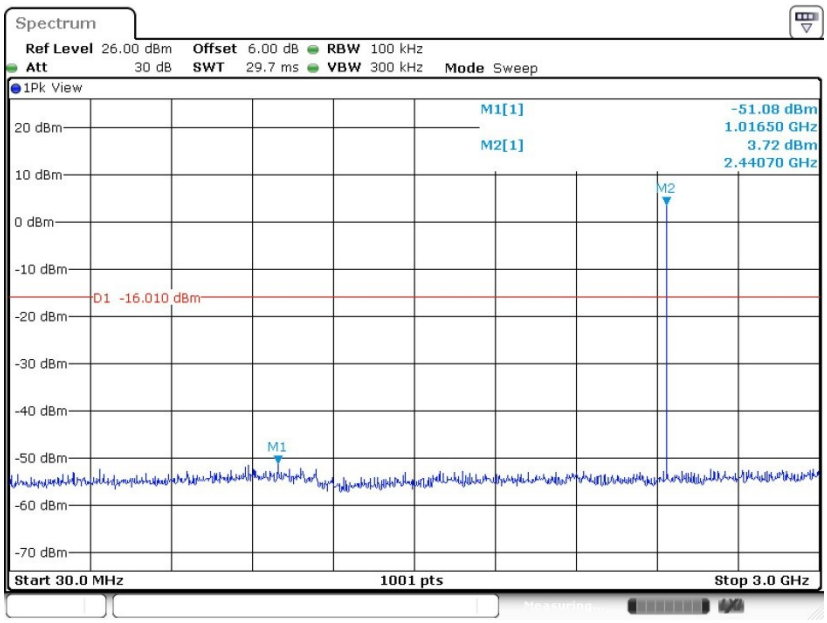
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps

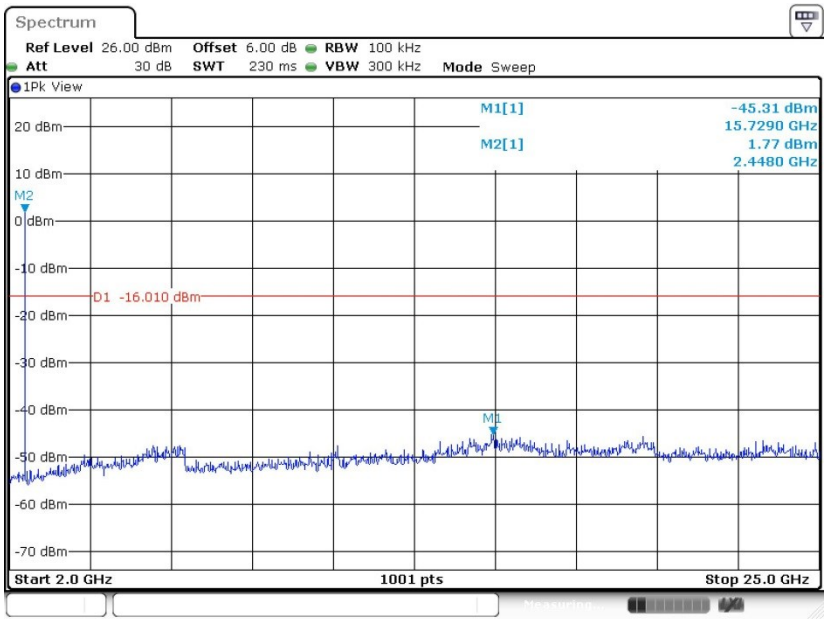
GFSK Channel 19



Date: 14.MAR.2020 04:40:47

Conducted Spurious Emission Plot on Bluetooth LE 1Mbps

GFSK Channel 19



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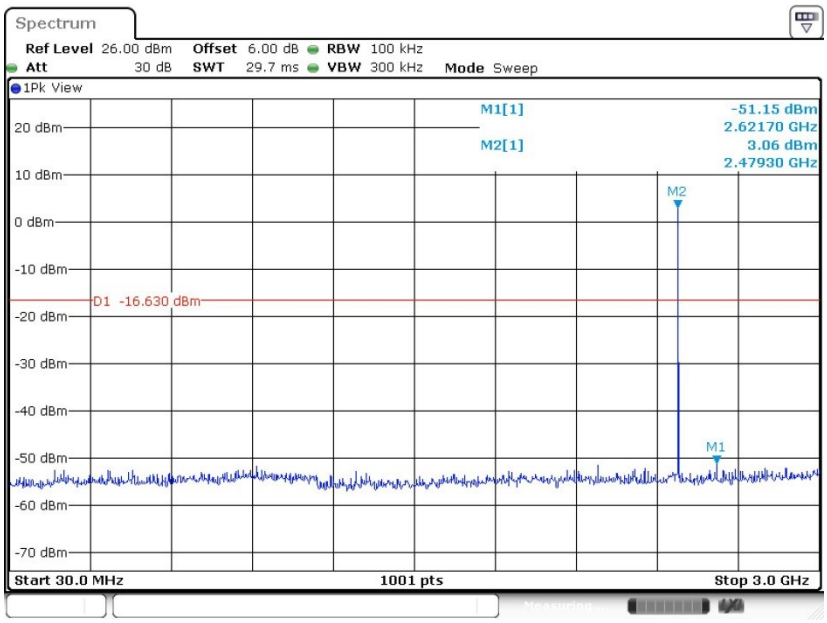
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps

GFSK Channel 39



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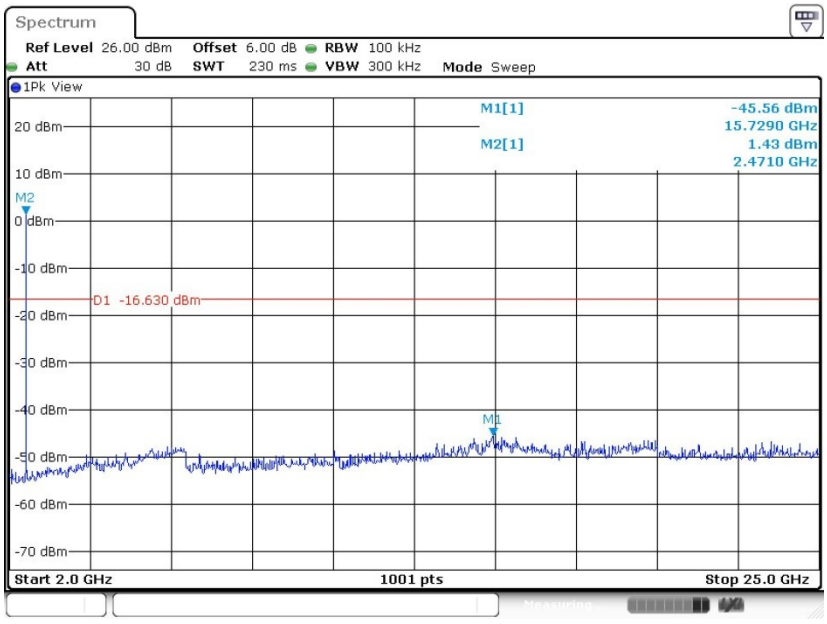
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps

GFSK Channel 39



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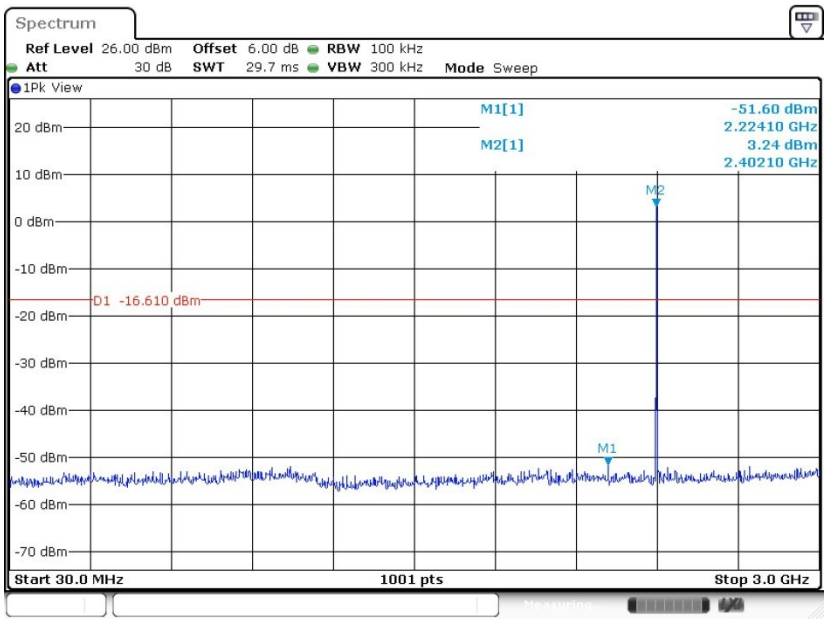
Bluetooth v5.0 LE

Conducted Spurious Emission Plot on Bluetooth LE 2Mbps

GFSK Channel 00



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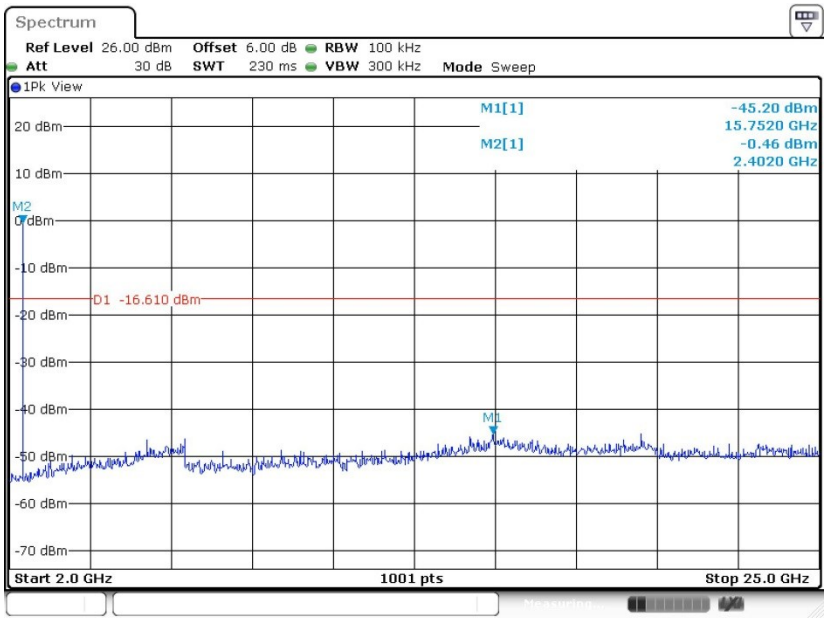
Conducted Spurious Emission Plot on Bluetooth LE 2Mbps

GFSK Channel 00



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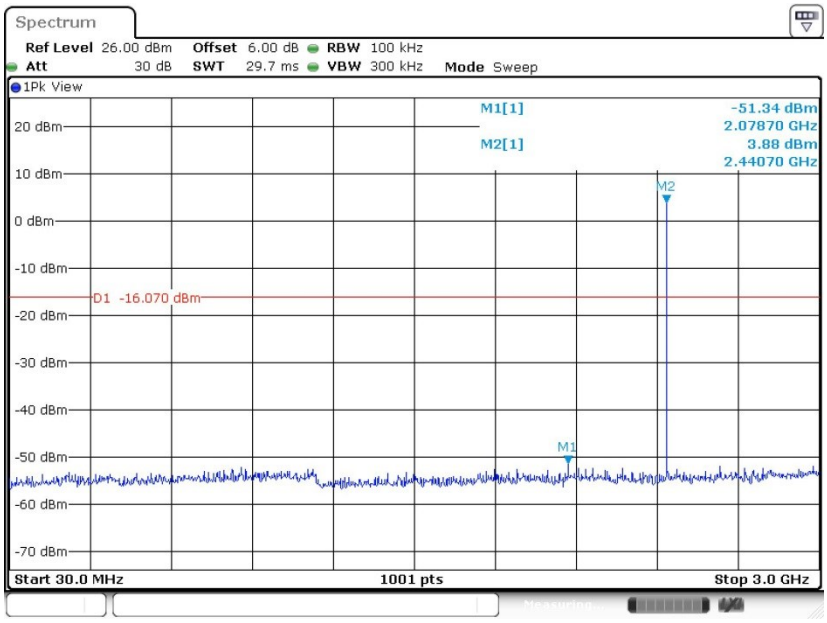
Conducted Spurious Emission Plot on Bluetooth LE 2Mbps

