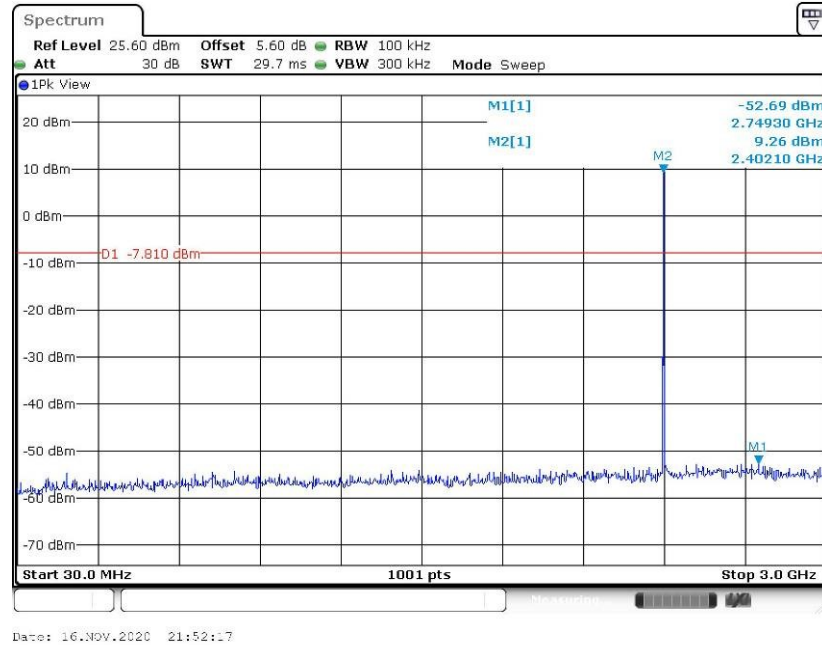


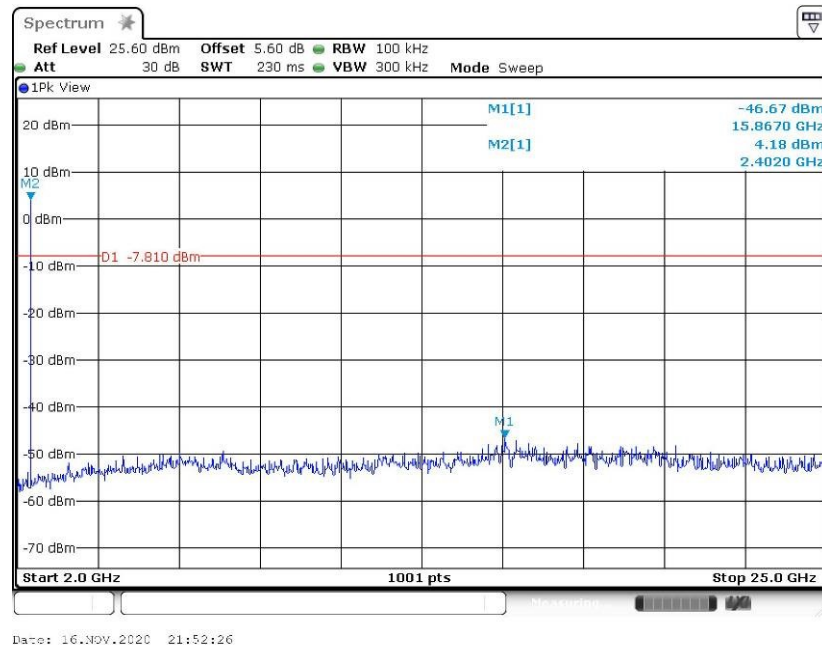


Bluetooth v5.1 LE

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

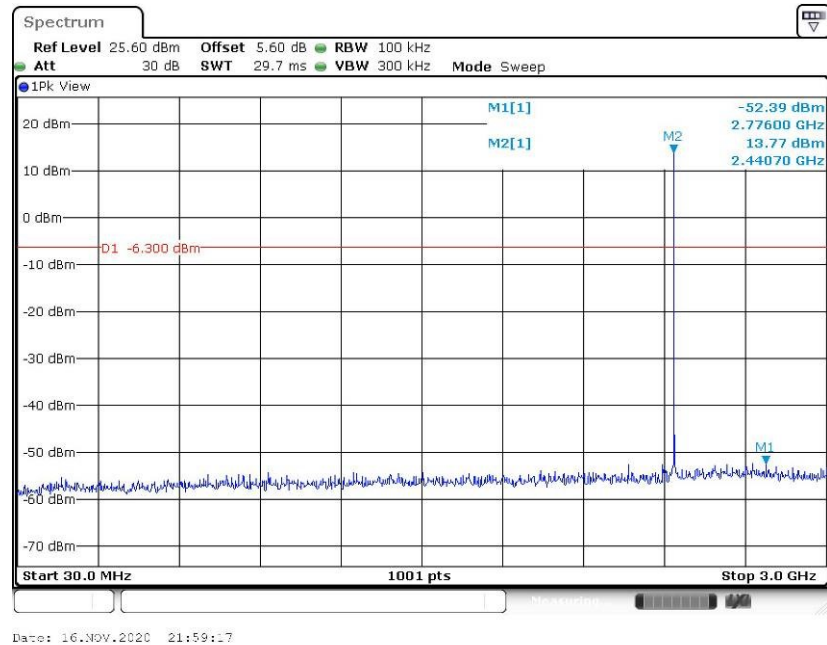


Conducted Spurious Emission Plot on Bluetooth LE 2Mbps
GFSK Channel 00

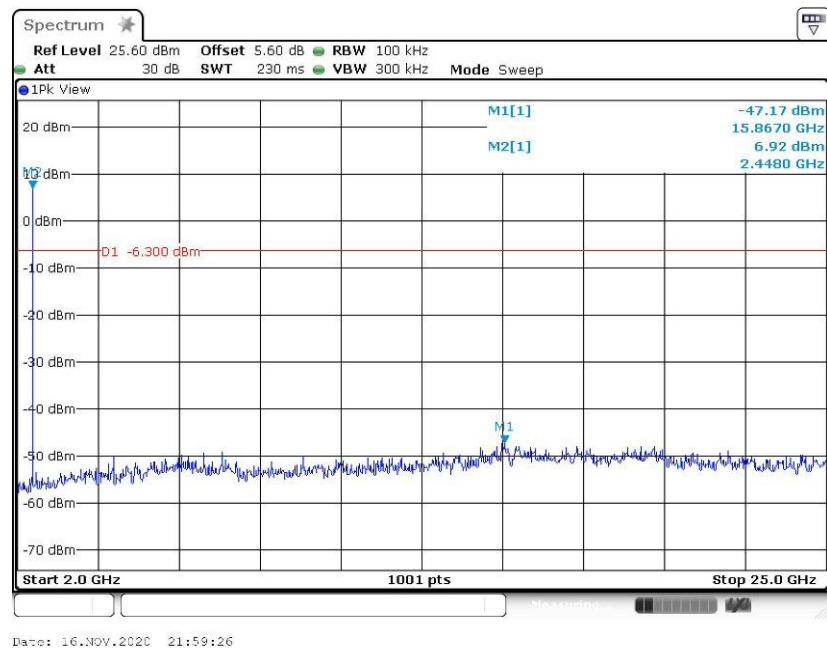




Conducted Spurious Emission Plot on Bluetooth LE 2Mbps
GFSK Channel 19

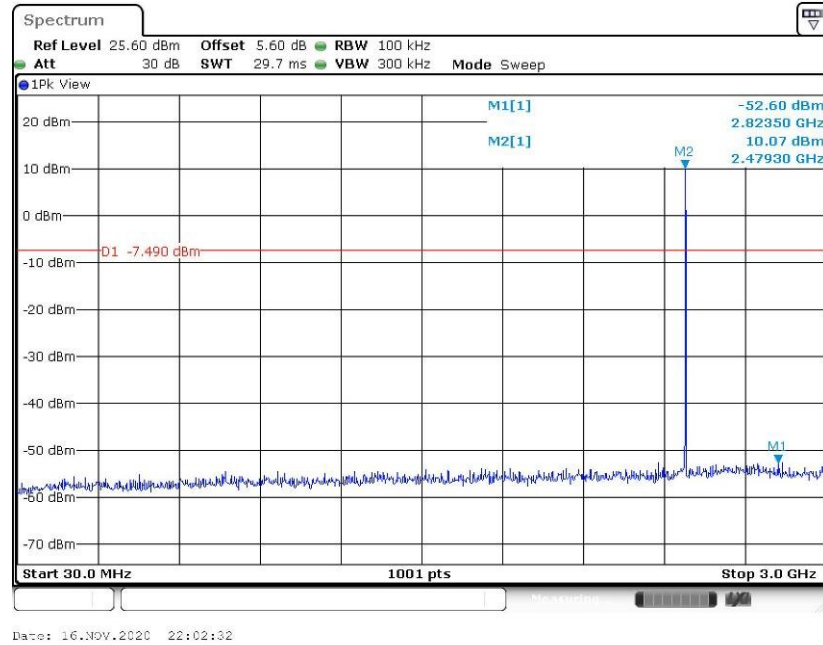


