



FCC RF Test Report

APPLICANT : Acer Incorporated
EQUIPMENT : Notebook computer
BRAND NAME : acer
MODEL NAME : N18H1
FCC ID : Contains FCC ID : HLZ9560D2W
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DTS) Digital Transmission System

The product was installed a module during the test: WLAN and BT, 2*2 PCIe M.2 1216 SD adapter card (Brand Name: acer, Model Name: 9560D2W, FCC ID: HLZ9560D2W) during test.

The product was received on Mar. 28, 2018 and testing was completed on Apr. 23, 2018. We, Sporton International (Shenzhen) 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 (Shenzhen) Inc., the test report shall not be reproduced except in full.

Approved by: Eric Shih / Manager



Sporton International (Shenzhen) Inc.

**1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan Shenzhen City
Guangdong Province 518055 China**



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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR832801B	Rev. 01	Initial issue of report	May 11, 2018

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
-	15.247(a)(2)	6dB Bandwidth	$\geq 0.5\text{MHz}$	Pass	1
-	-	99% Bandwidth	-	Pass	1
3.1	15.247(b)(3)	Peak Output Power	$\leq 30\text{dBm}$	Pass	-
-	15.247(e)	Power Spectral Density	$\leq 8\text{dBm}/3\text{kHz}$	Pass	1
-	15.247(d)	Conducted Band Edges and Spurious Emission	$\leq 20\text{dBc}$	Pass	1
3.2	15.247(d)	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 5.34 dB at 78.50 MHz
3.3	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 5.40 dB at 0.52 MHz
3.4	15.203 & 15.247(b)	Antenna Requirement	N/A	Pass	-
Remark 1: All conducted test items were leverage from module RF report which can refer to Report No. "170919-03.TR04".					



1 General Description

1.1 Applicant

Acer Incorporated

8F ,88, Sec.1 Xintai 5th Rd. Xizhi, New Taipei City 221, Taiwan, R.O.C

1.2 Manufacturer

Acer Incorporated

8F ,88, Sec.1 Xintai 5th Rd. Xizhi, New Taipei City 221, Taiwan, R.O.C

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Notebook computer
Brand Name	acer
Model Name	N18H1
FCC ID	Contains FCC ID : HLZ9560D2W
EUT supports Radios application	WLAN 2.4GHz 802.11b/g/n HT20/HT40 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80/VHT160 Bluetooth v3.0+EDR, Bluetooth v5.0 LE
EUT Stage	Identical Prototype

Module Feature & Specification	
Equipment	WLAN and BT, 2*2 PCIe M.2 1216 SD adapter card
Brand Name	acer
Model Name	9560D2W
FCC ID	HLZ9560D2W
Applicant	Acer Incorporated 8F ,88, Sec.1 Xintai 5th Rd. Xizhi, New Taipei City 221, Taiwan, R.O.C
Manufacturer	Acer Incorporated 8F ,88, Sec.1 Xintai 5th Rd. Xizhi, New Taipei City 221, Taiwan, R.O.C

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)
Maximum Output Power to Antenna	5.18 dBm (0.0033 W)
Antenna Type / Gain	PIFA Antenna with gain 3.30 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 Testing Location

Sporton International (Shenzhen) Inc. is accredited to ISO 17025 by National Voluntary Laboratory Accreditation Program (NVLAP code: 600156-0) and the FCC designation No are CN5018 and CN5019.

Test Site	Sporton International (Shenzhen) Inc.		
Test Site Location	1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan Shenzhen City Guangdong Province 518055 China TEL: +86-755-8637-9589 FAX: +86-755-8637-9595		
Test Site No.	Sporton Site No.		FCC Test Firm Registration No.
	TH01-SZ	CO01-SZ	251365

Test Site	Sporton International (Shenzhen) Inc.		
Test Site Location	No. 3 Bldg the third floor of south, Shahe River west, Fengzeyuan Warehouse, Nanshan District Shenzhen City Guangdong Province 518055 China TEL: +86-755-3320-2398		
Test Site No.	Sporton Site No.		FCC Test Firm Registration No.
	03CH04-SZ		577730

Note: The test site complies with ANSI C63.4 2014 requirement.



