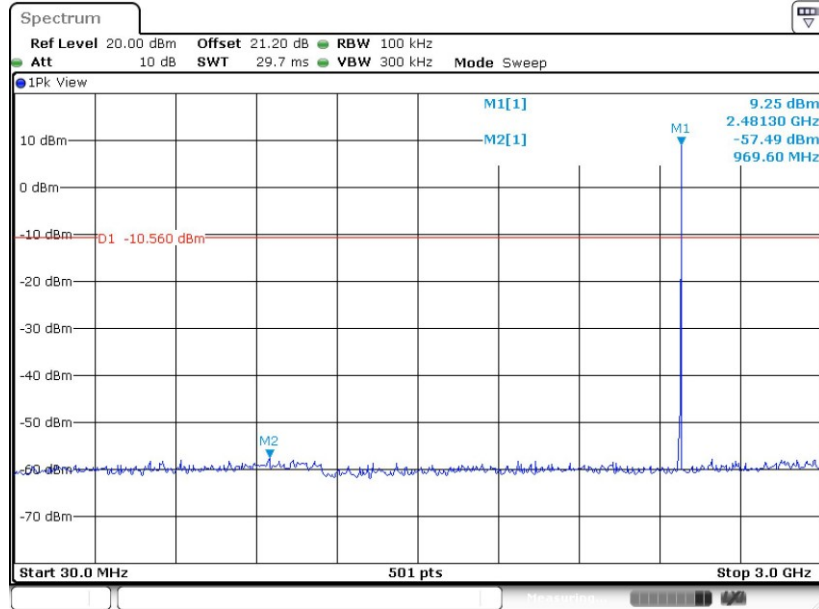


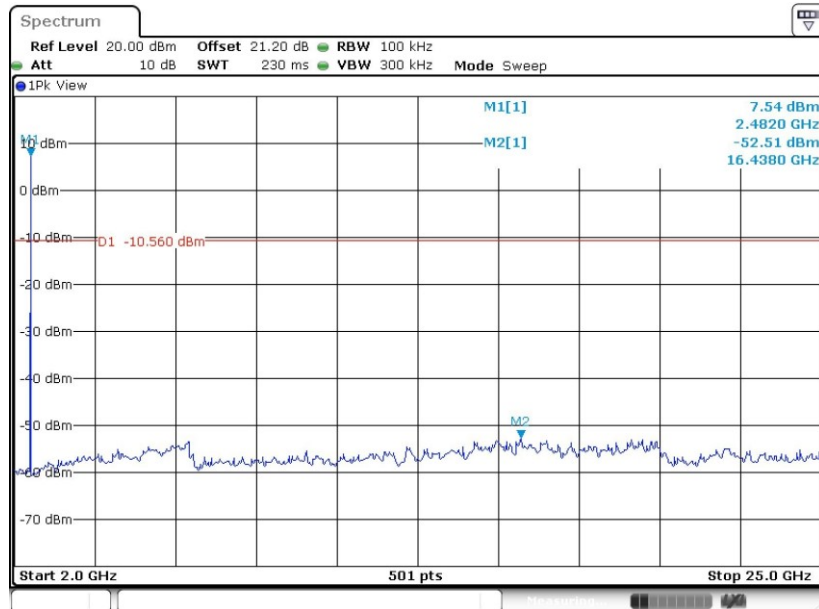


Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 39



Date: 31.JAN.2021 09:27:17

Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 39

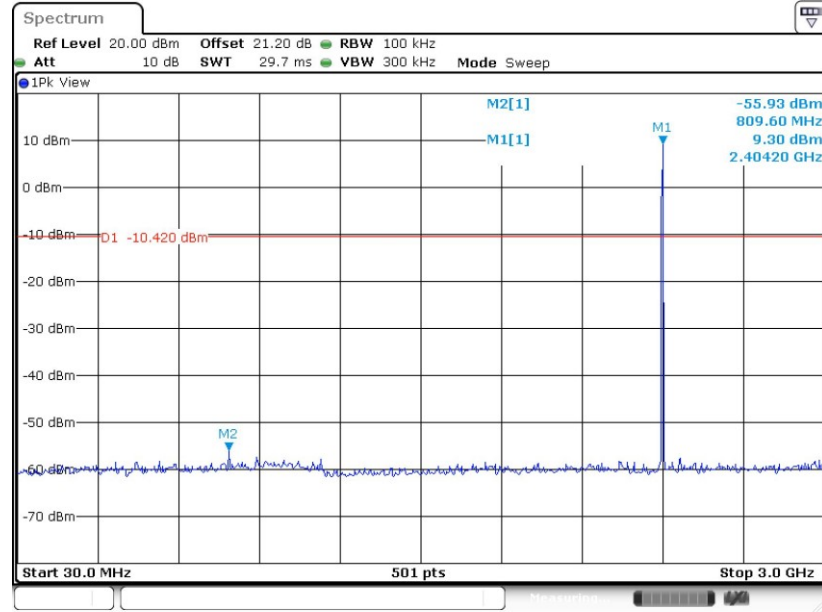


Date: 31.JAN.2021 09:27:35



