FCC RF Test Report

APPLICANT	:	**Xiaomi Communications Co., Ltd.**
EQUIPMENT	:	**Mobile Phone**
BRAND NAME	:	**MI**
MODEL NAME	:	**M1903C3GH**
FCC ID	:	**2AFZZ-RMSC3GH**
STANDARD	:	**FCC Part 15 Subpart C §15.247**
CLASSIFICATION	:	**(DTS) Digital Transmission System**

This is a data re-used report which is only valid together with the original test report. The product was received on Oct. 18, 2018 and testing was completed on Nov. 20, 2018. We, Sporton International (Kunshan) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (Kunshan) Inc., the test report shall not be reproduced except in full.

James Huang

TESTING
NVLAP LAB CODE 600155-0

Approved by: James Huang / Manager

Sporton International (Kunshan) Inc.
No. 1098, Pengxi North Road, Kunshan Economic Development Zone,
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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR8O1822-01B	Rev. 01	Initial issue of report	Dec. 04, 2018

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
-	15.247(a)(2)	6dB Bandwidth	≥ 0.5MHz	Pass	1
-	-	99% Bandwidth	-	Pass	1
-	15.247(b)(3)	Peak Output Power	≤ 30dBm	Pass	1
-	15.247(e)	Power Spectral Density	≤ 8dBm/3kHz	Pass	1
-	15.247(d)	Conducted Band Edges and Spurious Emission	≤ 20dBc	Pass	1
3.1	15.247(d)	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 13.68 dB at 2483.51 MHz
-	15.207	AC Conducted Emission	15.207(a)	Pass	1
-	15.203 & 15.247(b)	Antenna Requirement	N/A	Pass	1
Remark 1: Test items are performed on original report which can be referred to Sporton report number FR8O1822B.					

1 General Description

1.1 Applicant

Xiaomi Communications Co., Ltd.
The Rainbow City of China Resources,NO.68,Qinghe Middle Street,Haidian District,Beijing,China

1.2 Manufacturer

Xiaomi Communications Co., Ltd.
The Rainbow City of China Resources,NO.68,Qinghe Middle Street,Haidian District,Beijing,China

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Mobile Phone
Brand Name	MI
Model Name	M1903C3GH
FCC ID	2AFZZ-RMSC3GH
EUT supports Radios application	GSM/GPRS/EGPRS/WCDMA/HSPA/DC-HSDPA/ HSPA+(16QAM uplink is not supported)/LTE WLAN 2.4GHz 802.11b/g/n HT20 Bluetooth BR/EDR/LE
IMEI Code	864520040008403/864520040008411
HW Version	P2
SW Version	OPM1.171019.026 V10
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Frequency Range	2402 MHz ~ 2480 MHz
Number of Channels	40
Carrier Frequency of Each Channel	40 Channel(37 hopping + 3 advertising channel)
Antenna Type / Gain	PIFA Antenna with gain 0.8 dBi
Type of Modulation	Bluetooth LE : GFSK

1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 Re-use of Measured Data

1.6.1 Introduction Section

This application re-uses data collected on a similar device. The subject device of this application (Model: M1903C3GH, FCC ID: 2AFZZ-RMSC3GH) is electrically identical to the reference device (Model: M1903C3GG, FCC ID: 2AFZZ-RMSC3GG) for the portions of the circuitry corresponding to the data being re-used, as treated by KDB Publication 484596 D01.

1.6.2 Difference Section

For details concerning the similarity with respect to component placement, mechanical/electrical design etc., please refer to the Product Equality Declaration.

The re-used RF data includes the following bands provided in Appendix A (Sporton RF Report No. FR8O1122B for the reference device Model: M1903C3GG, FCC ID: 2AFZZ-RMSC3GG).