1.7 Applicable Standards

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

- ♦ FCC Part 15 Subpart C §15.247
- ♦ FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04
- ♦ 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 Descriptions of Test Mode

The RF output power was recorded in the following table:

Channel	Frequency	Bluetooth – LE RF Output Power
		Data Rate / Modulation
		GFSK
Ch00	2402MHz	5.18 dBm
Ch19	2440MHz	5.02 dBm
Ch39	2480MHz	5.00 dBm

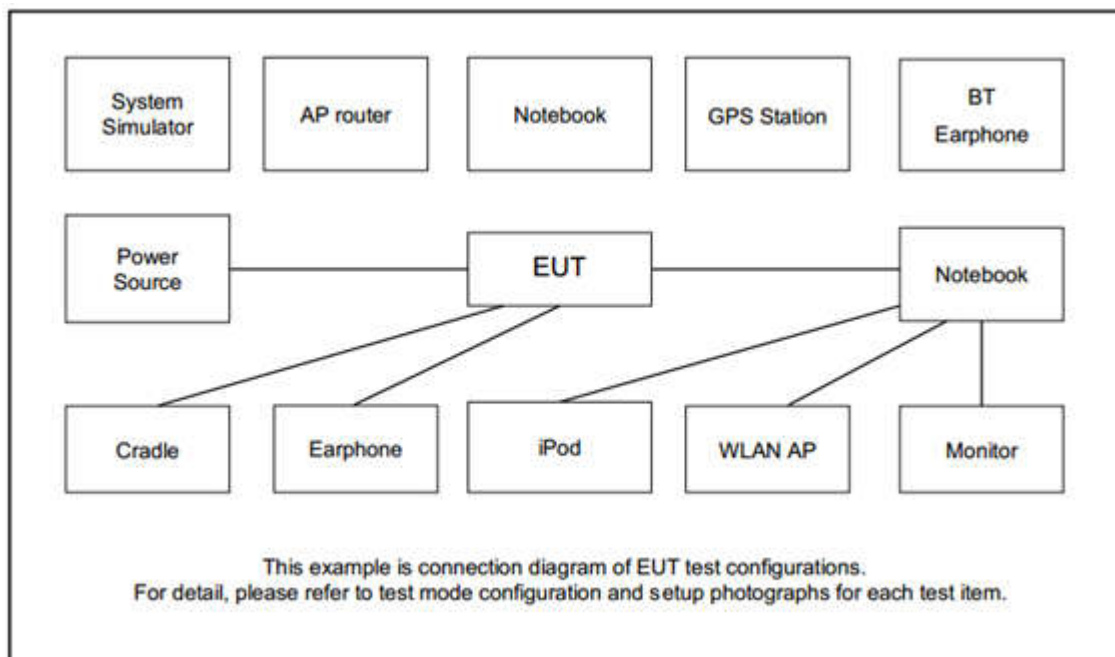
2.3 Test Mode

- 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: conduction emission (150 kHz to 30 MHz), 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(Y plane) cases were recorded in this report.
- AC power line Conducted Emission was tested under maximum output power.

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
Conducted 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
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
AC Conducted Emission	Mode 1 :Bluetooth Link + WLAN Link(2.4G) + Adapter 1 + Earphone Mode 2 :Bluetooth Link + WLAN Link(2.4G) + Adapter 2 + Earphone
Remark: 1. For Radiated Test Cases, The tests were performed with Adapter 1. 2. The worst case of AC is mode 2; only the test data of this mode is reported.	

2.4 Connection Diagram of Test System



2.5 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Bluetooth Earphone	Samsung	EO-MG900	PYAHS-107W	N/A	N/A
2.	Golden Earphone	Apple	N/A	N/A	N/A	N/A
3.	WLAN AP	Dlink	DIR-820L	KA2IR820LA1	N/A	Unshielded,1.8m
4.	SD Card	N/A	MicroSD HC	FCC DoC	N/A	N/A

2.6 EUT Operation Test Setup

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

For AC power line conducted emissions, the EUT was set to connect with the WLAN AP under large package sizes transmission.

3 Test Result

3.1 Peak Output Power Measurement

3.1.1 Limit of Peak Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting antenna of directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

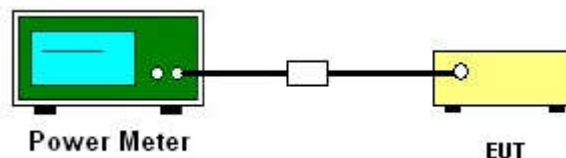
3.1.2 Measuring Instruments

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 the Measurement Procedure of FCC KDB 558074, clause 9.2.3.1 Method AVGPM (using an RF average power meter).
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

3.1.4 Test Setup



**3.1.5 Test Result of Peak Output Power**

Test Mode :	Bluetooth v5.0 LE	Temperature :	21~25℃
Test Engineer :	Sam Zheng	Relative Humidity :	51~54%