Conducted Spurious Emission Plot on Bluetooth LE 2Mbps
GFSK Channel 19

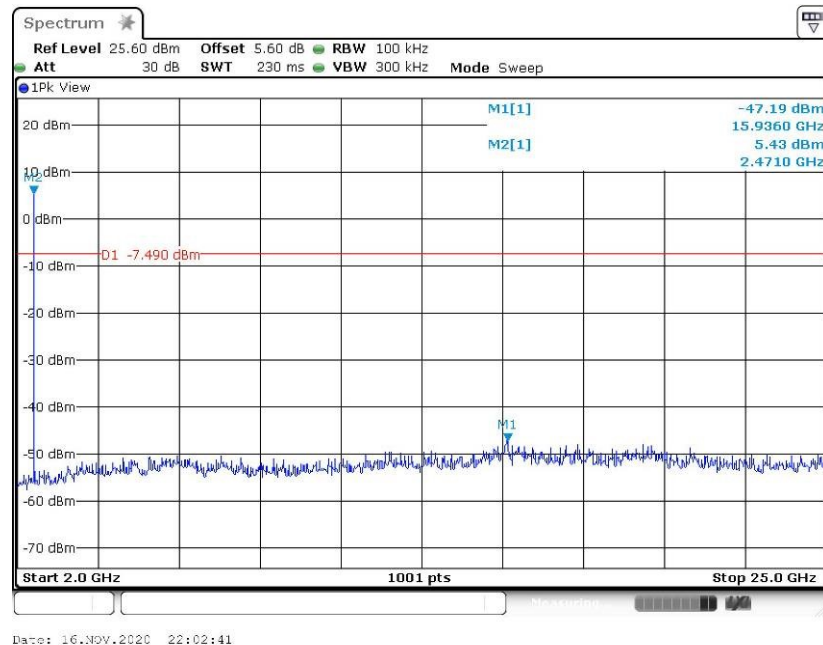




Conducted Spurious Emission Plot on Bluetooth LE 2Mbps
GFSK Channel 39



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



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

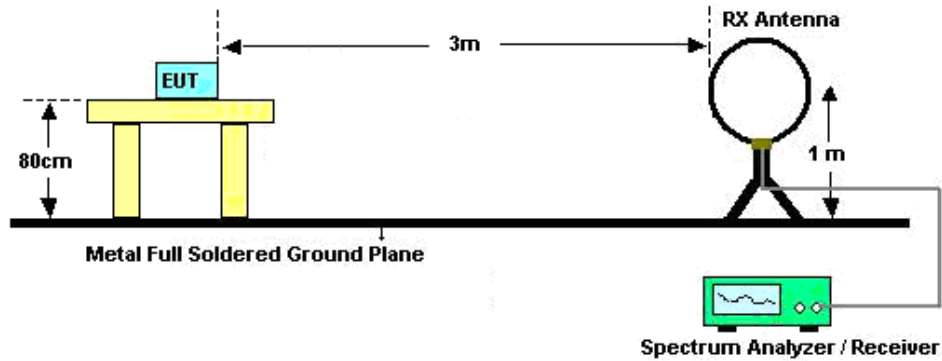
The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.5.3 Test Procedures