1.6.3 Reference detail Section:

Equipment Class	Reference FCC ID	Folder Test	Report Title/Section
DSS (BR/EDR)	2AFZZ-RMSC3GG	Part15C (FR8O1822A)	All sections applicable except Radiated Spurious Emission.
DTS (BLE)	2AFZZ-RMSC3GG	Part15C (FR8O1822B)	All sections applicable except Radiated Spurious Emission.
DTS (WLAN)	2AFZZ-RMSC3GG	Part15C (FR8O1822C)	All sections applicable except Radiated Spurious Emission.

1.6.4 Spot Check Verification Data Section

In order to confirm hardware similarity of the subject device with the reference device, spot check measurements were performed on the subject device for the following test items, the test result were consistent with FCC ID: 2AFZZ-RMSC3GG.

Assertions concerning the similarity of these devices are based on representations by the applicant. The applicant accepts full responsibility for the validity of the similarity claim, and for the determination that verification test data are sufficient to support it.

Test Item	Mode	2AFZZ-RMSC3GG Worst Result	2AFZZ-RMSC3GH Worst Result	Difference (dB)
Peak Conducted Power (dBm)	802.11b	19.72	19.69	0.03
	802.11g	23.15	23.08	0.07
	11n HT20	23.42	22.72	0.70
	BT (1Mbps)	11.65	11.43	0.22
	BT (2Mbps)	12.37	12.33	0.04
	BT (3Mbps)	12.89	12.46	0.43
	BT LE	1.68	1.65	0.03

1.7 Testing Location

Sporton Lab is accredited to ISO 17025 by National Voluntary Laboratory Accreditation Program (NVLAP code: 600155-0).

Test Site	Sporton International (Kunshan) Inc.		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone, Jiangsu Province 215335, China TEL : 86-512-57900158 FAX : 86-512-57900958		
Test Site No.	**Sporton Site No.**	**FCC designation No.**	**FCC Test Firm Registration No.**
	03CH02-KS	CN5013	630927

1.8 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR Part 15 Subpart C §15.247
- FCC KDB 558074 D01 15.247 Meas Guidance v05
- ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2 Test Configuration of Equipment Under Test

2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	0	2402	21	2444
	1	2404	22	2446
	2	2406	23	2448
	3	2408	24	2450
	4	2410	25	2452
	5	2412	26	2454
	6	2414	27	2456
	7	2416	28	2458
	8	2418	29	2460
	9	2420	30	2462
	10	2422	31	2464
	11	2424	32	2466
	12	2426	33	2468
	13	2428	34	2470
	14	2430	35	2472
	15	2432	36	2474
	16	2434	37	2476
	17	2436	38	2478
	18	2438	39	2480
	19	2440	-	-
	20	2442	-	-

