measurement of Radiated Emission Test Set Up



Measurement of Radiated Emission Test Set Up



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2. Any report issued by the Company as a result of this application for testing service (the "Report") shall be issued in confidence to the Clients and the Report will be strictly treated as such by the Company. It may not be reproduced either in its entirety or in part and it may not be used for advertising or other unauthorized purposes without the written consent of the Company. The Clients to whom the Report is issued may, however, show or send it, or a certified copy thereof prepared by the Company to his customer, supplier or other persons directly concerned. The Company will not, without the consent of the Clients, enter into any discussion or correspondence with any third party concerning the contents of the Report, unless required by the relevant governmental authorities, laws or court orders.

3. The Company shall not be called or be liable to be called to give evidence or testimony on the Report in a court of law without its prior written consent, unless required by the relevant governmental authorities, laws or court orders.

4. The Report refers only to the sample tested and does not apply to the bulk, unless the sampling has been carried out by the Company and is stated as such in the Report.

5. In the event of the improper use the report as determined by the Company, the Company reserves the right to withdraw it, and to adopt any other additional remedies which may be appropriate.

6. Sample submitted for testing are accepted on the understanding that the Report issued cannot form the basis of, or be the instrument for, any legal action against the Company.

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8. Clients wishing to use the Report in court proceedings or arbitration shall inform the Company to that effect prior to submitting the sample for testing.

9. Subject to the variable length of retention time for test data and report stored hereinto as to otherwise specifically required by individual accreditation authorities, the Company will only keep the supporting test data and information of this test report for a period of three years. The data and information will be disposed of after the aforementioned retention period has elapsed. Under no circumstances shall we provide any data and information which has been disposed of after the retention period. Under no circumstances shall we be liable for damages of any kind, including (but not limited to) compensatory damages, lost profits, lost data, or any form of special, incidental, indirect, consequential or punitive damages of any kind, whether based on breach of contract of warranty, tort (including negligence), product liability or otherwise, even if we are informed in advance of the possibility of such damages.

10. Issuance records of the Report are available on the internet at www.stc-group.org. Further enquiry of validity or verification of the Reports should be addressed to the Company.