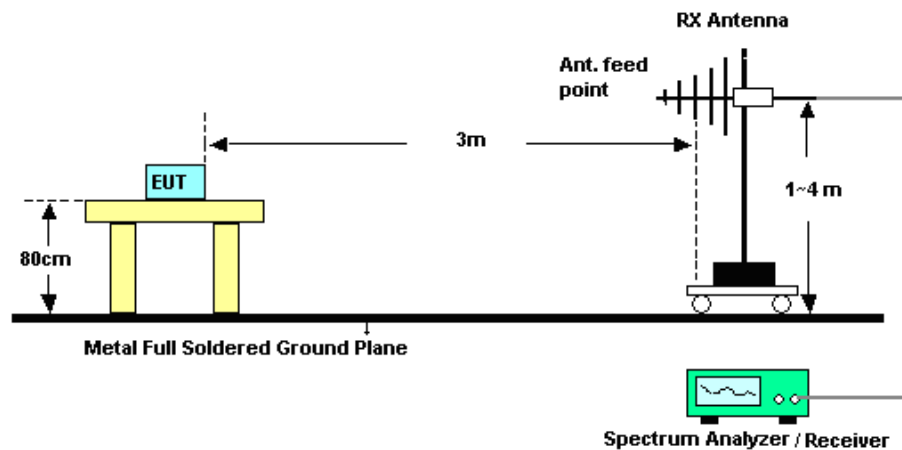
1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better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

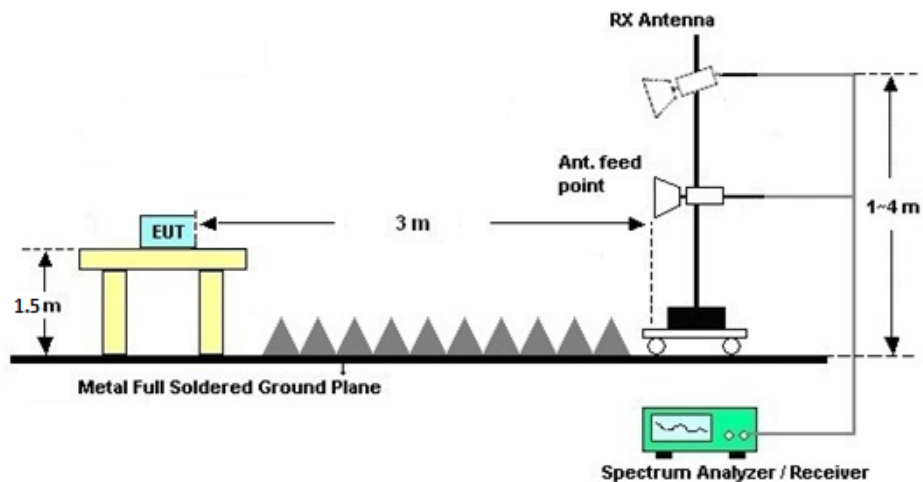
For radiated emissions below 30MHz



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)

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 (dB μ V)	
	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.