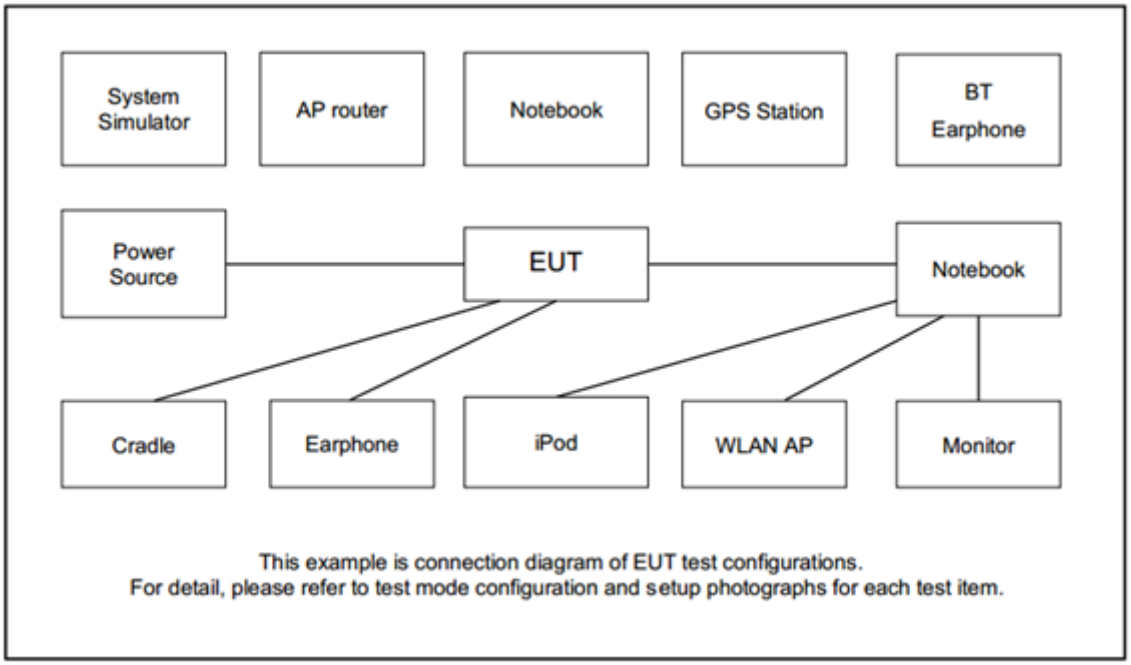
2.2 Test Mode

a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X plane) were recorded in this report.

The following summary table is showing all test modes to demonstrate in compliance with the standard.

Summary table of Test Cases	
Test Item	**Data Rate / Modulation**
	Bluetooth LE / GFSK
Radiated TCs	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps

2.3 Connection Diagram of Test System



2.4 EUT Operation Test Setup

For Bluetooth LE function, the engineering test program was provided and enabled to make EUT continuous transmit/receive.

3 Test Result

3.1 Radiated Band Edges and Spurious Emission Measurement

3.1.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

3.1.2 Measuring Instruments

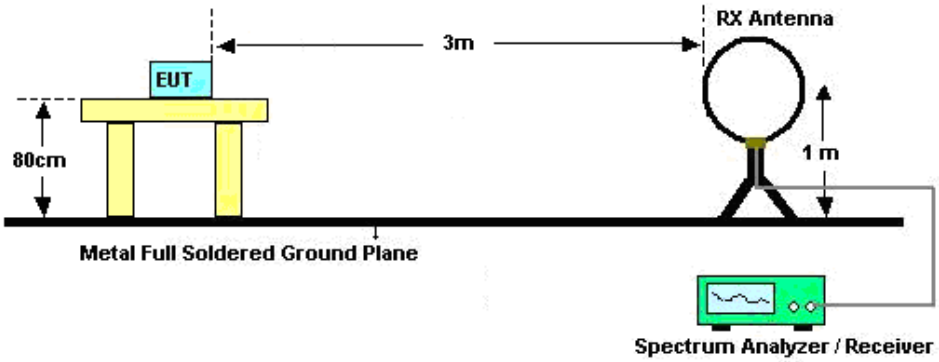
The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.1.3 Test Procedures

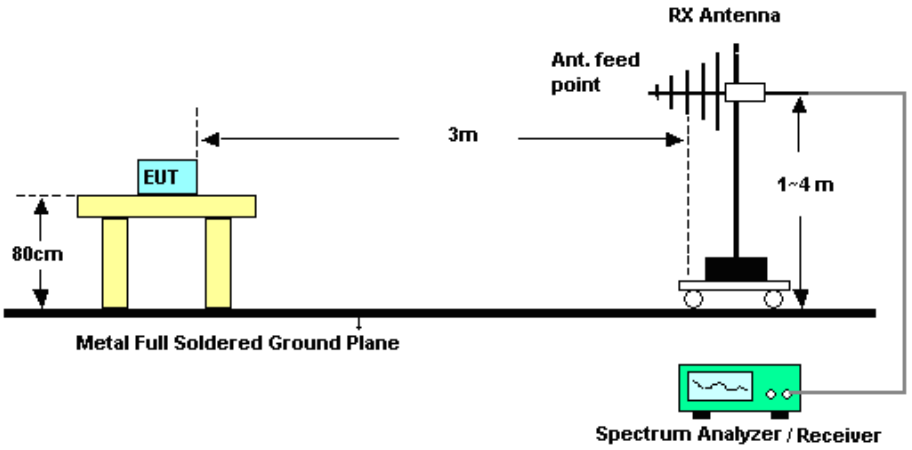
1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
8. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW=100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
   (3) Set RBW = 1 MHz, VBW= 3MHz for f ≥ 1 GHz for peak measurement.
   For average measurement:
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.1.4 Test Setup