GFSK Channel 19



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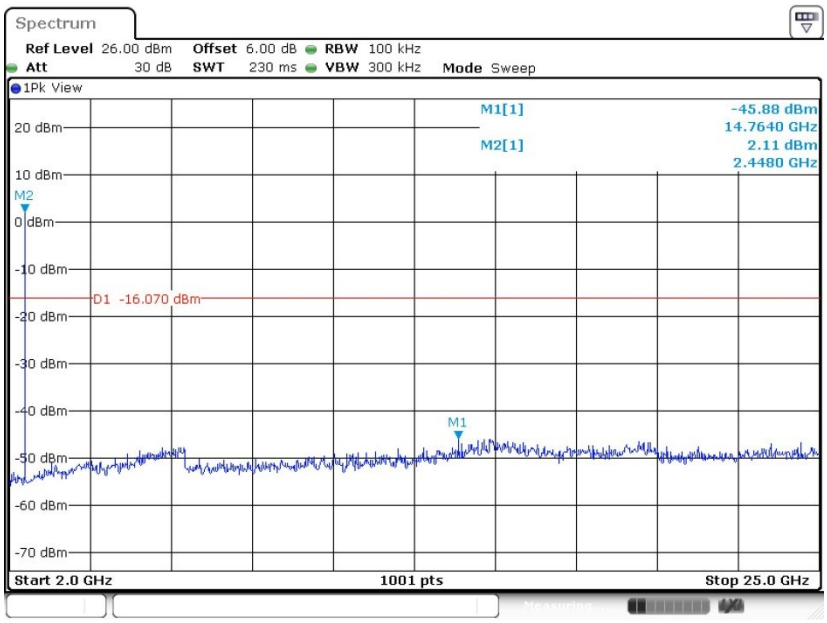
Conducted Spurious Emission Plot on Bluetooth LE 2Mbps

GFSK Channel 19



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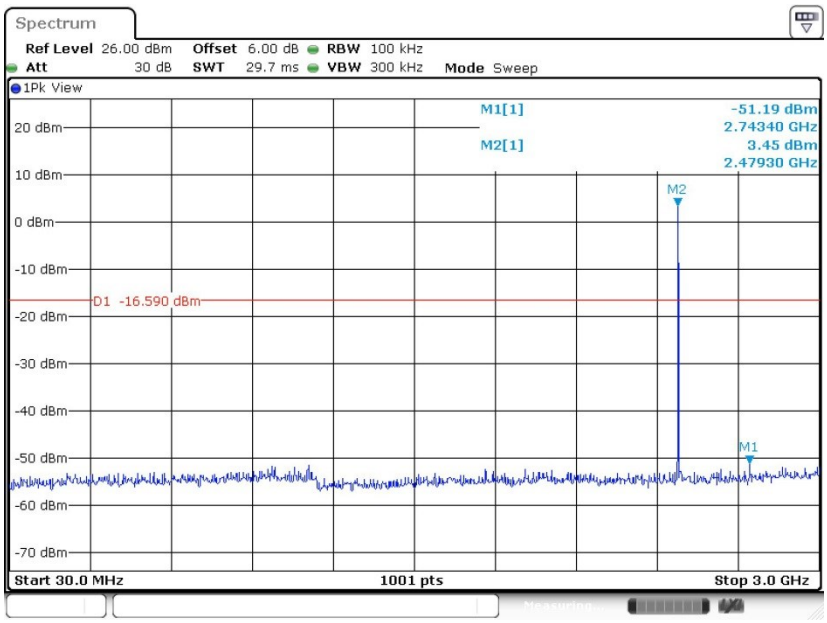
Conducted Spurious Emission Plot on Bluetooth LE 2Mbps

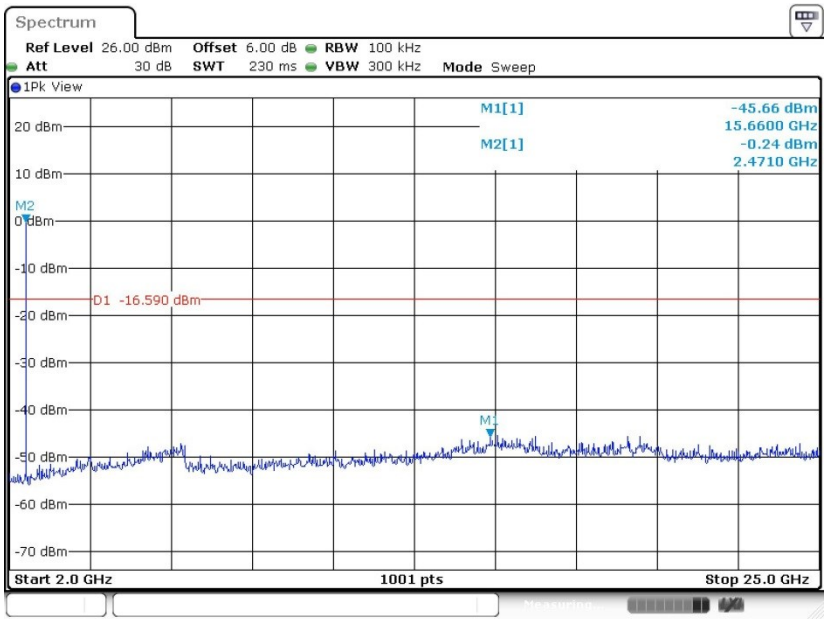
GFSK Channel 39



Date: 14.MAR.2020 04:50:23

Conducted Spurious Emission Plot on Bluetooth LE 2Mbps

GFSK Channel 39



Date: 14.MAR.2020 04:50:31

3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 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