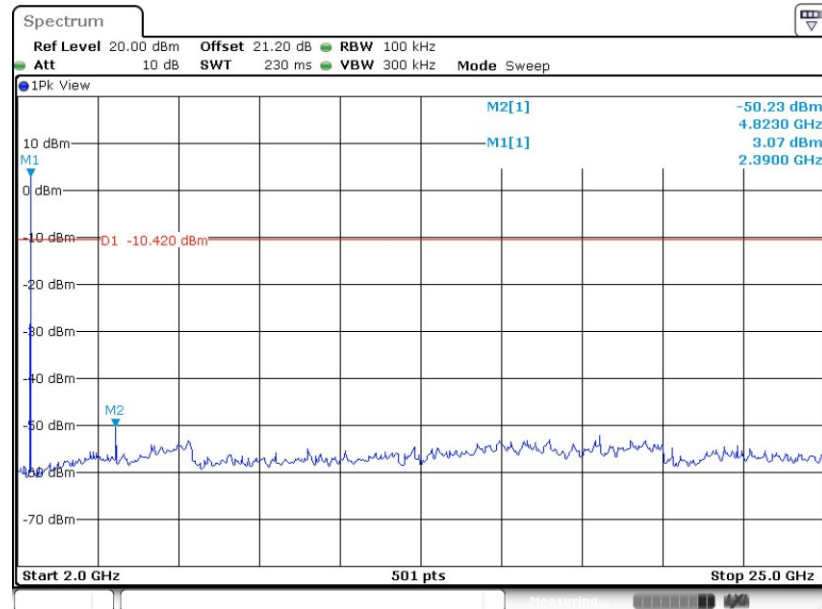
Bluetooth v5.1 LE:

Conducted Spurious Emission Plot on Bluetooth LE 2Mbps
GFSK Channel 00



Date: 31.JAN.2021 09:32:13

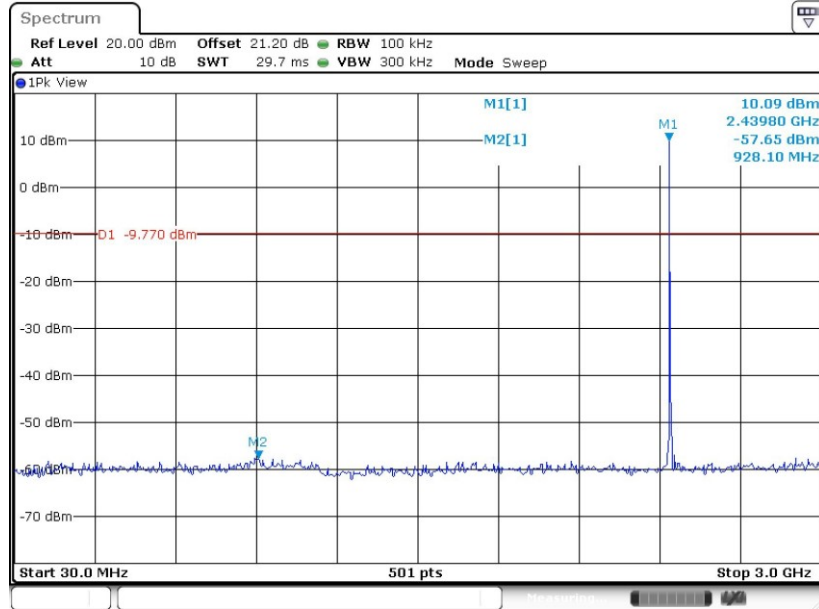
Conducted Spurious Emission Plot on Bluetooth LE 2Mbps
GFSK Channel 00