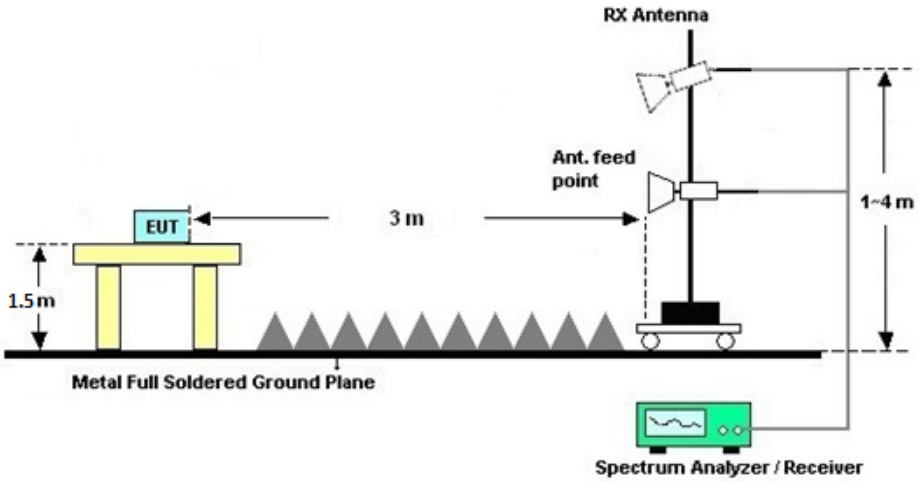
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.1.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.1.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A.

3.1.7 Duty Cycle

Please refer to Appendix B.

3.1.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix A.

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
EMI Test Receiver	R&S	ESR7	101403	9kHz~7GHz;Max 30dBm	Aug.06, 2018	Nov. 16, 2018~ Nov. 20, 2018	Aug.05, 2019	Radiation (03CH02-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55150208	10Hz-44G,MAX 30dB	Apr.17, 2018	Nov. 16, 2018~ Nov. 20, 2018	Apr. 16, 2019	Radiation (03CH02-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 19, 2018	Nov. 16, 2018~ Nov. 20, 2018	Oct. 18, 2019	Radiation (03CH02-KS)
Bilog Antenna	TeseQ	CBL6112D	23182	30MHz-2GHz	Jan. 29, 2018	Nov. 16, 2018~ Nov. 20, 2018	Jan. 28, 2019	Radiation (03CH02-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	75959	1GHz~18GHz	Jan. 21, 2018	Nov. 16, 2018~ Nov. 20, 2018	Jan. 20, 2019	Radiation (03CH02-KS)
high gain Amplifier	MITEQ	AMF-7D-00101800-30-10P	2025788	100MHz-18GHz	Apr.17, 2018	Nov. 16, 2018~ Nov. 20, 2018	Apr.16, 2019	Radiation (03CH02-KS)
SHF-EHF Horn	Schwarzbeck	BBHA 9170	BBHA170249	15GHz~40GHz	Feb. 07, 2018	Nov. 16, 2018~ Nov. 20, 2018	Feb. 06, 2019	Radiation (03CH02-KS)
Amplifier	SONOMA	310N	187289	9KHz-1GHz	Aug.06, 2018	Nov. 16, 2018~ Nov. 20, 2018	Aug. 05, 2019	Radiation (03CH02-KS)
Amplifier	Keysight	83017A	MY53270203	500MHz~26.5GHz	Apr.18, 2018	Nov. 16, 2018~ Nov. 20, 2018	Apr.17, 2019	Radiation (03CH02-KS)
Amplifier	MITEQ	TTA1840-35-HG	1887435	18~40GHz	Feb. 08, 2018	Nov. 16, 2018~ Nov. 20, 2018	Feb. 07, 2019	Radiation (03CH02-KS)
AC Power Source	Chroma	61601	616010002473	N/A	NCR	Nov. 16, 2018~ Nov. 20, 2018	NCR	Radiation (03CH02-KS)
Turn Table	MF	MF7802	N/A	0~360 degree	NCR	Nov. 16, 2018~ Nov. 20, 2018	NCR	Radiation (03CH02-KS)
Antenna Mast	MF	MF7802	N/A	1 m~4 m	NCR	Nov. 16, 2018~ Nov. 20, 2018	NCR	Radiation (03CH02-KS)