3.5.2 Measuring Instruments

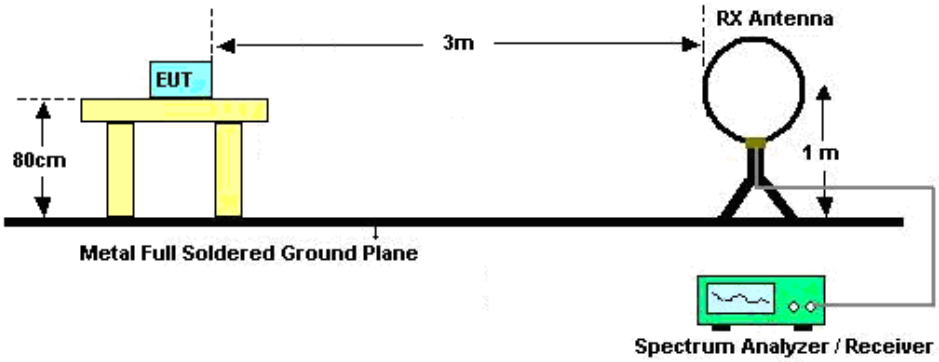
The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.5.3 Test Procedures

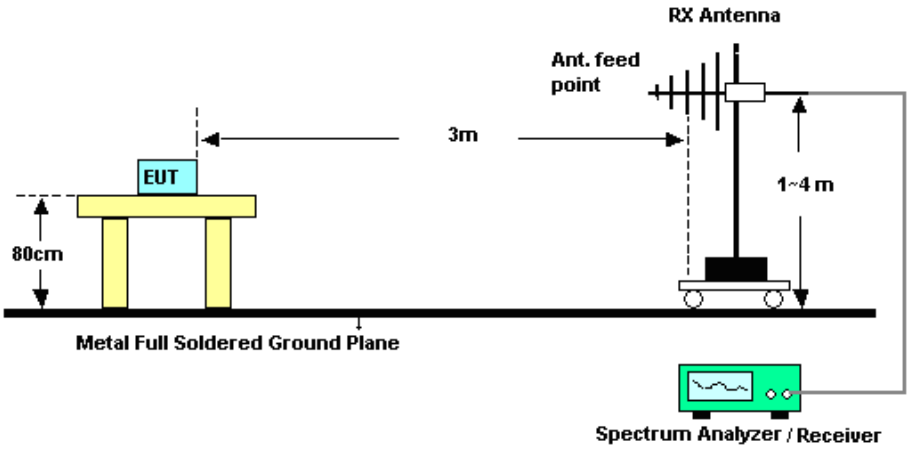
1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better 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.

3.5.4 Test Setup

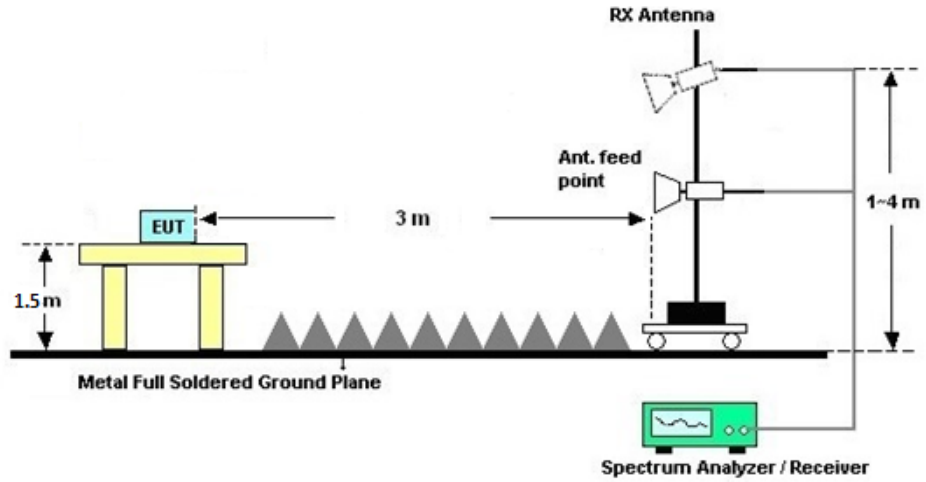
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.5.5 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.

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C.

3.5.7 Duty Cycle

Please refer to Appendix D.

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

Please refer to Appendix C.

3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

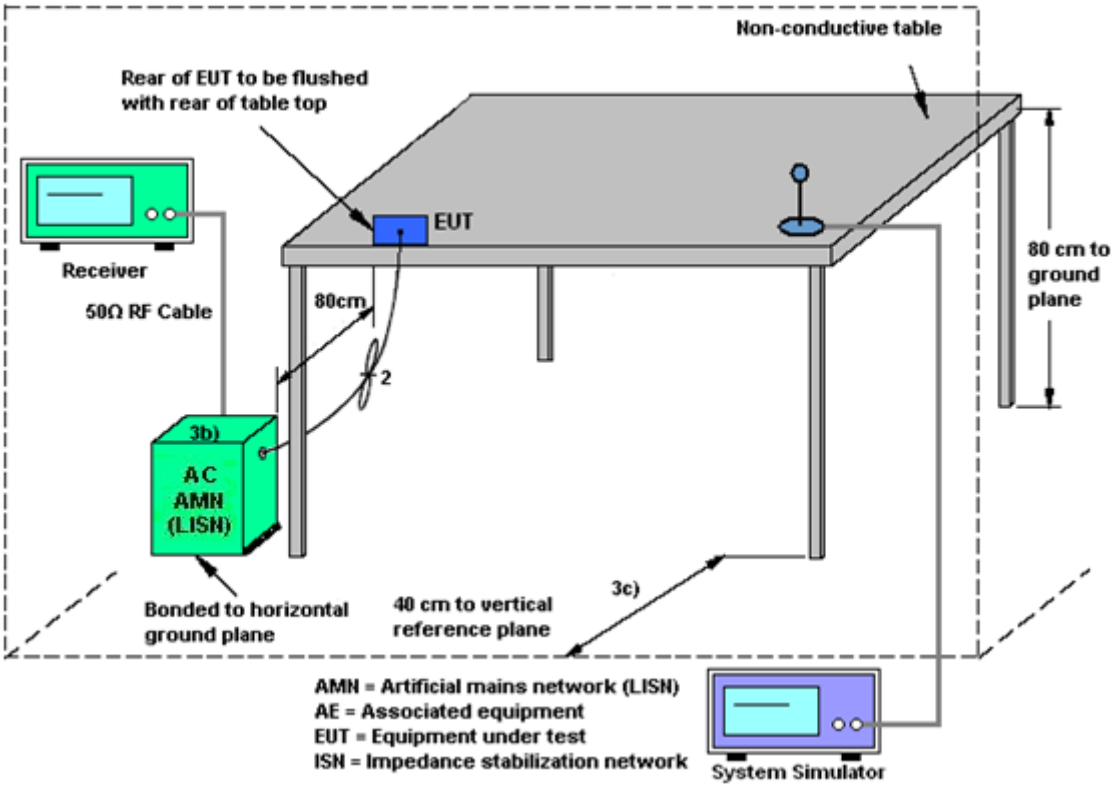
3.6.2 Measuring Instruments

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

3.6.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

3.6.4 Test Setup



3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.7 Antenna Requirements

3.7.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. 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 rule.