Channel	Frequency (MHz)	RF Power (dBm)		
		GFSK	Max. Limits (dBm)	Pass/Fail
00	2402	5.18	30.00	Pass
19	2440	5.02	30.00	Pass
39	2480	5.00	30.00	Pass



3.2 Radiated Band Edges and Spurious Emission Measurement

3.2.1 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

3.2.2 Measuring Instruments

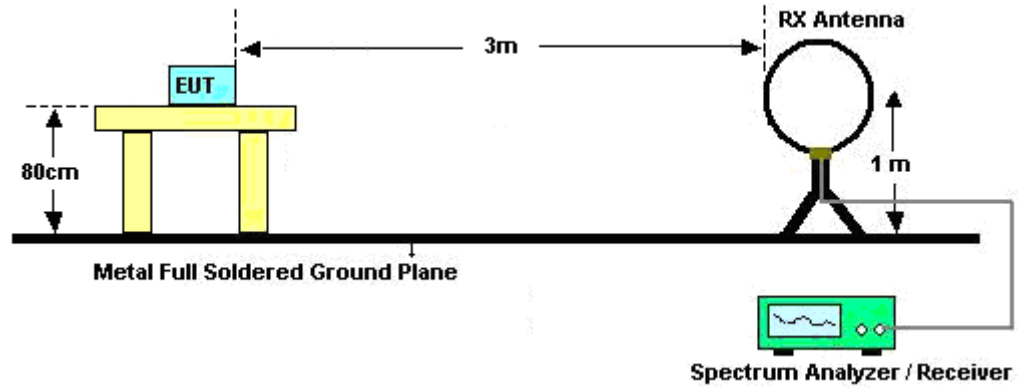
The section 4.0 of List of Measuring Equipment of this test report is used for test.

3.2.3 Test Procedures

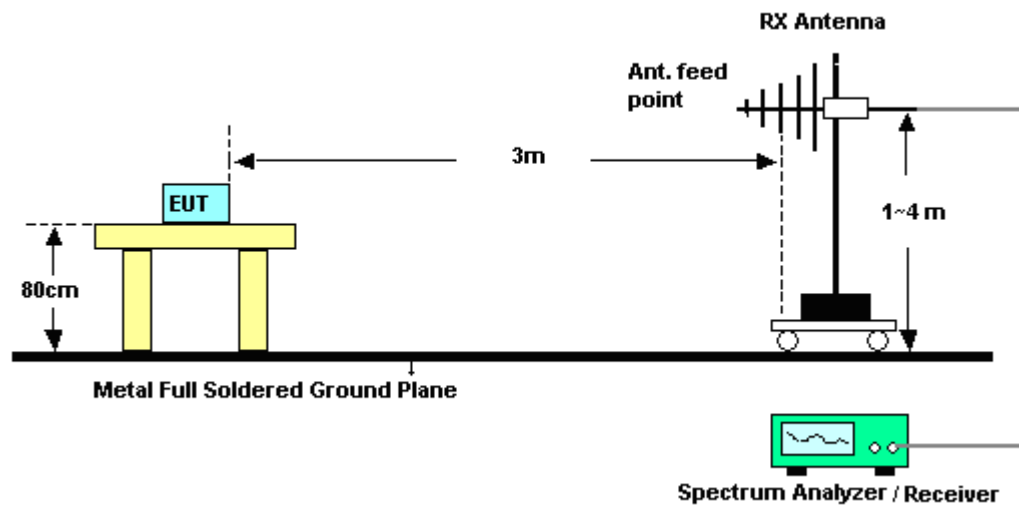
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test 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.

3.2.4 Test Setup

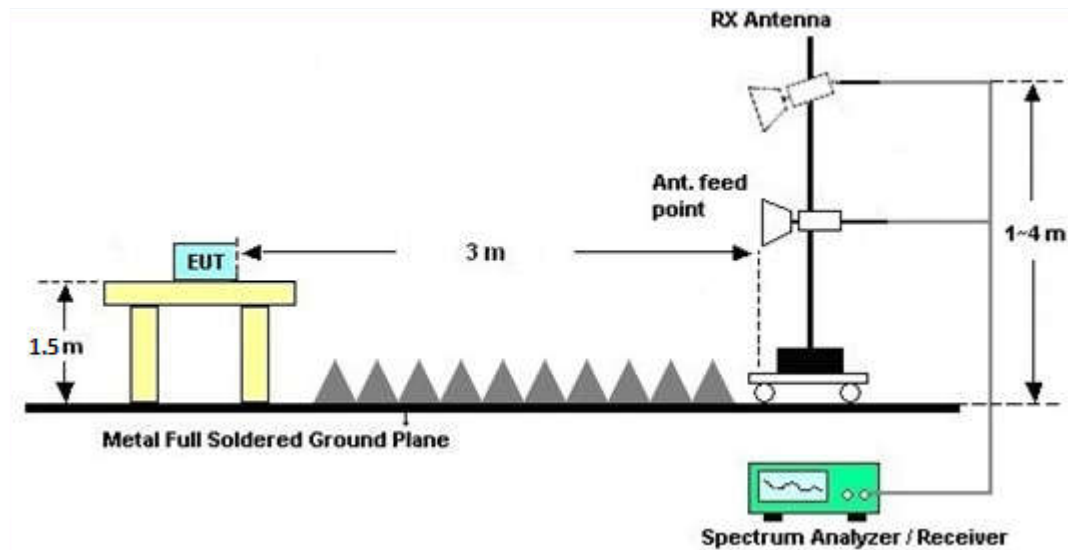
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.2.5 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.