Date: 31.JAN.2021 09:32:26

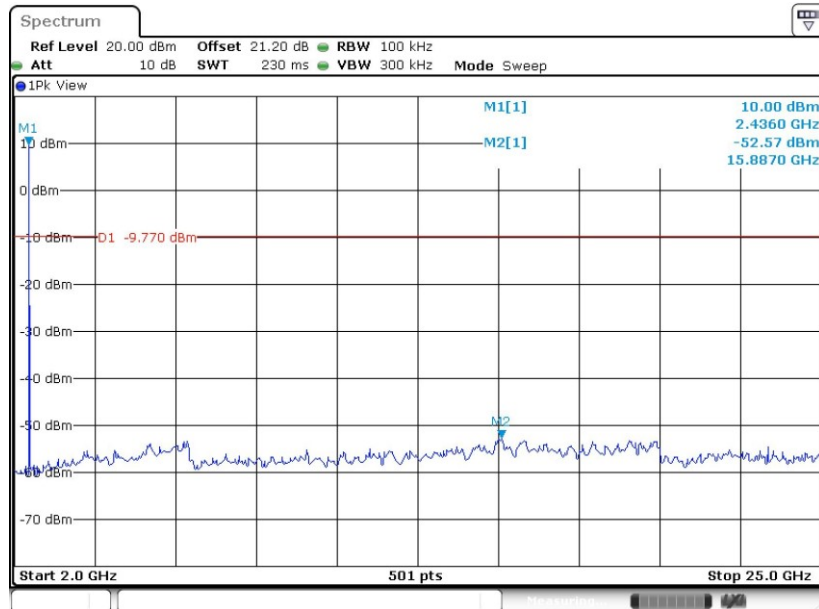


Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 19



Date: 31.JAN.2021 09:34:47

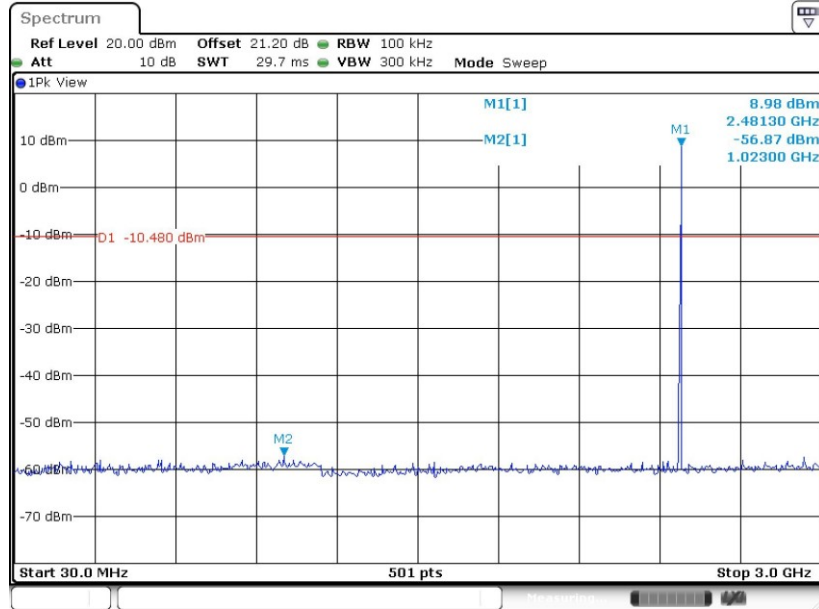
Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 19



Date: 31.JAN.2021 09:35:00

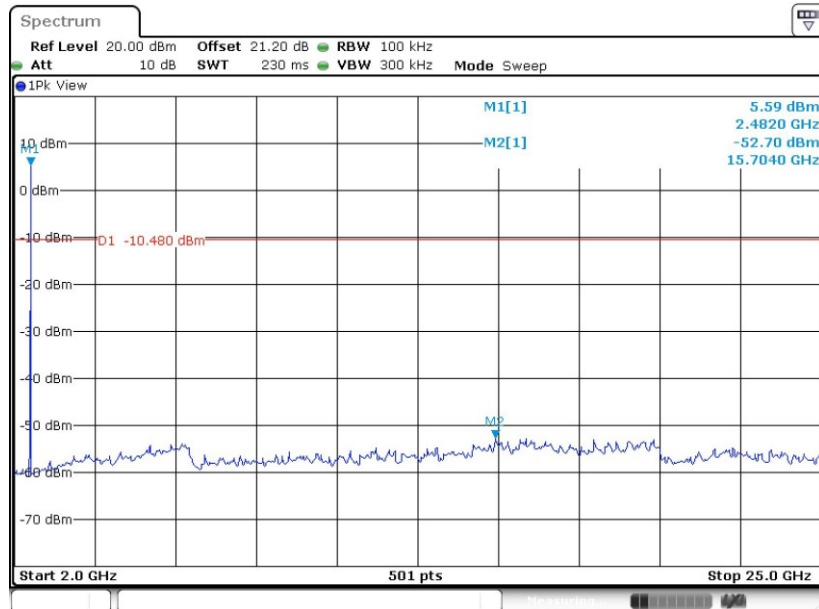


Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 39



Date: 31.JAN.2021 09:46:42

Conducted Spurious Emission Plot on Bluetooth LE 2Mbps GFSK Channel 39



Date: 31.JAN.2021 09:47:08



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.