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.7.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101040	10Hz~40GHz	Nov. 02, 2019	Mar. 14, 2020	Nov. 01, 2020	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 13, 2020	Mar. 14, 2020	Jan. 12, 2021	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 13, 2020	Mar. 14, 2020	Jan. 12, 2021	Conducted (TH01-KS)
EMI Test Receiver	Keysight	N9038A	MY57290157	3Hz~8.5GHz;Max 30dBm	Jul. 18, 2019	Feb. 26, 2020	Jul. 17, 2020	Radiation (03CH06-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55150208	10Hz-44GHz	Apr. 16, 2019	Feb. 26, 2020	Apr. 15, 2020	Radiation (03CH06-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Nov. 10, 2019	Feb. 26, 2020	Nov. 09, 2020	Radiation (03CH06-KS)
Bilog Antenna	TeseQ	CBL6111D	49921	30MHz-1GHz	May 30, 2019	Feb. 26, 2020	May 29, 2020	Radiation (03CH06-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00218652	1GHz~18GHz	Apr. 27, 2019	Feb. 26, 2020	Apr. 26, 2020	Radiation (03CH06-KS)
SHF-EHF Horn	Com-power	AH-840	101115	18GHz~40GHz	Nov. 10, 2019	Feb. 26, 2020	Nov. 09, 2020	Radiation (03CH06-KS)
Amplifier	SONOMA	310N	187289	9KHz ~1GHZ	Aug. 06, 2019	Feb. 26, 2020	Aug. 05, 2020	Radiation (03CH06-KS)
Amplifier	MITEQ	EM18G40GGA	060728	18~40GHz	Jan. 08, 2020	Feb. 26, 2020	Jan. 07, 2021	Radiation (03CH06-KS)
high gain Amplifier	MITEQ	AMF-7D-00101800-30-10P	2025788	1Ghz-18Ghz	Aug. 16, 2019	Feb. 26, 2020	Aug. 15, 2020	Radiation (03CH06-KS)
Amplifier	Keysight	83017A	MY53270203	500MHz~26.5GHz	Apr. 15, 2019	Feb. 26, 2020	Apr. 14, 2020	Radiation (03CH06-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Feb. 26, 2020	NCR	Radiation (03CH06-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Feb. 26, 2020	NCR	Radiation (03CH06-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Feb. 26, 2020	NCR	Radiation (03CH06-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	Apr. 16, 2019	Mar. 07, 2020	Apr. 15, 2020	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 18, 2019	Mar. 07, 2020	Oct. 17, 2020	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060105	9kHz~30MHz	Oct. 28, 2019	Mar. 07, 2020	Oct. 27, 2020	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP000000811	AC 0V~300V, 45Hz~1000Hz	Oct. 18, 2019	Mar. 07, 2020	Oct. 17, 2020	Conduction (CO01-KS)

NCR: No Calibration Required

5 Uncertainty of Evaluation

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.9 dB**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.0 dB**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.0 dB**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.0 dB**

Appendix A. Conducted Test Results

Report Number : FR010812B

Bluetooth v4.2 Low Energy

Test Engineer:	Asa Cheng	Temperature:	20~26	°C
Test Date:	2020/3/14	Relative Humidity:	40~51	%

TEST RESULTS DATA
6dB and 99% Occupied Bandwidth

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
BLE	1Mbps	1	0	2402	1.015	0.67	0.50	Pass
BLE	1Mbps	1	19	2440	1.017	0.67	0.50	Pass
BLE	1Mbps	1	39	2480	1.015	0.67	0.50	Pass

TEST RESULTS DATA
Peak Power Table

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	1Mbps	1	0	2402	3.77	30.00	-5.00	-1.23	36.00	Pass
BLE	1Mbps	1	19	2440	4.43	30.00	-5.00	-0.57	36.00	Pass
BLE	1Mbps	1	39	2480	3.97	30.00	-5.00	-1.03	36.00	Pass

TEST RESULTS DATA
Average Power Table
(Reporting Only)

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)
BLE	1Mbps	1	0	2402	2.07	3.09
BLE	1Mbps	1	19	2440	2.07	3.85
BLE	1Mbps	1	39	2480	2.07	3.65

TEST RESULTS DATA
Peak Power Density

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak PSD (dBm /100kHz)	Peak PSD (dBm /3kHz)	DG (dBi)	Peak PSD Limit (dBm /3kHz)	Pass/Fail
BLE	1Mbps	1	0	2402	3.26	-11.22	-5.00	8.00	Pass
BLE	1Mbps	1	19	2440	3.99	-10.59	-5.00	8.00	Pass
BLE	1Mbps	1	39	2480	3.37	-11.09	-5.00	8.00	Pass

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 20dBc limit.

Report Number : FR010812B

Bluetooth v5.0 Low Energy

Test Engineer:	Asa Cheng	Temperature:	20~26	°C
Test Date:	2020/3/14	Relative Humidity:	40~51	%

TEST RESULTS DATA
6dB and 99% Occupied Bandwidth

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
BLE	1Mbps	1	0	1000	1.988	1.14	0.50	Pass
BLE	1Mbps	1	19	2440	1.988	1.14	0.50	Pass
BLE	1Mbps	1	39	2480	1.983	1.14	0.50	Pass

TEST RESULTS DATA
Peak Power Table

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	1Mbps	1	0	2402	3.99	30.00	-5.00	-1.01	36.00	Pass
BLE	1Mbps	1	19	2440	4.77	30.00	-5.00	-0.23	36.00	Pass
BLE	1Mbps	1	39	2480	4.21	30.00	-5.00	-0.79	36.00	Pass

TEST RESULTS DATA
Average Power Table
(Reporting Only)