3.2.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A.

3.2.7 Duty Cycle

Please refer to Appendix B.

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

Please refer to Appendix A.

3.2.9 Test Result of Radiated Spurious Emission (Simultaneous TX)

Please refer to Appendix A.

Note: The worst cases of mode (BT3.0/BLE/WLAN2.4GHz) is tested

3.3 AC Conducted Emission Measurement

3.3.1 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.

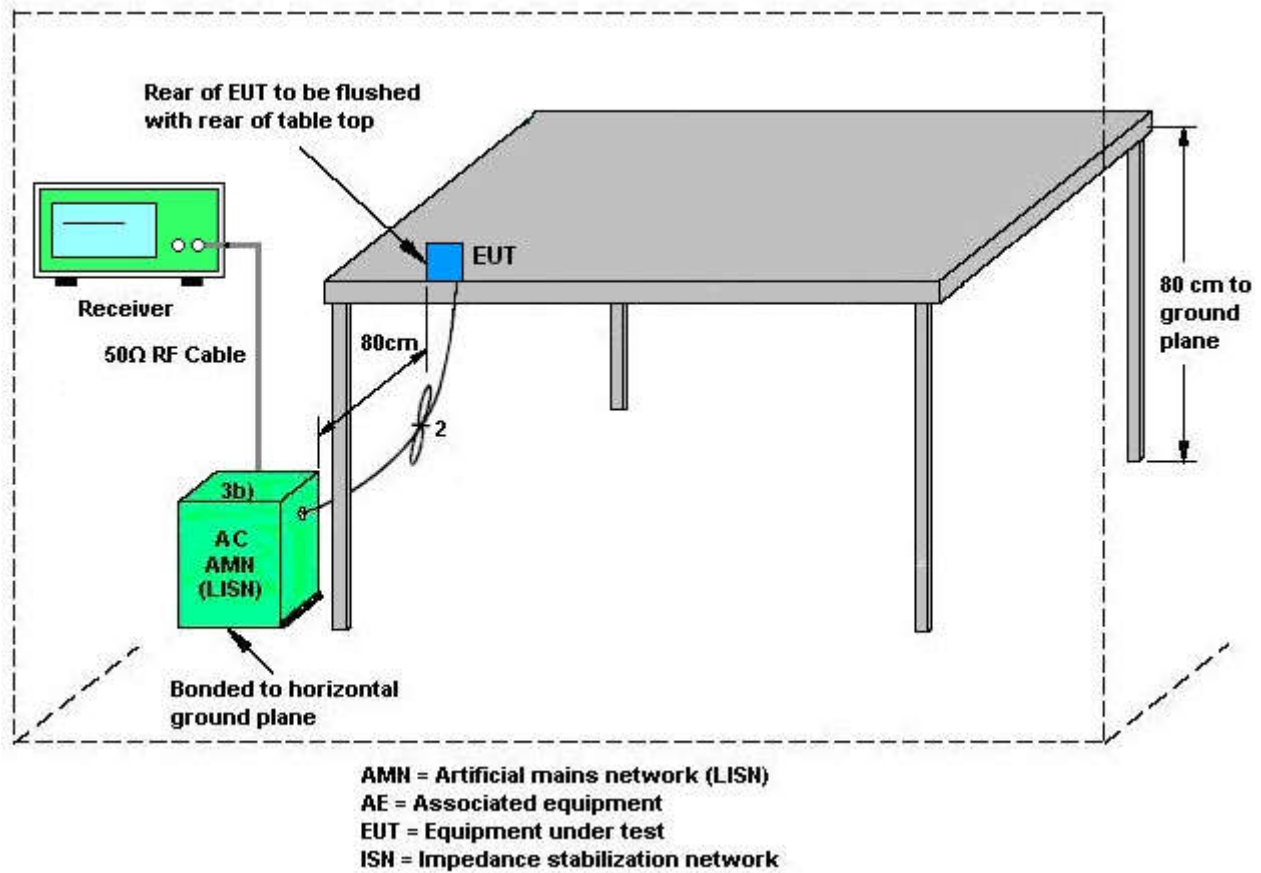
3.3.2 Measuring Instruments

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

3.3.3 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.