5 Uncertainty of Evaluation

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.3dB**

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.8dB**

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.8dB**

Appendix A. Radiated Spurious Emission

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 00 2402MHz		2314.29	46.79	-27.21	74	48.87	25.33	5.53	32.94	140	164	P	H
		2389.69	36.42	-17.58	54	38.19	25.6	5.63	33	140	164	A	H
	*	2402	92.14	-	-	93.94	25.6	5.63	33.03	140	164	P	H
	*	2402	91.08	-	-	92.88	25.6	5.63	33.03	140	164	A	H
		2379.16	46.42	-27.58	74	48.26	25.55	5.61	33	358	133	P	V
		2352.9	36.46	-17.54	54	38.35	25.49	5.59	32.97	358	133	A	V
	*	2402	90.57	-	-	92.37	25.6	5.63	33.03	358	133	P	V
	*	2402	90.02	-	-	91.82	25.6	5.63	33.03	358	133	A	V
BLE CH 39 2480MHz	*	2480	94.33	-	-	94.57	26.53	5.72	32.49	127	39	P	H
	*	2480	93.7	-	-	93.94	26.53	5.72	32.49	127	39	A	H
		2488.9	48.3	-25.7	74	48.34	26.71	5.74	32.49	127	39	P	H
		2483.51	40.32	-13.68	54	40.56	26.53	5.72	32.49	127	39	A	H
	*	2480	91.93	-	-	92.17	26.53	5.72	32.49	380	140	P	V
	*	2480	91.32	-	-	91.56	26.53	5.72	32.49	380	140	A	V
		2498.02	48.54	-25.46	74	48.4	26.71	5.74	32.31	380	140	P	V
		2483.51	39.43	-14.57	54	39.67	26.53	5.72	32.49	380	140	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

BLE	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BLE CH 00 2402MHz		4806	38.87	-35.13	74	63.32	30.88	8.43	63.76	100	0	P	H
		4806	37.9	-36.1	74	62.35	30.88	8.43	63.76	100	0	P	V
BLE CH 19 2440MHz		4878	38.58	-35.42	74	62.83	31.05	8.43	63.73	100	0	P	H
		7320	41.2	-32.8	74	59.93	35.56	10.08	64.37	100	0	P	H
		4878	38.98	-35.02	74	63.23	31.05	8.43	63.73	100	0	P	V
		7320	42.25	-31.75	74	60.98	35.56	10.08	64.37	100	0	P	V
BLE CH 39 2480MHz		4962	43.64	-30.36	74	67.62	31.27	8.44	63.69	100	0	P	H
		7440	41.77	-32.23	74	60.17	35.8	10.18	64.38	100	0	P	H
		4962	40.95	-33.05	74	63.32	31.27	8.44	62.08	100	0	P	V
		7440	42.05	-31.95	74	58.85	35.8	10.18	62.78	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