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)
BLE	1Mbps	1	0	2402	4.89	3.50
BLE	1Mbps	1	19	2440	4.89	3.86
BLE	1Mbps	1	39	2480	4.89	3.55

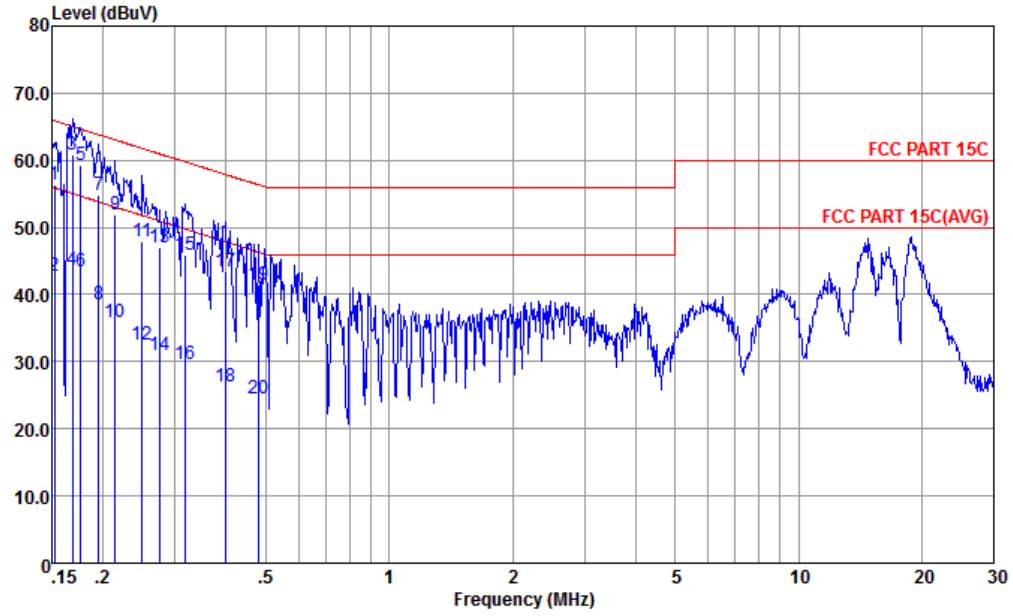
TEST RESULTS DATA
Peak Power Density

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak PSD (dBm /100kHz)	Peak PSD (dBm /3kHz)	DG (dBi)	Peak PSD Limit (dBm /3kHz)	Pass/Fail
BLE	1Mbps	1	0	2402	3.39	-14.13	-5.00	8.00	Pass
BLE	1Mbps	1	19	2440	3.93	-13.58	-5.00	8.00	Pass
BLE	1Mbps	1	39	2480	3.41	-13.91	-5.00	8.00	Pass

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 20dBc limit.

Appendix B. AC Conducted Emission Test Results

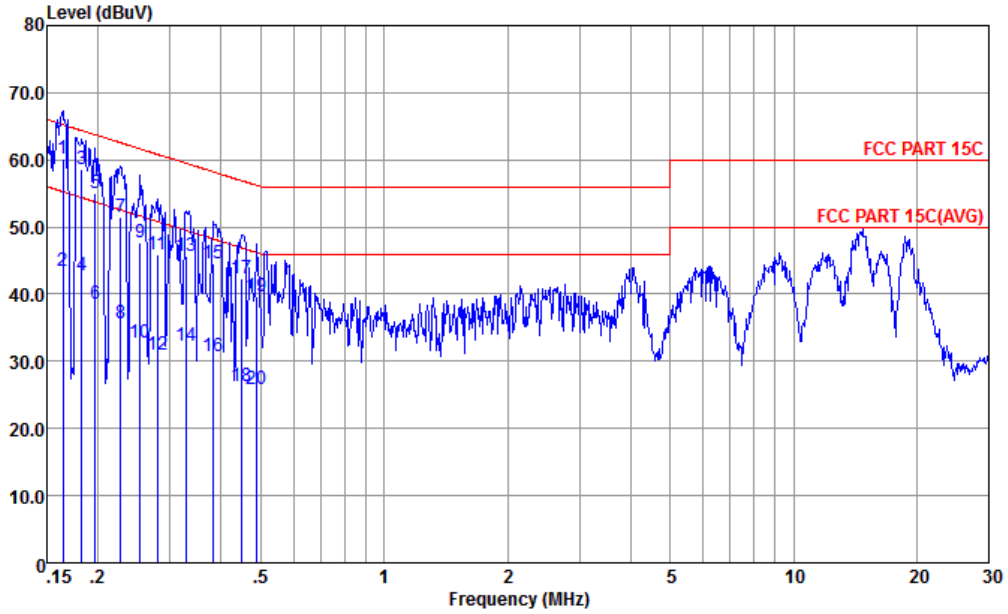
Test Engineer :	Amos Zhang	**Temperature :**	25.3~26.2℃
		Relative Humidity :	38~40%
Test Voltage :	120Vac / 60Hz	**Phase :**	Line
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Site : CO01-KS
Condition : FCC PART 15C LISN-L-191028-060105 LINE

		Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
		MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1		0.152	56.40	-9.47	65.87	45.90	0.03	10.47	QP
2		0.152	42.80	-13.07	55.87	32.30	0.03	10.47	Average
3	*	0.169	60.77	-4.26	65.03	50.31	0.03	10.43	QP
4		0.169	43.77	-11.26	55.03	33.31	0.03	10.43	Average
5		0.177	59.35	-5.29	64.64	48.90	0.04	10.41	QP
6		0.177	43.35	-11.29	54.64	32.90	0.04	10.41	Average
7		0.195	54.91	-8.89	63.80	44.50	0.04	10.37	QP
8		0.195	38.51	-15.29	53.80	28.10	0.04	10.37	Average
9		0.214	51.90	-11.15	63.05	41.51	0.04	10.35	QP
10		0.214	35.90	-17.15	53.05	25.51	0.04	10.35	Average
11		0.249	47.98	-13.80	61.78	37.61	0.04	10.33	QP
12		0.249	32.48	-19.30	51.78	22.11	0.04	10.33	Average
13		0.276	46.97	-13.97	60.94	36.60	0.05	10.32	QP
14		0.276	30.97	-19.97	50.94	20.60	0.05	10.32	Average
15		0.317	45.85	-13.95	59.80	35.50	0.05	10.30	QP
16		0.317	29.55	-20.25	49.80	19.20	0.05	10.30	Average
17		0.400	43.52	-14.34	57.86	33.19	0.06	10.27	QP
18		0.400	26.22	-21.64	47.86	15.89	0.06	10.27	Average
19		0.481	41.50	-14.82	56.32	31.20	0.06	10.24	QP
20		0.481	24.50	-21.82	46.32	14.20	0.06	10.24	Average