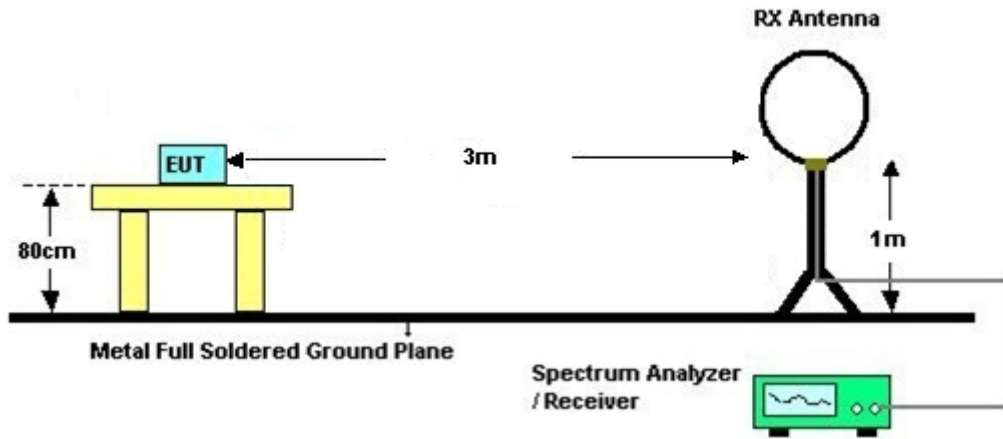


3.5.3 Test Procedures

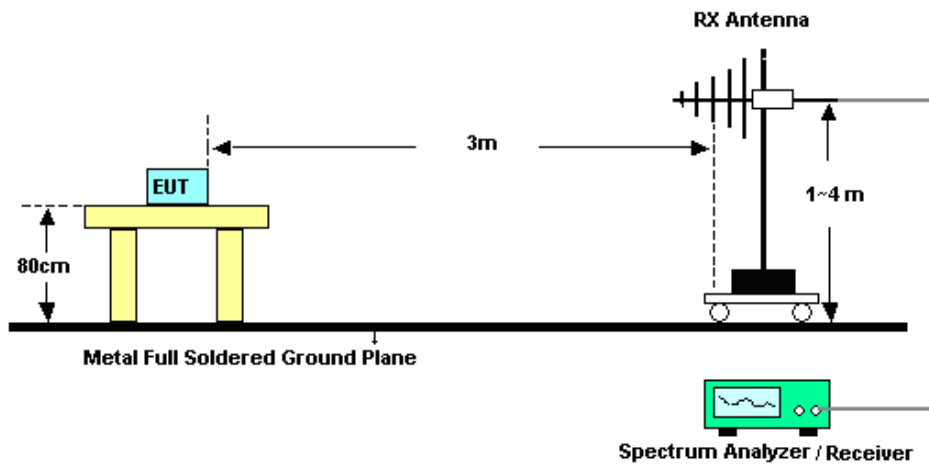
1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better 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 peak 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; $VBW \geq RBW$; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW= 3MHz for $f \geq 1$ GHz for peak measurement.
For average measurement:
 - $VBW = 10$ Hz, when duty cycle is no less than 98 percent.
 - $VBW \geq 1/T$, 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

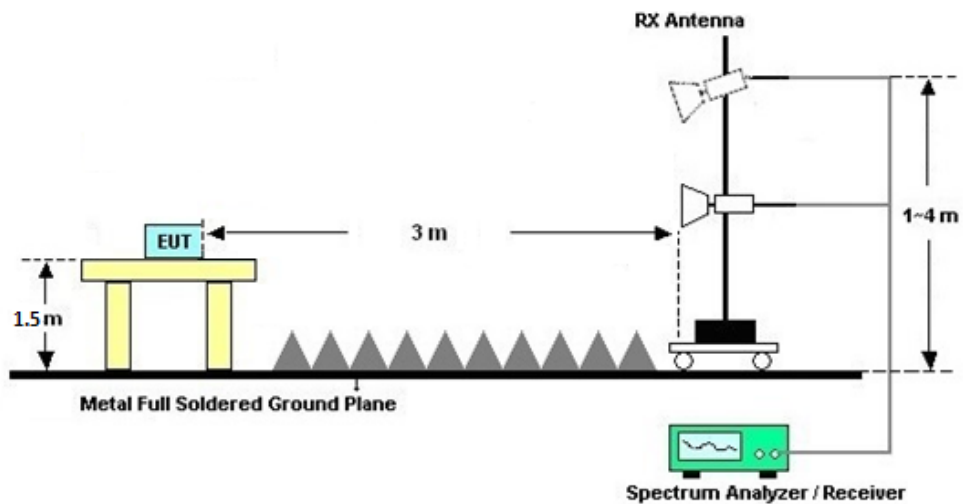
For radiated emissions below 30MHz



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 or 40GHz, whichever is lower)

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.