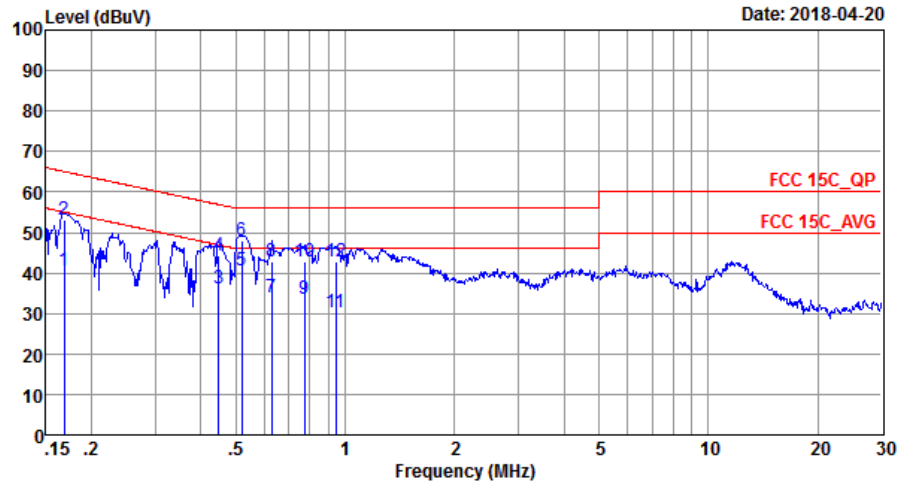
3.3.4 Test Setup





3.3.5 Test Result of AC Conducted Emission

Test Mode :	Mode 2	Temperature :	22~25℃
Test Engineer :	Lion Gao	Relative Humidity :	50~55%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	Bluetooth Link + WLAN Link(2.4G) + Adapter 2 + Earphone		

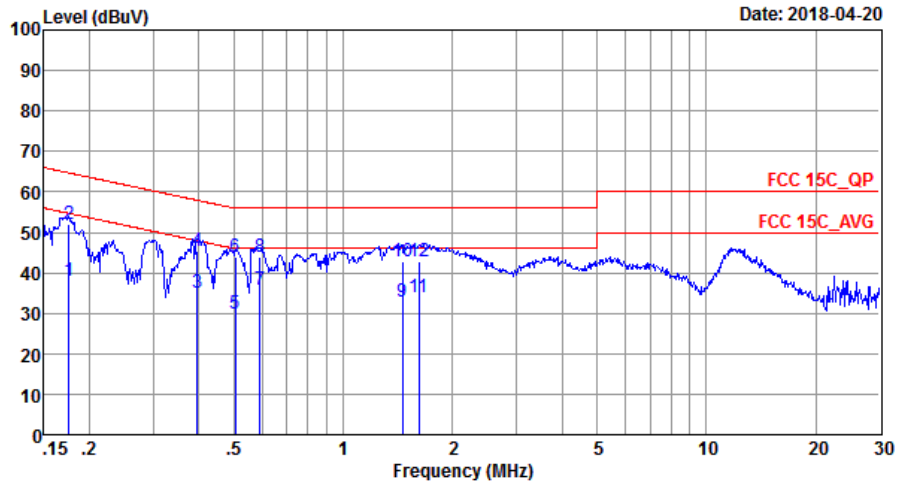


Site : CO01-SZ
Condition : FCC 15C_QP LISN_20170907_L LINE
Project : 832801
Mode : Mode 2

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.17	40.49	-14.54	55.03	30.39	0.03	10.07	Average
2	0.17	53.10	-11.93	65.03	43.00	0.03	10.07	QP
3	0.45	36.30	-10.59	46.89	26.20	0.02	10.08	Average
4	0.45	44.10	-12.79	56.89	34.00	0.02	10.08	QP
5 *	0.52	40.60	-5.40	46.00	30.50	0.02	10.08	Average
6	0.52	47.80	-8.20	56.00	37.70	0.02	10.08	QP
7	0.63	33.80	-12.20	46.00	23.70	0.02	10.08	Average
8	0.63	42.70	-13.30	56.00	32.60	0.02	10.08	QP
9	0.77	33.52	-12.48	46.00	23.41	0.03	10.08	Average
10	0.77	42.92	-13.08	56.00	32.81	0.03	10.08	QP
11	0.94	30.15	-15.85	46.00	20.00	0.06	10.09	Average
12	0.94	42.65	-13.35	56.00	32.50	0.06	10.09	QP