Test Engineer :	Amos Zhang	**Temperature :**	25.3~26.2℃
		Relative Humidity :	38~40%
Test Voltage :	120Vac / 60Hz	**Phase :**	Neutral
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Site : CO01-KS
Condition : FCC PART 15C LISN-N-191028-060105 NEUTRAL

		Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
		MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	*	0.164	60.12	-5.13	65.25	49.60	0.08	10.44	QP
2		0.164	43.42	-11.83	55.25	32.90	0.08	10.44	Average
3		0.182	58.68	-5.69	64.37	48.20	0.08	10.40	QP
4		0.182	42.68	-11.69	54.37	32.20	0.08	10.40	Average
5		0.197	54.95	-8.81	63.76	44.50	0.08	10.37	QP
6		0.197	38.65	-15.11	53.76	28.20	0.08	10.37	Average
7		0.227	51.53	-11.04	62.57	41.10	0.08	10.35	QP
8		0.227	35.63	-16.94	52.57	25.20	0.08	10.35	Average
9		0.253	47.72	-13.92	61.64	37.30	0.09	10.33	QP
10		0.253	32.72	-18.92	51.64	22.30	0.09	10.33	Average
11		0.279	46.01	-14.84	60.85	35.60	0.09	10.32	QP
12		0.279	30.91	-19.94	50.85	20.50	0.09	10.32	Average
13		0.329	45.68	-13.81	59.49	35.30	0.09	10.29	QP
14		0.329	32.28	-17.21	49.49	21.90	0.09	10.29	Average
15		0.381	44.57	-13.68	58.25	34.21	0.09	10.27	QP
16		0.381	30.67	-17.58	48.25	20.31	0.09	10.27	Average
17		0.447	42.45	-14.48	56.93	32.10	0.10	10.25	QP
18		0.447	26.25	-20.68	46.93	15.90	0.10	10.25	Average
19		0.489	39.64	-16.55	56.19	29.30	0.10	10.24	QP
20		0.489	25.84	-20.35	46.19	15.50	0.10	10.24	Average

Note:

1. Level(dBμV) = Read Level(dBμV) + LISN Factor(dB) + Cable Loss(dB)
2. Over Limit(dB) = Level(dBμV) – Limit Line(dBμV)

Appendix C. Radiated Spurious Emission

Bluetooth v4.2 LE

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		2314.16	54.06	-19.94	74	48.73	31.15	6.89	32.71	298	139	P	H
		2388.91	43.93	-10.07	54	38.32	31.2	7.04	32.63	298	139	A	H
	*	2402	93.13	-	-	87.51	31.2	7.04	32.62	298	139	P	H
	*	2402	92.58	-	-	86.96	31.2	7.04	32.62	298	139	A	H
		2312.47	54.54	-19.46	74	49.21	31.15	6.89	32.71	149	83	P	V
		2385.27	43.91	-10.09	54	38.34	31.19	7.01	32.63	149	83	A	V
	*	2402	94	-	-	88.38	31.2	7.04	32.62	149	83	P	V
	*	2402	93.53	-	-	87.91	31.2	7.04	32.62	149	83	A	V
BLE CH 39 2480MHz		2489.56	54.33	-19.67	74	47.86	31.89	7.18	32.6	317	136	P	H
		2483.56	44.69	-9.31	54	38.36	31.77	7.16	32.6	317	136	A	H
	*	2480	94.76	-	-	88.43	31.77	7.16	32.6	317	136	P	H
	*	2480	94.15	-	-	87.82	31.77	7.16	32.6	317	136	A	H
		2495.92	54.48	-19.52	74	48.01	31.89	7.18	32.6	307	160	P	V
		2485.66	44.63	-9.37	54	38.3	31.77	7.16	32.6	307	160	A	V
	*	2480	94.43	-	-	88.1	31.77	7.16	32.6	307	160	P	V
	*	2480	93.89	-	-	87.56	31.77	7.16	32.6	307	160	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	39.6	-34.4	74	58.65	33.7	9.81	62.56	100	360	P	H
		4806	38.87	-35.13	74	57.92	33.7	9.81	62.56	100	360	P	V
BLE CH 19 2440MHz		4878	39.12	-34.88	74	57.94	33.77	9.95	62.54	100	360	P	H
		7320	41.4	-32.6	74	56.52	35.89	12.64	63.65	100	360	P	H
		4878	38.03	-35.97	74	56.85	33.77	9.95	62.54	100	360	P	V
		7320	40.63	-33.37	74	55.75	35.89	12.64	63.65	100	360	P	V
BLE CH 39 2480MHz		4962	39.26	-34.74	74	57.79	33.85	10.13	62.51	100	360	P	H
		7440	39	-35	74	54.82	36.11	12.84	64.77	100	360	P	H
		4962	39.22	-34.78	74	57.75	33.85	10.13	62.51	100	360	P	V
		7440	39.62	-34.38	74	55.44	36.11	12.84	64.77	100	360	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		36.79	19.54	-20.46	40	29.64	21.14	0.72	31.96	-	-	P	H
		103.72	23.48	-20.02	43.5	37.96	16.28	1.17	31.93	-	-	P	H
		150.28	23.15	-20.35	43.5	36.49	17.2	1.4	31.94	-	-	P	H
		236.61	24.38	-21.62	46	36.79	17.73	1.8	31.94	-	-	P	H
		268.62	22.8	-23.2	46	33.98	18.92	1.9	32	-	-	P	H
		904.94	27.89	-18.11	46	26.47	29.37	3.46	31.41	100	0	P	H
		37.76	33.46	-6.54	40	44.05	20.66	0.71	31.96	100	0	P	V
		43.58	31.65	-8.35	40	45.31	17.54	0.75	31.95	-	-	P	V
		95.96	31	-12.5	43.5	46.08	15.72	1.13	31.93	-	-	P	V
		145.43	21.23	-22.27	43.5	34.72	17.1	1.35	31.94	-	-	P	V
		252.13	18.59	-27.41	46	29.96	18.72	1.87	31.96	-	-	P	V
		951.5	28.45	-17.55	46	24.99	30.88	3.55	30.97	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Bluetooth v5.0 LE