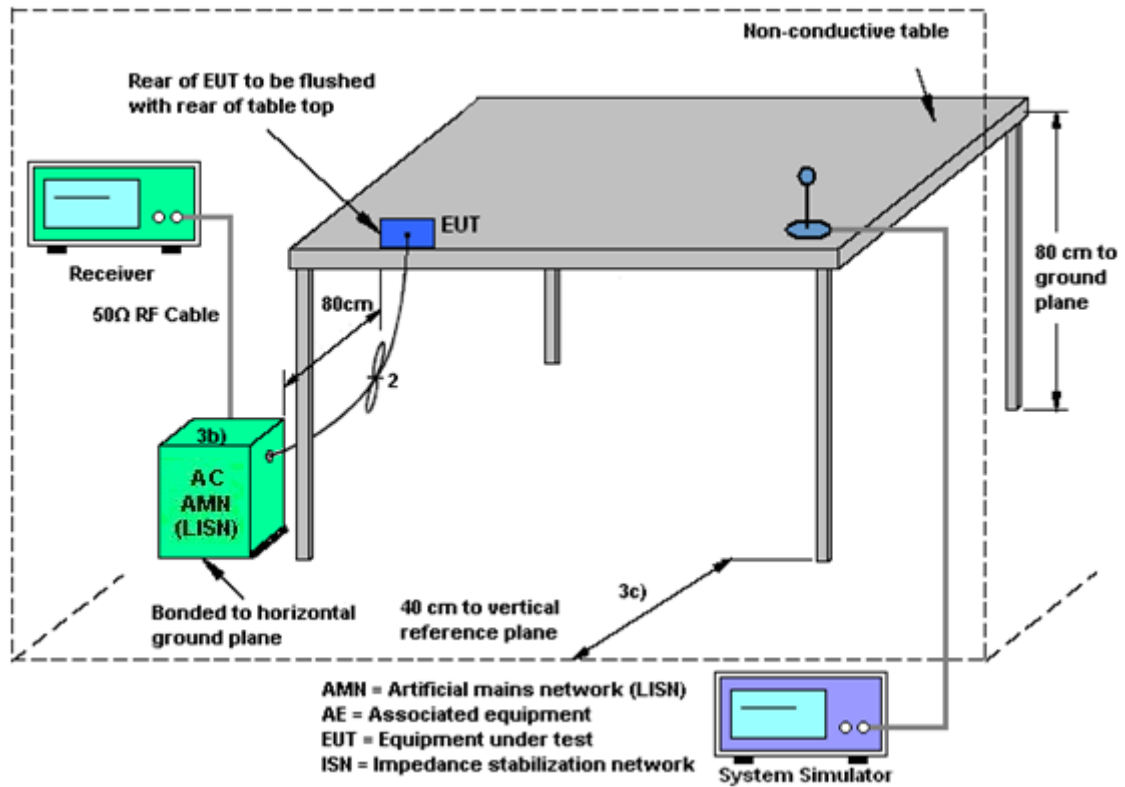
3.6.2 Measuring Instruments

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	101078	10Hz~40GHz	Apr. 17, 2020	Jan. 31, 2021	Apr. 16, 2021	Conducted (TH01-SZ)
Pulse Power Sensor	Anritsu	MA2411B	1207253	30MHz~40GHz	Dec. 25, 2020	Jan. 31, 2021	Dec. 24, 2021	Conducted (TH01-SZ)
Power Meter	Anritsu	ML2495A	1218010	50MHz Bandwidth	Dec. 25, 2020	Jan. 31, 2021	Dec. 24, 2021	Conducted (TH01-SZ)
EMI Test Receiver&SA	KEYSIGHT	N9038A	MY54450083	20Hz~8.4GHz	Apr. 17, 2020	Feb. 27, 2021	Apr. 16, 2021	Radiation (03CH03-SZ)
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY55150246	10Hz~44GHz;	Apr. 17, 2020	Feb. 27, 2021	Apr. 16, 2021	Radiation (03CH03-SZ)
Loop Antenna	R&S	HFH2-Z2	100354	9kHz~30MHz	Jun. 22, 2020	Feb. 27, 2021	Jun. 21, 2021	Radiation (03CH03-SZ)
Bilog Antenna	TeseQ	CBL6112D	35408	30MHz-2GHz	Jun. 22, 2020	Feb. 27, 2021	Jun. 21, 2021	Radiation (03CH03-SZ)
Double Ridge Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-1355	1GHz~18GHz	Apr. 30, 2020	Feb. 27, 2021	Apr. 29, 2021	Radiation (03CH03-SZ)
HF Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz	Jul. 21, 2020	Feb. 27, 2021	Jul. 20, 2021	Radiation (03CH03-SZ)
SHF-EHF Horn	com-power	AH-840	101071	18Ghz-40GHz	Apr. 23, 2020	Feb. 27, 2021	Apr. 22, 2021	Radiation (03CH03-SZ)
Amplifier	Burgeon	BPA-530	102210	0.01Hz~3000MHz	Oct. 17, 2020	Feb. 27, 2021	Oct. 16, 2021	Radiation (03CH03-SZ)
HF Amplifier	MITEQ	AMF-7D-00101800-30-10P-R	1943528	1GHz~18GHz	Oct. 17, 2020	Feb. 27, 2021	Oct. 16, 2021	Radiation (03CH03-SZ)
Amplifier	Agilent Technologies	83017A	MY39501302	500MHz~26.5GHz	Dec. 25, 2020	Feb. 27, 2021	Dec. 24, 2021	Radiation (03CH03-SZ)
AC Power Source	Chroma	61601	616010001985	N/A	NCR	Feb. 27, 2021	NCR	Radiation (03CH03-SZ)
Turn Table	EM	EM1000	N/A	0~360 degree	NCR	Feb. 27, 2021	NCR	Radiation (03CH03-SZ)
Antenna Mast	EM	EM1000	N/A	1 m~4 m	NCR	Feb. 27, 2021	NCR	Radiation (03CH03-SZ)
EMI Receiver	R&S	ESR7	101630	9kHz~7GHz;	Dec. 25, 2020	Feb. 02, 2021	Dec. 24, 2021	Conduction (CO01-SZ)
AC LISN	EMCO	3816/2 LISN	00103912	9kHz~30MHz	Dec. 25, 2020	Feb. 02, 2021	Dec. 24, 2021	Conduction (CO01-SZ)
AC LISN (for auxiliary equipment)	EMCO	3816/2SH	00103892	9kHz~30MHz	Oct. 15, 2020	Feb. 02, 2021	Oct. 14, 2021	Conduction (CO01-SZ)
AC Power Source	Chroma	61602	616020000891	100Vac~250Vac	Jul. 21, 2020	Feb. 02, 2021	Jul. 20, 2021	Conduction (CO01-SZ)