Test Mode :	Mode 2	Temperature :	22~25°C
Test Engineer :	Lion Gao	Relative Humidity :	50~55%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	Bluetooth Link + WLAN Link(2.4G) + Adapter 2 + Earphone		



Site : CO01-SZ
 Condition : FCC 15C_QP LISN_20170907_N NEUTRAL
 Project : 832801
 Mode : Mode 2

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.18	38.10	-16.58	54.68	28.00	0.03	10.07	Average
2	0.18	52.10	-12.58	64.68	42.00	0.03	10.07	QP
3	0.40	35.20	-12.75	47.95	25.10	0.02	10.08	Average
4	0.40	45.50	-12.45	57.95	35.40	0.02	10.08	QP
5	0.50	29.80	-16.20	46.00	19.70	0.02	10.08	Average
6	0.50	43.90	-12.10	56.00	33.80	0.02	10.08	QP
7 *	0.59	35.80	-10.20	46.00	25.70	0.02	10.08	Average
8	0.59	43.90	-12.10	56.00	33.80	0.02	10.08	QP
9	1.46	32.95	-13.05	46.00	22.80	0.05	10.10	Average
10	1.46	42.75	-13.25	56.00	32.60	0.05	10.10	QP
11	1.62	33.95	-12.05	46.00	23.80	0.05	10.10	Average
12	1.62	42.95	-13.05	56.00	32.80	0.05	10.10	QP



3.4 Antenna Requirements

3.4.1 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.

3.4.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.4.3 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
Pulse Power Sensor	Anritsu	MA2411B	1207253	30MHz~40GHz	Dec.26, 2017	Apr. 11, 2018	Dec.25, 2018	Conducted (TH01-SZ)
Power Meter	Anritsu	ML2495A	1218010	50MHz Bandwidth	Dec.26, 2017	Apr. 11, 2018	Dec.25, 2018	Conducted (TH01-SZ)
EMI Receiver	R&S	ESR7	101630	9kHz~7GHz;	Dec.26, 2017	Apr. 20, 2018	Dec.25, 2018	Conduction (CO01-SZ)
AC LISN	EMCO	3816/2SH	00103912	9kHz~30MHz	Dec.26, 2017	Apr. 20, 2018	Dec.25, 2018	Conduction (CO01-SZ)
AC LISN (for auxiliary equipment)	MessTec	3816/2SH	00103892	9kHz~30MHz	Nov. 01, 2017	Apr. 20, 2018	Oct. 31, 2018	Conduction (CO01-SZ)
AC Power Source	Chroma	61602	616020000891	100Vac~250Vac	Jul. 19, 2017	Apr. 20, 2018	Jul. 18, 2018	Conduction (CO01-SZ)
EMI Test Receiver	R&S	ESR7	101404	9kHz~7GHz	Apr. 18, 2017	Apr. 11, 2018	Apr. 17, 2018	Radiation (03CH04-SZ)
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY55150213	10Hz~44GHz	Apr. 18, 2017	Apr. 11, 2018	Apr. 17, 2018	Radiation (03CH04-SZ)
Loop Antenna	R&S	HFH2-Z2	100354	9kHz~30MHz	May 14, 2017	Apr. 11, 2018	May 13, 2018	Radiation (03CH04-SZ)
Bilog Antenna	TeseQ	CBL6111D	41909	30MHz~1GHz	May 16, 2017	Apr. 11, 2018	May 15, 2018	Radiation (03CH04-SZ)
Double Ridge Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-1285	1GHz~18GHz	Dec. 13, 2017	Apr. 11, 2018	Dec. 12, 2018	Radiation (03CH04-SZ)
Horn Antenna	SCHWARZBECK	BBHA9170	9170#679	15GHz~40GHz	May 17, 2017	Apr. 11, 2018	May 16, 2018	Radiation (03CH04-SZ)
Amplifier	Burgeon	BPA-530	102211	0.01Hz~3000MHz	Oct. 19, 2017	Apr. 11, 2018	Oct. 18, 2018	Radiation (03CH04-SZ)
HF Amplifier	MITEQ	AMF-7D-00101800-30-10P-R	1989346	1GHz~18GHz	Jul. 27, 2017	Apr. 11, 2018	Jul. 26, 2018	Radiation (03CH04-SZ)
HF Amplifier	MITEQ	TTA1840-35-HG	1988315	18GHz~40GHz	Jul. 27, 2017	Apr. 11, 2018	Jul. 26, 2018	Radiation (03CH04-SZ)
Amplifier	Agilent Technologies	83017A	MY53270156	500MHz~26.5GHz	Apr. 18, 2017	Apr. 11, 2018	Apr. 17, 2018	Radiation (03CH04-SZ)
AC Power Source	Chroma	61601	N/A	N/A	NCR	Apr. 11, 2018	NCR	Radiation (03CH04-SZ)
Turn Table	EM	EM1000	N/A	0~360 degree	NCR	Apr. 11, 2018	NCR	Radiation (03CH04-SZ)
Antenna Mast	EM	EM1000	N/A	1 m~4 m	NCR	Apr. 11, 2018	NCR	Radiation (03CH04-SZ)