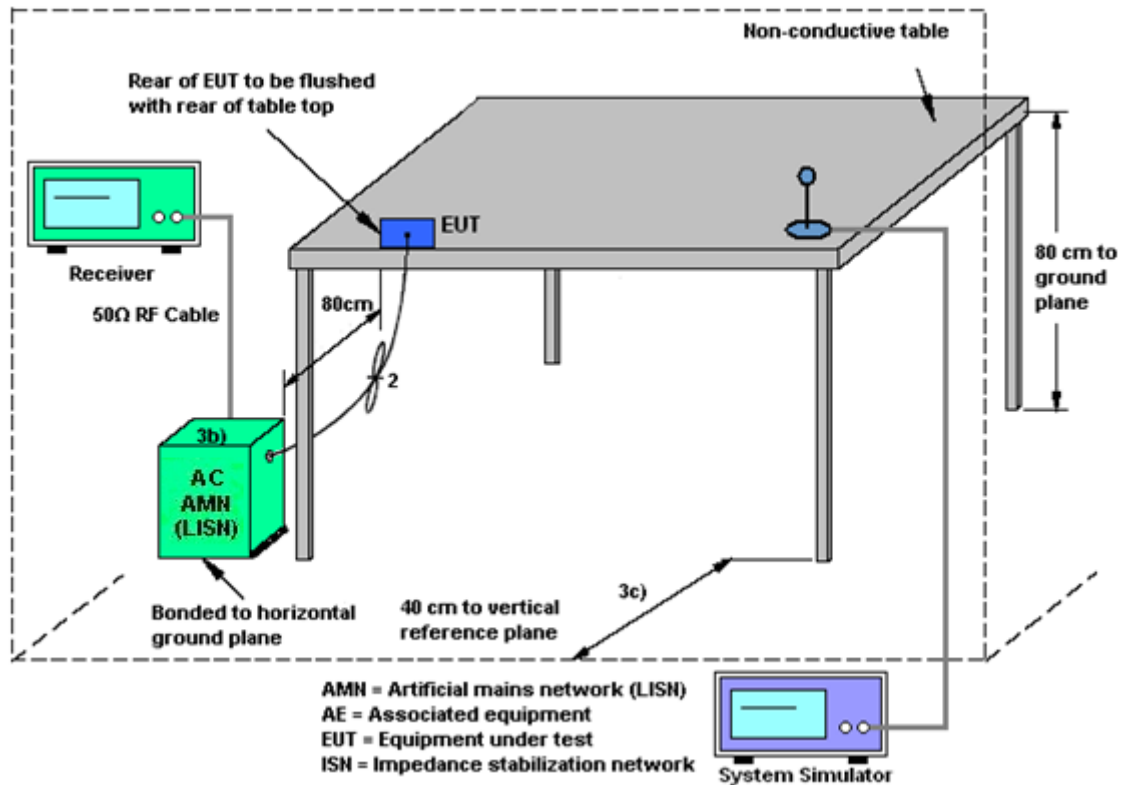
3.6.2 Measuring Instruments

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, 2020	Nov. 16, 2020	Nov. 01, 2021	Conducted (TH01-KS)
Pulse Power Sensor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 13, 2020	Nov. 16, 2020	Jan. 12, 2021	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 13, 2020	Nov. 16, 2020	Jan. 12, 2021	Conducted (TH01-KS)
EMI Test Receiver	Keysight	N9038A	MY56400004	3Hz~8.5GHz; Max 30dBm	Oct. 17, 2020	Nov. 22, 2020~Dec. 08, 2020	Oct. 16, 2021	Radiation (03CH06-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55150208	10Hz~44GHz	Apr. 14, 2020	Nov. 22, 2020~Dec. 08, 2020	Apr. 13, 2021	Radiation (03CH06-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Nov. 01, 2020	Nov. 22, 2020~Dec. 08, 2020	Oct. 31, 2021	Radiation (03CH06-KS)
Bilog Antenna	TeseQ	CBL6111D	49921	30MHz~1GHz	May 29, 2020	Nov. 22, 2020~Dec. 08, 2020	May 28, 2021	Radiation (03CH06-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00218652	1GHz~18GHz	Apr. 27, 2020	Nov. 22, 2020~Dec. 08, 2020	Apr. 26, 2021	Radiation (03CH06-KS)
SHF-EHF Horn	Com-power	AH-840	101115	18GHz~40GHz	Nov. 09, 2020	Nov. 22, 2020~Dec. 08, 2020	Nov. 08, 2021	Radiation (03CH06-KS)
Amplifier	SONOMA	310N	187289	9KHz ~1GHZ	Apr. 14, 2020	Nov. 22, 2020~Dec. 08, 2020	Apr. 13, 2021	Radiation (03CH06-KS)
Amplifier	MITEQ	EM18G40GGA	060728	18~40GHz	Jan. 08, 2020	Nov. 22, 2020~Dec. 08, 2020	Jan. 07, 2021	Radiation (03CH06-KS)
high gain Amplifier	MITEQ	AMF-7D-00101800-30-10P	2025788	1Ghz-18Ghz	Jan. 03, 2020	Nov. 22, 2020~Dec. 08, 2020	Jan. 02, 2021	Radiation (03CH06-KS)
Amplifier	Keysight	83017A	MY53270203	500MHz~26.5GHz	Apr. 15, 2020	Nov. 22, 2020~Dec. 08, 2020	Apr. 14, 2021	Radiation (03CH06-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Nov. 22, 2020~Dec. 08, 2020	NCR	Radiation (03CH06-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Nov. 22, 2020~Dec. 08, 2020	NCR	Radiation (03CH06-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Nov. 22, 2020~Dec. 08, 2020	NCR	Radiation (03CH06-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	Apr. 14, 2020	Nov. 12, 2020	Apr. 13, 2021	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 17, 2020	Nov. 12, 2020	Oct. 16, 2021	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060105	9kHz~30MHz	Oct. 27, 2020	Nov. 12, 2020	Oct. 26, 2021	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP000000811	AC 0V~300V, 45Hz~1000Hz	Oct. 17, 2020	Nov. 12, 2020	Oct. 16, 2021	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