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))	2.7dB
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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))	4.9 dB
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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

Appendix A. Test Result of Conducted Test Items**Bluetooth v4.2 LE:**

Test Engineer:	Liu Qiu Qiu	Temperature:	21~25	°C
Test Date:	2021/1/31	Relative Humidity:	51~54	%

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	1.025	0.665	0.50	Pass
BLE	1Mbps	1	19	2440	1.023	0.667	0.50	Pass
BLE	1Mbps	1	39	2480	1.025	0.667	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	11.06	30.00	-2.00	9.06	36.00	Pass
BLE	1Mbps	1	19	2440	11.60	30.00	-2.00	9.60	36.00	Pass
BLE	1Mbps	1	39	2480	10.66	30.00	-2.00	8.66	36.00	Pass

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	9.54	-5.01	-2.00	8.00	Pass
BLE	1Mbps	1	19	2440	10.11	-4.44	-2.00	8.00	Pass
BLE	1Mbps	1	39	2480	9.44	-5.06	-2.00	8.00	Pass

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

Bluetooth v5.1 LE:

Test Engineer:	Liu Qiu Qiu	Temperature:	21~25	°C
Test Date:	2021/1/31	Relative Humidity:	51~54	%

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
BLE5.1	2Mbps	1	0	2402	2.030	1.135	0.50	Pass
BLE5.1	2Mbps	1	19	2440	2.030	1.143	0.50	Pass
BLE5.1	2Mbps	1	39	2480	2.034	1.143	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
BLE5.1	2Mbps	1	0	2402	10.58	30.00	-2.00	8.58	36.00	Pass
BLE5.1	2Mbps	1	19	2440	11.15	30.00	-2.00	9.15	36.00	Pass
BLE5.1	2Mbps	1	39	2480	10.48	30.00	-2.00	8.48	36.00	Pass

TEST RESULTS DATA
Peak Power Density

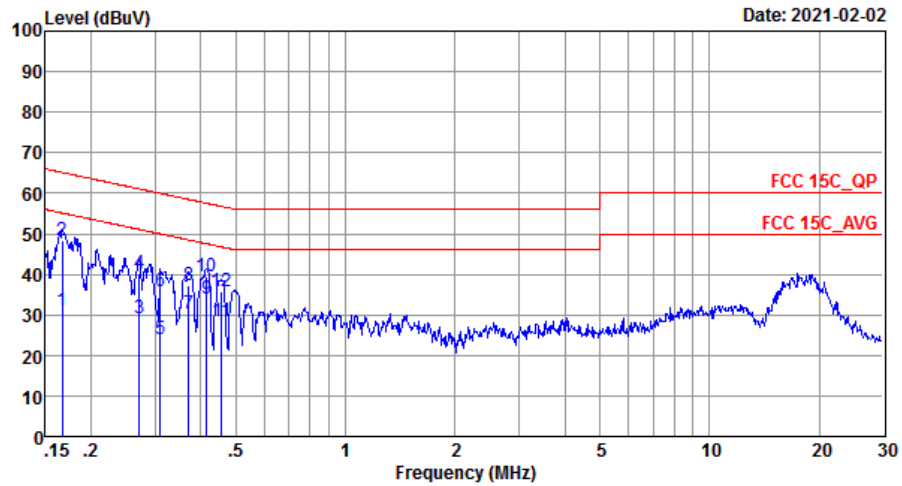
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak PSD (dBm /100kHz)	Peak PSD (dBm /3kHz)	DG (dBi)	Peak PSD Limit (dBm /3kHz)	Pass/Fail
BLE5.1	2Mbps	1	0	2402	9.58	-8.57	-2.00	8.00	Pass
BLE5.1	2Mbps	1	19	2440	10.23	-7.94	-2.00	8.00	Pass
BLE5.1	2Mbps	1	39	2480	9.52	-8.63	-2.00	8.00	Pass

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 :	Xie YuQiang	Temperature :	22~25°C
		Relative Humidity :	50~55%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		