NCR: No Calibration Required



5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	2.6dB
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	5.1dB
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	4.8dB
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	5.1dB
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Appendix A. Radiated Spurious Emission

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

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)
BLE CH 00 2402MHz		2370.585	52.1	-21.9	74	48.14	27.72	4.72	28.48	158	119	P	H
		2389.8	43.09	-10.91	54	38.97	27.7	4.78	28.36	158	119	A	H
	*	2402	98.39	-	-	94.27	27.7	4.78	28.36	158	119	P	H
	*	2402	98	-	-	93.88	27.7	4.78	28.36	158	119	A	H
		2343.075	53.19	-20.81	74	49.37	27.75	4.66	28.59	157	96	P	V
		2388.645	43.27	-10.73	54	39.27	27.7	4.78	28.48	157	96	A	V
	*	2402	98.29	-	-	94.17	27.7	4.78	28.36	157	96	P	V
	*	2402	97.91	-	-	93.79	27.7	4.78	28.36	157	96	A	V
BLE CH 19 2440MHz		2346.54	52.63	-21.37	74	48.75	27.75	4.72	28.59	158	123	P	H
		2385.04	42.92	-11.08	54	38.9	27.72	4.78	28.48	158	123	A	H
	*	2440	98.9	-	-	94.66	27.66	4.82	28.24	158	123	P	H
	*	2440	98.41	-	-	94.17	27.66	4.82	28.24	158	123	A	H
		2487.47	52.65	-21.35	74	48.18	27.63	4.85	28.01	158	123	P	H
		2486.91	43.58	-10.42	54	39.11	27.63	4.85	28.01	158	123	A	H
		2356.34	52.25	-21.75	74	48.38	27.74	4.72	28.59	180	87	P	V
		2363.34	43.59	-10.41	54	39.72	27.74	4.72	28.59	180	87	A	V
	*	2440	98.24	-	-	94	27.66	4.82	28.24	180	87	P	V
	*	2440	97.65	-	-	93.41	27.66	4.82	28.24	180	87	A	V
		2486.35	52.76	-21.24	74	48.29	27.63	4.85	28.01	180	87	P	V
		2489.92	43.4	-10.6	54	38.95	27.61	4.85	28.01	180	87	A	V