2.4GHz BLE (LF)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz BLE LF		34.85	21.42	-18.58	40	32.47	21.4	0.5	32.95	-	-	P	H
		398.6	23.63	-22.37	46	33.05	21.58	2.12	33.12	-	-	P	H
		490.75	21.52	-24.48	46	29.2	23.23	2.33	33.24	-	-	P	H
		656.62	23.37	-22.63	46	29.17	24.77	2.73	33.3	-	-	P	H
		746.83	25.67	-20.33	46	30.34	25.46	2.99	33.12	-	-	P	H
		957.32	27.94	-18.06	46	29.1	27.02	3.46	31.64	100	0	P	H
		30	24.09	-15.91	40	32.41	24.2	0.46	32.98	-	-	P	V
		40.67	25.17	-14.83	40	39.41	18.19	0.55	32.98	100	0	P	V
		47.46	24.91	-15.09	40	41.93	15.33	0.61	32.96	-	-	P	V
		408.3	23.72	-22.28	46	32.96	21.76	2.14	33.14	-	-	P	V
		716.76	25.76	-20.24	46	30.96	25.1	2.92	33.22	-	-	P	V
		966.05	29.5	-24.5	54	30.5	27.09	3.48	31.57	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Note symbol

*	**Fundamental Frequency** which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is **over limit** line.
P/A	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

A calculation example for radiated spurious emission is shown as below:

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Level(dBμV/m) =

Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

2. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

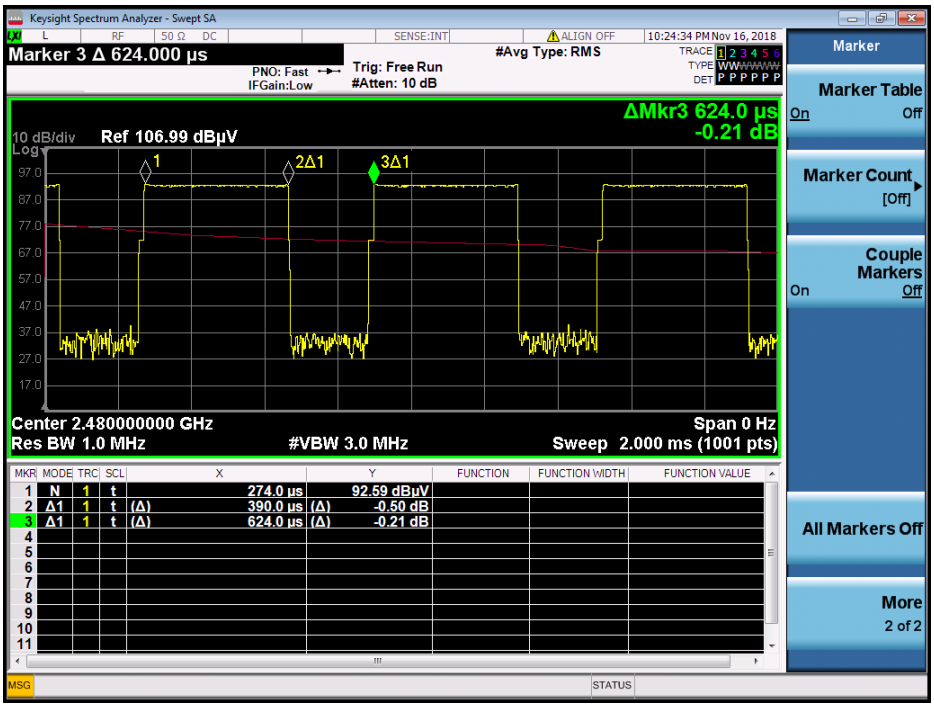
= -10.46(dB)

Both peak and average measured complies with the limit line, so test result is “PASS”.

Appendix B. Duty Cycle Plots

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
Bluetooth LE v4.0	62.50	0.390	2.564	2.7KHz

Bluetooth LE v4.0



Appendix D. Reference Report

Please refer to Sporton report number FR8O1822B which is issued separately.