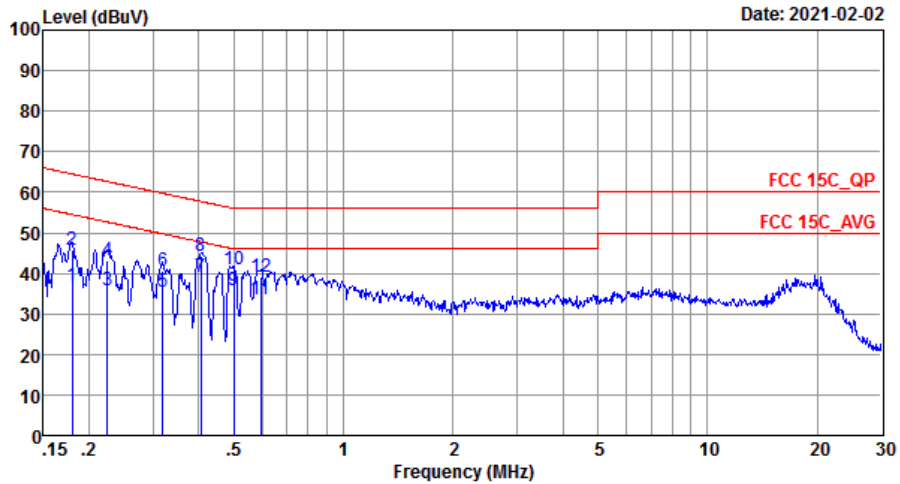


Site : CO01-SZ
 Condition: FCC 15C_QP LISN_20200719_L LINE

	Freq	Level	Over	Limit	Read	LISN	Cable	
	MHz	dBuV	Limit	Line	Level	Factor	Loss	Remark
			dB	dBuV	dBuV	dB	dB	
1	0.17	31.14	-23.98	55.12	21.10	0.03	10.01	Average
2	0.17	48.34	-16.78	65.12	38.30	0.03	10.01	QP
3	0.27	29.04	-22.03	51.07	19.00	0.03	10.01	Average
4	0.27	40.04	-21.03	61.07	30.00	0.03	10.01	QP
5	0.31	23.84	-26.13	49.97	13.80	0.03	10.01	Average
6	0.31	35.64	-24.33	59.97	25.60	0.03	10.01	QP
7	0.37	30.34	-18.13	48.47	20.30	0.03	10.01	Average
8	0.37	37.14	-21.33	58.47	27.10	0.03	10.01	QP
9 *	0.41	33.85	-13.70	47.55	23.80	0.03	10.02	Average
10	0.41	39.55	-18.00	57.55	29.50	0.03	10.02	QP
11	0.46	28.56	-18.20	46.76	18.50	0.02	10.04	Average
12	0.46	35.96	-20.80	56.76	25.90	0.02	10.04	QP



Test Engineer :	Xie YuQiang	Temperature :	22~25°C
		Relative Humidity :	50~55%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Site : CO01-SZ
 Condition: FCC 15C QP LISN 20200719_N NEUTRAL

	Freq	Level	Over	Limit	Read	LISN	Cable	
	MHz	dBuV	Limit	Line	Level	Factor	Loss	Remark
			dB	dBuV	dBuV	dB	dB	
1	0.18	37.04	-17.46	54.50	27.00	0.03	10.01	Average
2	0.18	45.74	-18.76	64.50	35.70	0.03	10.01	QP
3	0.22	35.74	-16.92	52.66	25.70	0.03	10.01	Average
4	0.22	43.04	-19.62	62.66	33.00	0.03	10.01	QP
5	0.32	35.54	-14.21	49.75	25.50	0.03	10.01	Average
6	0.32	40.54	-19.21	59.75	30.50	0.03	10.01	QP
7 *	0.41	39.23	-8.50	47.73	29.20	0.02	10.01	Average
8	0.41	44.33	-13.40	57.73	34.30	0.02	10.01	QP
9	0.50	35.68	-10.33	46.01	25.60	0.02	10.06	Average
10	0.50	40.78	-15.23	56.01	30.70	0.02	10.06	QP
11	0.59	33.49	-12.51	46.00	23.40	0.02	10.07	Average
12	0.59	39.19	-16.81	56.00	29.10	0.02	10.07	QP

Note:

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



Appendix C. 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		2386.335	50.23	-23.77	74	51.92	26.98	4.91	33.58	115	314	P	H
		2383.815	40.44	-13.56	54	42.18	26.96	4.88	33.58	115	314	A	H
	*	2402	104.29	-	-	105.96	26.98	4.91	33.56	115	314	P	H
	*	2402	103.59	-	-	105.26	26.98	4.91	33.56	115	314	A	H
		2320.92	49.99	-24.01	74	51.92	26.89	4.78	33.6	122	310	P	V
		2371.11	40.58	-13.42	54	42.32	26.96	4.88	33.58	122	310	A	V
	*	2402	106.27	-	-	107.94	26.98	4.91	33.56	122	310	P	V
	*	2402	105.66	-	-	107.33	26.98	4.91	33.56	122	310	A	V
BLE CH 19 2440MHz		2387.28	49.25	-24.75	74	50.94	26.98	4.91	33.58	108	311	P	H
		2375.38	40.45	-13.55	54	42.19	26.96	4.88	33.58	108	311	A	H
	*	2440	103.43	-	-	104.97	27.04	4.96	33.54	108	311	P	H
	*	2440	102.87	-	-	104.41	27.04	4.96	33.54	108	311	A	H
		2492.51	50.27	-23.73	74	51.66	27.1	5.01	33.5	108	311	P	H
		2485.51	40.67	-13.33	54	42.11	27.08	4.99	33.51	108	311	A	H
		2322.18	49.87	-24.13	74	51.8	26.89	4.78	33.6	141	312	P	V
		2367.68	40.49	-13.51	54	42.3	26.93	4.84	33.58	141	312	A	V
	*	2440	105.82	-	-	107.36	27.04	4.96	33.54	141	312	P	V
	*	2440	105.18	-	-	106.72	27.04	4.96	33.54	141	312	A	V
		2492.3	50.31	-23.69	74	51.7	27.1	5.01	33.5	141	312	P	V
		2495.45	40.76	-13.24	54	42.15	27.1	5.01	33.5	141	312	A	V



BLE CH 39 2480MHz	*	2480	102.04	-	-	103.48	27.08	4.99	33.51	106	313	P	H
	*	2480	101.4	-	-	102.84	27.08	4.99	33.51	106	313	A	H
		2483.52	50.75	-23.25	74	52.19	27.08	4.99	33.51	106	313	P	H
		2484.72	40.87	-13.13	54	42.31	27.08	4.99	33.51	106	313	A	H
	*	2480	104.91	-	-	106.35	27.08	4.99	33.51	130	311	P	V
	*	2480	104.43	-	-	105.87	27.08	4.99	33.51	130	311	A	V
		2483.52	53.35	-20.65	74	54.79	27.08	4.99	33.51	130	311	P	V
		2483.52	41.22	-12.78	54	42.66	27.08	4.99	33.51	130	311	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		4804	43.03	-30.97	74	62.6	30.81	7.09	57.47	145	274	P	H
		4804	43.63	-30.37	74	63.2	30.81	7.09	57.47	165	232	P	V
BLE CH 19 2440MHz		4880	42.89	-31.11	74	62.23	30.99	7.19	57.52	157	201	P	H
		7320	48.07	-25.93	74	61.89	36.31	8.8	58.93	112	266	P	H
		4880	43.57	-30.43	74	62.91	30.99	7.19	57.52	138	298	P	V
BLE CH 39 2480MHz		7320	46.27	-27.73	74	60.09	36.31	8.8	58.93	172	302	P	V
		4960	40.72	-33.28	74	59.87	31.21	7.22	57.58	216	294	P	H
		7440	46.69	-27.31	74	60	36.72	8.95	58.98	245	174	P	H
		4960	44.11	-29.89	74	63.26	31.21	7.22	57.58	139	71	P	V
		7440	46.93	-27.07	74	60.24	36.72	8.95	58.98	110	221	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		50.37	23.46	-16.54	40	36.04	20.29	2.23	35.1	-	-	P	H
		154.16	27.91	-15.59	43.5	41.15	19.29	2.57	35.1	-	-	P	H
		354.95	26.45	-19.55	46	37.13	20.97	3.24	34.89	-	-	P	H
		479.11	27.67	-18.33	46	35.44	23.53	3.4	34.7	-	-	P	H
		607.15	29.37	-16.63	46	34.11	25.87	3.89	34.5	-	-	P	H
		935.98	32.09	-13.91	46	32.52	29.68	4.12	34.23	100	38	P	H
		48.43	32.03	-7.97	40	44.63	20.28	2.2	35.08	100	64	P	V
		97.9	27.08	-16.42	43.5	45.36	14.45	2.47	35.2	-	-	P	V
		156.1	33.09	-10.41	43.5	46.32	19.3	2.57	35.1	-	-	P	V
		479.11	30.48	-15.52	46	38.25	23.53	3.4	34.7	-	-	P	V
		553.8	33.2	-12.8	46	39.28	24.84	3.67	34.59	-	-	P	V
	989.33	31.43	-22.57	54	31.24	30.14	4.17	34.12	-	-	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	Peak or Average
H/V	Horizontal or Vertical



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		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
CH 01													
2412MHz		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

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

For Peak Limit @ 2390MHz:

- 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)
- Over Limit(dB)
= Level(dBμV/m) – Limit Line(dBμV/m)
= 55.45(dBμV/m) – 74(dBμV/m)
= -18.55(dB)

For Average Limit @ 2390MHz:

- 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)
- 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	62.22	0.389	2.570	3kHz

Bluetooth LE v4.2