BLE CH 39 2480MHz	*	2480	98.89	-	-	94.42	27.63	4.85	28.01	158	118	P	H
	*	2480	98.21	-	-	93.74	27.63	4.85	28.01	158	118	A	H
		2489.32	55.94	-18.06	74	51.49	27.61	4.85	28.01	158	118	P	H
		2489.68	46.96	-7.04	54	42.51	27.61	4.85	28.01	158	118	A	H
	*	2480	97.17	-	-	92.7	27.63	4.85	28.01	173	99	P	V
	*	2480	96.8	-	-	92.33	27.63	4.85	28.01	173	99	A	V
		2489.72	53.97	-20.03	74	49.52	27.61	4.85	28.01	173	99	P	V
		2489.6	45.5	-8.5	54	41.05	27.61	4.85	28.01	173	99	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	40.24	-33.76	74	61.19	31.72	5.55	58.22	178	97	P	H
		4804	39.62	-34.38	74	60.85	31.44	5.55	58.22	151	219	P	V
BLE CH 19 2440MHz		4880	39.83	-34.17	74	60.4	31.88	5.65	58.1	164	214	P	H
		7320	45.4	-28.6	74	59.07	36.94	7.26	57.87	168	336	P	H
		4880	39.22	-34.78	74	60.06	31.61	5.65	58.1	150	258	P	V
		7320	45.42	-28.58	74	59.84	36.19	7.26	57.87	152	309	P	V
BLE CH 39 2480MHz		4960	38.99	-35.01	74	58.91	32.08	5.96	57.96	120	269	P	H
		7440	45.9	-28.1	74	58.82	37.4	7.17	57.49	184	278	P	H
		4960	38.36	-35.64	74	58.54	31.82	5.96	57.96	118	289	P	V
		7440	45.66	-28.34	74	59.64	36.34	7.17	57.49	158	273	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		30	24.47	-15.53	40	31.29	24.9	0.25	31.97	-	-	P	H
		190.05	34.59	-8.91	43.5	49.3	15.15	1.51	31.37	100	94	P	H
		273.47	26.78	-19.22	46	36.76	19.47	1.78	31.23	-	-	P	H
		464.56	27.66	-18.34	46	33.34	23.25	2.34	31.27	-	-	P	H
		582.9	28.5	-17.5	46	31.62	25.49	2.65	31.26	-	-	P	H
		781.75	31.97	-14.03	46	31.87	28.17	3.11	31.18	-	-	P	H
		54.25	31.28	-8.72	40	48.99	13.46	0.75	31.92	-	-	P	V
		78.5	34.66	-5.34	40	52.23	13.44	0.84	31.85	100	301	P	V
		190.05	34.39	-9.11	43.5	49.1	15.15	1.51	31.37	-	-	P	V
		479.11	29.59	-16.41	46	34.9	23.56	2.38	31.25	-	-	P	V
		540.22	29.91	-16.09	46	33.91	24.72	2.53	31.25	-	-	P	V
		866.14	32.8	-13.2	46	31.65	29.03	3.3	31.18	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



For Simultaneous TX

2.4GHz 2400~2483.5MHz
WIFI 802.11n HT20 (Harmonic @ 3m)

BLE WIFI Ant. 1+2	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		4824	39.7	-34.3	74	60.58	31.76	5.55	58.19	163	360	P	H
CH39		4960	38.02	-35.98	74	57.94	32.08	5.96	57.96	120	269	P	H
2480MHz		7440	44.56	-29.44	74	57.48	37.4	7.17	57.49	184	278	P	H
802.11n		4824	37.98	-36.02	74	59.13	31.49	5.55	58.19	163	360	P	V
HT20		4960	37.76	-36.24	74	57.94	31.82	5.96	57.96	105	247	P	V
CH 01													
2412MHz		7440	43.72	-30.28	74	57.7	36.34	7.17	57.49	156	277	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 3 - 5470~5725MHz

WIFI 802.11n HT40 (Harmonic @ 3m)

BLE 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)
BLE CH39 2480MHz 802.11n HT40 CH134 5670MHz		4960	38.2	-35.8	74	58.12	32.08	5.96	57.96	120	269	P	H
		7440	45.74	-28.26	74	58.66	37.4	7.17	57.49	184	278	P	H
		11340	44.19	-29.81	74	51.18	39.14	9.46	55.59	163	0	P	H
		17010	49.08	-24.92	74	49.28	41.61	14.5	56.31	163	0	P	H
		4960	37.51	-36.49	74	57.43	32.08	5.96	57.96	118	289	P	V
		7440	45.42	-28.58	74	58.34	37.4	7.17	57.49	158	273	P	V
		11340	45.61	-28.39	74	52.6	39.14	9.46	55.59	163	0	P	V
		17010	50.85	-23.15	74	51.05	41.61	14.5	56.31	163	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 - 5725~5850MHz

WIFI 802.11n HT40 (Harmonic @ 3m)

BLE WIFI Ant. 1+2	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 CH39 2480MHz 802.11n HT40 CH159 5795MHz		4960	36.69	-37.31	74	56.61	32.08	5.96	57.96	120	269	P	H
		7440	45.02	-28.98	74	57.94	37.4	7.17	57.49	184	278	P	H
		11590	46.86	-27.14	74	53.24	39.3	9.53	55.21	163	0	P	H
		17385	50.55	-23.45	74	47.93	44.03	15.2	56.61	163	0	P	H
		4960	37.58	-36.42	74	57.5	32.08	5.96	57.96	118	289	P	V
		7440	45.21	-28.79	74	58.13	37.4	7.17	57.49	158	273	P	V
		11590	46.43	-27.57	74	52.81	39.3	9.53	55.21	163	0	P	V
		17385	50.85	-23.15	74	48.23	44.03	15.2	56.61	163	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average 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		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

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	62.59	0.393	2.5469	3kHz

Bluetooth LE