Bluetooth v4.2 Low Energy

Test Engineer:	Rise liu	Temperature:	20~26	°C
Test Date:	2020/11/16	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	1.02	0.67	0.50	Pass
BLE	1Mbps	1	19	2440	1.01	0.67	0.50	Pass
BLE	1Mbps	1	39	2480	1.01	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	7.63	30.00	-4.60	3.03	36.00	Pass
BLE	1Mbps	1	19	2440	9.21	30.00	-4.60	4.61	36.00	Pass
BLE	1Mbps	1	39	2480	8.27	30.00	-4.60	3.67	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	7.51
BLE	1Mbps	1	19	2440	2.07	9.01
BLE	1Mbps	1	39	2480	2.07	8.10

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	12.17	-2.23	-4.60	8.00	Pass
BLE	1Mbps	1	19	2440	13.68	-0.71	-4.60	8.00	Pass
BLE	1Mbps	1	39	2480	12.44	-1.88	-4.60	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 Low Energy

Test Engineer:	Rise liu	Temperature:	20~26	°C
Test Date:	2020/11/16	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	2Mbps	1	0	1000	1.99	1.15	0.50	Pass
BLE	2Mbps	1	19	2440	1.99	1.14	0.50	Pass
BLE	2Mbps	1	39	2480	1.98	1.15	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	2Mbps	1	0	2402	7.17	30.00	-4.60	2.57	36.00	Pass
BLE	2Mbps	1	19	2440	8.71	30.00	-4.60	4.11	36.00	Pass
BLE	2Mbps	1	39	2480	7.52	30.00	-4.60	2.92	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	2Mbps	1	0	2402	4.83	6.45
BLE	2Mbps	1	19	2440	4.83	8.19
BLE	2Mbps	1	39	2480	4.83	6.88