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		2381.37	53.7	-20.3	74	48.15	31.19	7.01	32.65	300	128	P	H
		2383.19	44.39	-9.61	54	38.82	31.19	7.01	32.63	300	128	A	H
	*	2402	93.26	-	-	87.64	31.2	7.04	32.62	300	128	P	H
	*	2402	90.88	-	-	85.26	31.2	7.04	32.62	300	128		H
		2345.23	53.4	-20.6	74	47.95	31.17	6.95	32.67	100	64	P	V
		2365.51	44.2	-9.8	54	38.69	31.18	6.98	32.65	100	64	A	V
	*	2402	93.27	-	-	87.65	31.2	7.04	32.62	100	64	P	V
	*	2402	91.82	-	-	86.2	31.2	7.04	32.62	100	64		V
BLE CH 39 2480MHz		2497.18	54.98	-19.02	74	48.51	31.89	7.18	32.6	316	137	P	H
		2483.5	45.97	-8.03	54	39.64	31.77	7.16	32.6	316	137	A	H
	*	2480	95.09	-	-	88.76	31.77	7.16	32.6	316	137	P	H
	*	2480	93.82	-	-	87.49	31.77	7.16	32.6	316	137	A	H
		2483.92	55.46	-18.54	74	49.13	31.77	7.16	32.6	140	85	P	V
		2483.5	46.79	-7.21	54	40.46	31.77	7.16	32.6	140	85	A	V
	*	2480	95.76	-	-	89.43	31.77	7.16	32.6	140	85	P	V
	*	2480	94.26	-	-	87.93	31.77	7.16	32.6	140	85	A	V
Remark	3. No other spurious found. 4. 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	40	-34	74	59.05	33.7	9.81	62.56	100	360	P	H
		4806	39.26	-34.74	74	58.31	33.7	9.81	62.56	100	360	P	V
BLE CH 19 2440MHz		4878	38.75	-35.25	74	57.57	33.77	9.95	62.54	100	360	P	H
		7320	41.22	-32.78	74	56.34	35.89	12.64	63.65	100	360	P	H
		4878	40.32	-33.68	74	59.14	33.77	9.95	62.54	100	360	P	V
		7320	41.81	-32.19	74	56.93	35.89	12.64	63.65	100	360	P	V
BLE CH 39 2480MHz		4962	38.44	-35.56	74	56.97	33.85	10.13	62.51	100	360	P	H
		7440	39.56	-34.44	74	55.38	36.11	12.84	64.77	100	360	P	H
		4962	38.81	-35.19	74	57.34	33.85	10.13	62.51	100	360	P	V
		7440	38.86	-35.14	74	54.68	36.11	12.84	64.77	100	360	P	V
Remark	3. No other spurious found. 4. 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		36.79	17.87	-22.13	40	27.97	21.14	0.72	31.96	-	-	P	H
		194.9	19.43	-24.07	43.5	34.4	15.31	1.62	31.9	-	-	P	H
		214.3	21.8	-21.7	43.5	35.88	16.14	1.7	31.92	-	-	P	H
		270.56	20.29	-25.71	46	31.44	18.95	1.91	32.01	-	-	P	H
		768.17	27.71	-18.29	46	28.33	28.39	3.19	32.2	100	0	P	H
		970.9	30.5	-23.5	54	26.99	30.73	3.57	30.79	-	-	P	H
		43.58	19.14	-20.86	40	19.14	0	0	0	-	-	P	V
		52.31	26.51	-13.49	40	26.51	0	0	0	-	-	P	V
		108.57	21.04	-22.46	43.5	35.4	16.37	1.2	31.93	-	-	P	V
		200.72	21.86	-21.64	43.5	36.95	15.17	1.64	31.9	-	-	P	V
		749.74	26.69	-19.31	46	27.3	28.5	3.14	32.25	-	-	P	V
		939.86	29.62	-16.38	46	26.6	30.57	3.53	31.08	-	-	P	V
Remark	3. No other spurious found. 4. 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)

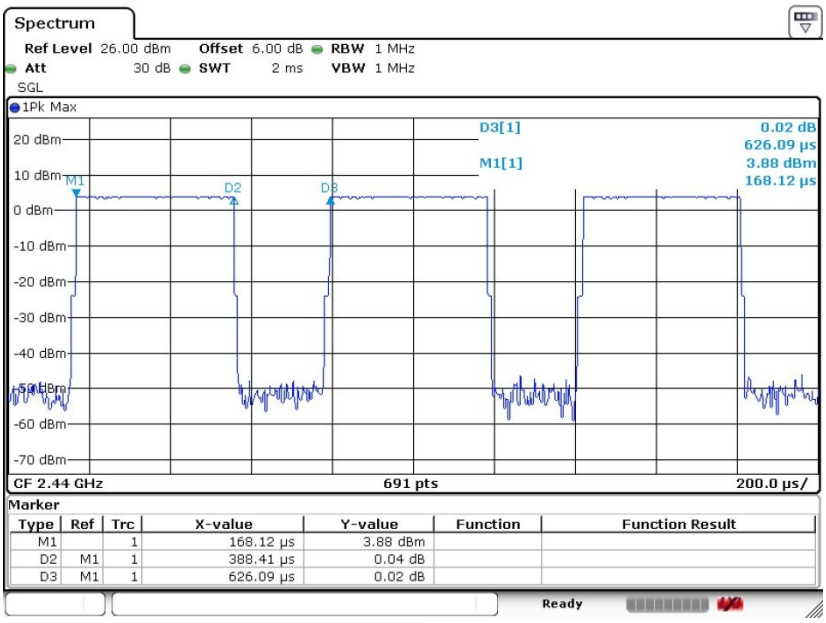
= -10.46(dB)

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

Appendix D. Duty Cycle Plots

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
Bluetooth LE v4.2	62.04	0.388	2.575	2.7KHz
Bluetooth LE v5.0	32.41	0.203	4.929	5.1KHz

Bluetooth LE v4.2



Bluetooth LE v5.0