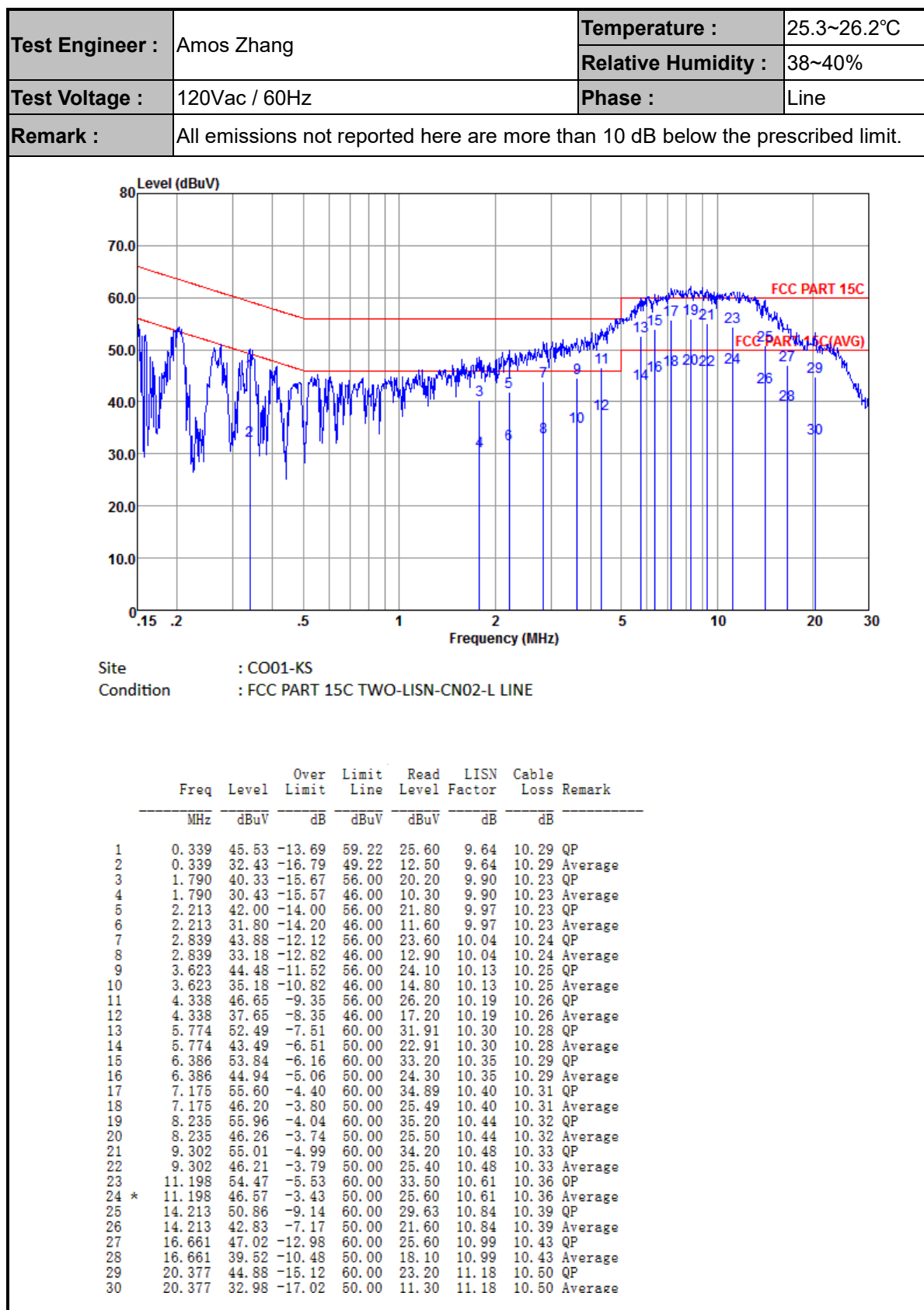
TEST RESULTS DATA
Peak Power Density

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	2Mbps	1	0	2402	12.19	-5.14	-4.60	8.00	Pass
BLE	2Mbps	1	19	2440	13.70	-3.61	-4.60	8.00	Pass
BLE	2Mbps	1	39	2480	12.51	-4.76	-4.60	8.00	Pass

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

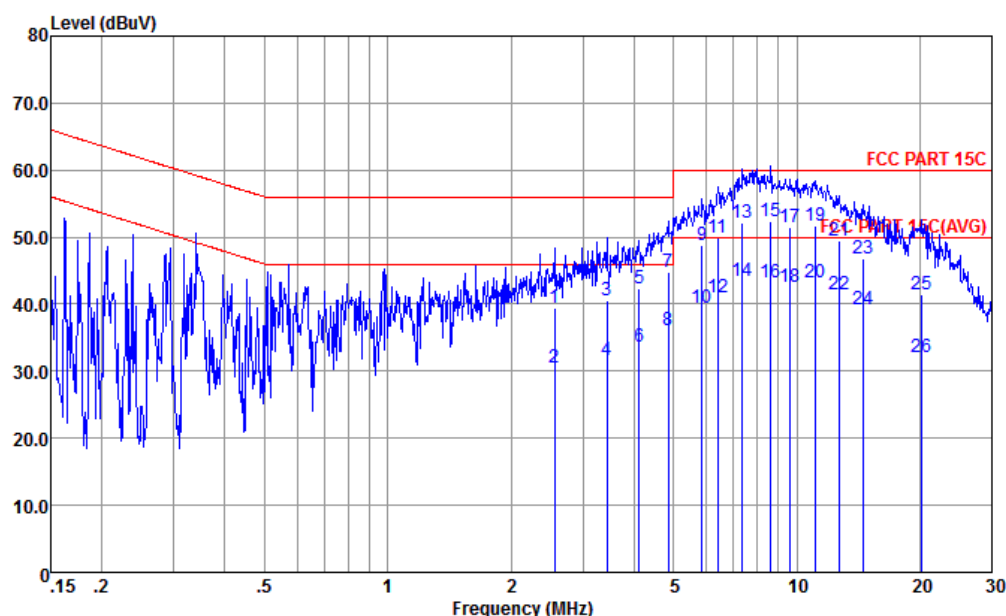


Appendix B. AC Conducted Emission Test Results





Test Engineer :	Amos Zhang	Temperature :	25.3~26.2°C
		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 TWO-LISN-CN02-N NEUTRAL

	Freq	Level	Over	Limit	Read	LISN	Cable	Remark
	MHz	dBuV	Limit	Line	Level	Factor	Loss	
			dB	dBuV	dBuV	dB	dB	
1	2.554	39.45	-16.55	56.00	19.20	10.01	10.24	QP
2	2.554	30.55	-15.45	46.00	10.30	10.01	10.24	Average
3	3.436	40.67	-15.33	56.00	20.30	10.12	10.25	QP
4	3.436	31.67	-14.33	46.00	11.30	10.12	10.25	Average
5	4.114	42.24	-13.76	56.00	21.81	10.18	10.25	QP
6	4.114	33.74	-12.26	46.00	13.31	10.18	10.25	Average
7	4.848	44.71	-11.29	56.00	24.20	10.24	10.27	QP
8	4.848	36.01	-9.99	46.00	15.50	10.24	10.27	Average
9	5.867	48.82	-11.18	60.00	28.21	10.33	10.28	QP
10	5.867	39.52	-10.48	50.00	18.91	10.33	10.28	Average
11	6.420	49.87	-10.13	60.00	29.21	10.37	10.29	QP
12	6.420	40.97	-9.03	50.00	20.31	10.37	10.29	Average
13	7.368	52.04	-7.96	60.00	31.29	10.44	10.31	QP
14 *	7.368	43.34	-6.66	50.00	22.59	10.44	10.31	Average
15	8.637	52.32	-7.68	60.00	31.49	10.50	10.33	QP
16	8.637	43.12	-6.88	50.00	22.29	10.50	10.33	Average
17	9.654	51.47	-8.53	60.00	30.59	10.54	10.34	QP
18	9.654	42.47	-7.53	50.00	21.59	10.54	10.34	Average
19	11.139	51.64	-8.36	60.00	30.60	10.68	10.36	QP
20	11.139	43.34	-6.66	50.00	22.30	10.68	10.36	Average
21	12.716	49.42	-10.58	60.00	28.21	10.84	10.37	QP
22	12.716	41.52	-8.48	50.00	20.31	10.84	10.37	Average
23	14.594	46.91	-13.09	60.00	25.51	11.01	10.39	QP
24	14.594	39.21	-10.79	50.00	17.81	11.01	10.39	Average
25	20.270	41.55	-18.45	60.00	19.60	11.45	10.50	QP
26	20.270	32.15	-17.85	50.00	10.20	11.45	10.50	Average

Note:

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



Appendix C. Radiated Spurious Emission

For Bluetooth LE v4.2:

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path 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		2387.74	54.84	-19.16	74	49.2	32.2	7.43	33.99	100	229	P	H
		2385.92	44.52	-9.48	54	38.88	32.2	7.43	33.99	100	229	A	H
	*	2402	106.64	-	-	100.99	32.2	7.43	33.98	100	229	P	H
	*	2402	105.26	-	-	99.61	32.2	7.43	33.98	100	229	A	H
		2383.32	54.34	-19.66	74	48.83	32.1	7.4	33.99	331	121	P	V
		2367.72	44.35	-9.65	54	38.98	32	7.37	34	331	121	A	V
	*	2402	104.27	-	-	98.62	32.2	7.43	33.98	331	121	P	V
	*	2402	103.58	-	-	97.93	32.2	7.43	33.98	331	121	A	V
BLE CH 39 2480MHz		2486.62	54.51	-19.49	74	48.89	31.99	7.56	33.93	141	90	P	H
		2483.5	46.87	-7.13	54	41.26	31.99	7.56	33.94	141	90	A	H
	*	2480	102.36	-	-	96.75	31.99	7.56	33.94	141	90	P	H
	*	2480	101.61	-	-	96	31.99	7.56	33.94	141	90	A	H
		2489.8	54.37	-19.63	74	48.77	31.94	7.59	33.93	400	118	P	V
		2483.5	45.53	-8.47	54	39.92	31.99	7.56	33.94	400	118	A	V
	*	2480	99.03	-	-	93.42	31.99	7.56	33.94	400	118	P	V
	*	2480	98.96	-	-	93.35	31.99	7.56	33.94	400	118	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)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BLE CH 00 2402MHz		4806	39.97	-34.03	74	56.74	35.16	10.65	62.58	300	0	P	H
		4806	41.02	-32.98	74	57.79	35.16	10.65	62.58	300	360	P	V
BLE CH 19 2440MHz		4878	41.1	-32.9	74	57.38	35.17	10.75	62.2	300	0	P	H
		7320	42.9	-31.1	74	54.82	36.87	13.35	62.14	300	0	P	H
		4878	41	-33	74	57.28	35.17	10.75	62.2	300	360	P	V
		7320	43.52	-30.48	74	55.44	36.87	13.35	62.14	300	360	P	V
BLE CH 39 2480MHz		4962	41.96	-32.04	74	57.93	35.19	10.87	62.03	300	0	P	H
		7440	42.62	-31.38	74	54.39	36.89	13.45	62.11	300	0	P	H
		4962	41.4	-32.6	74	57.37	35.19	10.87	62.03	300	360	P	V
		7440	43.18	-30.82	74	54.95	36.89	13.45	62.11	300	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	Path	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		30.97	19.05	-20.95	40	25.84	24.57	0.84	32.2	-	-	P	H
		128.94	17.47	-26.03	43.5	30.03	17.6	1.98	32.14	-	-	P	H
		171.62	21.11	-22.39	43.5	35.34	15.59	2.28	32.1	-	-	P	H
		222.06	23.98	-22.02	46	38	15.52	2.6	32.14	-	-	P	H
		308.39	25.88	-20.12	46	35.44	19.49	3.07	32.12	100	360	P	H
		588.72	24.9	-21.1	46	27.27	25.71	4.22	32.3	-	-	P	H
		32.91	30.6	-9.4	40	38.4	23.51	0.89	32.2	100	0	P	V
		54.25	26.2	-13.8	40	43.73	13.4	1.27	32.2	-	-	P	V
		206.54	21.75	-21.75	43.5	36.18	15.17	2.51	32.11	-	-	P	V
		436.43	19.92	-26.08	46	25.72	22.78	3.65	32.23	-	-	P	V
		734.22	26.22	-19.78	46	26.05	27.73	4.71	32.27	-	-	P	V
		912.7	28.06	-17.94	46	25.43	29.58	5.25	32.2	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



For Bluetooth LE v5.1:

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path 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		2381.11	53.95	-20.05	74	48.45	32.1	7.4	34	190	234	P	H
		2386.7	44.69	-9.31	54	39.05	32.2	7.43	33.99	190	234	A	H
	*	2402	106.34	-	-	100.69	32.2	7.43	33.98	190	234	P	H
	*	2402	104.92	-	-	99.27	32.2	7.43	33.98	190	234	A	H
		2389.69	54.75	-19.25	74	49.11	32.2	7.43	33.99	345	122	P	V
		2386.44	44.91	-9.09	54	39.27	32.2	7.43	33.99	345	122	A	V
	*	2402	104.08	-	-	98.43	32.2	7.43	33.98	345	122	P	V
	*	2402	102.67	-	-	97.02	32.2	7.43	33.98	345	122	A	V
BLE CH 39 2480MHz		2483.5	54.59	-19.41	74	48.98	31.99	7.56	33.94	123	86	P	H
		2483.5	49.32	-4.68	54	43.71	31.99	7.56	33.94	123	86	A	H
	*	2480	101.79	-	-	96.18	31.99	7.56	33.94	123	86	P	H
	*	2480	100.38	-	-	94.77	31.99	7.56	33.94	123	86	A	H
		2484.82	53.93	-20.07	74	48.32	31.99	7.56	33.94	400	123	P	V
		2483.5	47.69	-6.31	54	42.08	31.99	7.56	33.94	400	123	A	V
	*	2480	99.61	-	-	94	31.99	7.56	33.94	400	123	P	V
	*	2480	97.92	-	-	92.31	31.99	7.56	33.94	400	123	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)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BLE CH 00 2402MHz		4806	41.14	-32.86	74	57.91	35.16	10.65	62.58	300	0	P	H
		4806	39.89	-34.11	74	56.66	35.16	10.65	62.58	300	360	P	V
BLE CH 19 2440MHz		4878	40.95	-33.05	74	57.23	35.17	10.75	62.2	300	0	P	H
		7320	43.77	-30.23	74	55.69	36.87	13.35	62.14	300	0	P	H
		4878	41.68	-32.32	74	57.96	35.17	10.75	62.2	300	360	P	V
		7320	43.38	-30.62	74	55.3	36.87	13.35	62.14	300	360	P	V
BLE CH 39 2480MHz		4962	41.29	-32.71	74	57.26	35.19	10.87	62.03	300	0	P	H
		7440	43.06	-30.94	74	54.83	36.89	13.45	62.11	300	0	P	H
		4962	41.05	-32.95	74	57.02	35.19	10.87	62.03	300	360	P	V
		7440	42.85	-31.15	74	54.62	36.89	13.45	62.11	300	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	Path	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		30.97	18.91	-21.09	40	25.7	24.57	0.84	32.2	-	-	P	H
		157.07	19.14	-24.36	43.5	32.37	16.68	2.19	32.1	-	-	P	H
		234.67	23.44	-22.56	46	35.99	16.95	2.67	32.17	-	-	P	H
		309.36	26.13	-19.87	46	35.68	19.5	3.07	32.12	-	-	P	H
		620.73	24.38	-21.62	46	26.22	26.09	4.33	32.26	-	-	P	H
		936.95	27.74	-18.26	46	24.1	30.52	5.32	32.2	100	360	P	H
		31.94	29.72	-10.28	40	37.02	24.04	0.86	32.2	100	0	P	V
		54.25	24.72	-15.28	40	42.25	13.4	1.27	32.2	-	-	P	V
		159.01	17.1	-26.4	43.5	30.44	16.56	2.2	32.1	-	-	P	V
		210.42	21.29	-22.21	43.5	35.68	15.2	2.53	32.12	-	-	P	V
		464.56	20.84	-25.16	46	25.97	23.36	3.77	32.26	-	-	P	V
		806	25.54	-20.46	46	24.58	28.33	4.94	32.31	-	-	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:

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	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)
BLE CH 00 2402MHz		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. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) =
Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)
= Antenna Factor(dB/m) + Path 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:

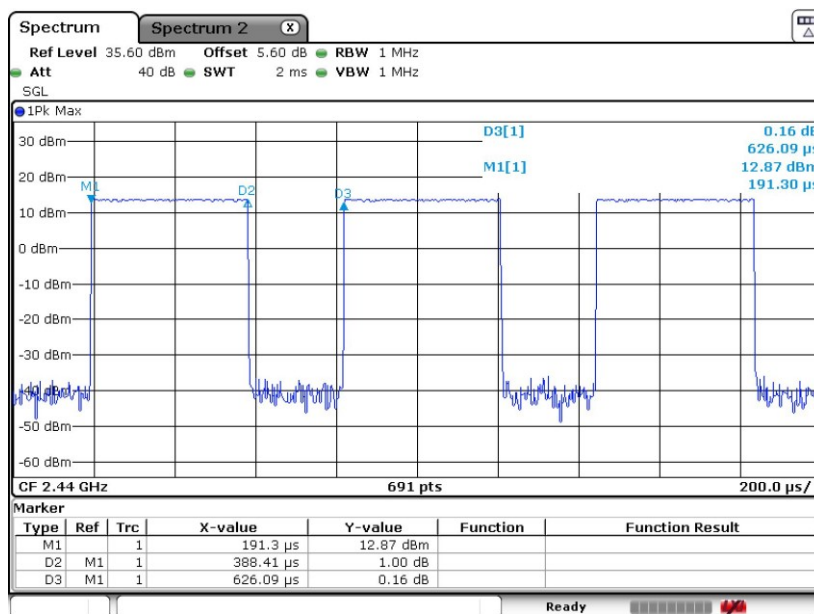
1. Level(dBμV/m)
= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)
= 43.54 (dBμV/m)
2. Over Limit(dB)
= Level(dBμV/m) – Limit Line(dBμV/m)
= 43.54(dBμV/m) – 54(dBμV/m)
= -10.46(dB)

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 v5.1	32.87	0.206	4.859	5.1KHz

Bluetooth LE v4.2



Bluetooth LE v5.1

