

FCC RF Test Report

APPLICANT : Acer Incorporated
EQUIPMENT : Notebook computer
BRAND NAME : acer
MODEL NAME : N17H2
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 Aug. 03, 2018 and testing was completed on Sep. 17, 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.

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR880301C	Rev. 01	Initial issue of report	Sep. 26, 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)	Power Output Measurement	$\leq 30\text{dBm}$	Pass	-
-	15.247(e)	Power Spectral Density	$\leq 8\text{dBm}/3\text{kHz}$	Pass	1
-	15.247(d)	Conducted Band Edges	$\leq 20\text{dBc}$	Pass	1
		Conducted Spurious Emission		Pass	1
3.2	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 1.39 dB at 2487.68 MHz
3.3	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 6.70 dB at 0.50 MHz
3.4	15.203 & 15.247(b)	Antenna Requirement	N/A	Pass	-
Remark 1: Test items are leveraged from module RF report "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	N17H2
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 BR/EDR/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

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. There are three samples under test, the detailed differences are shown in the Component List. The differences have no influence on RF features, only Sample 1 perform full test.

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification				
Tx/Rx Channel Frequency Range		2412 MHz ~ 2472 MHz		
Maximum (Peak) Output Power to antenna		<Ant. 1> 802.11b : 13.67 dBm (0.0233 W) 802.11g : 17.17 dBm (0.0521 W) 802.11n HT20 : 17.10 dBm (0.0513 W) 802.11n HT40 : 17.56 dBm (0.0570 W) <Ant. 2> 802.11b : 13.35 dBm (0.0216 W) 802.11g : 16.90 dBm (0.0490 W) 802.11n HT20 : 16.92 dBm (0.0492 W) 802.11n HT40 : 17.34 dBm (0.0542 W) MIMO <Ant. 1 + 2> 802.11n HT20 : 19.96 dBm (0.0991 W) 802.11n HT40 : 20.43 dBm (0.1104 W)		
Antenna Type / Gain		Ant. 1: PIFA Antenna with gain 1.06 dBi Ant. 2: PIFA Antenna with gain 1.07 dBi		
Type of Modulation		802.11b : DSSS (DBPSK / DQPSK / CCK) 802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM)		
Antenna Function for Transmitter			Ant. 1	Ant. 2
		802.11 b/g/n SISO	V	V
		802.11 n MIMO	V	V

Note: MIMO Ant. 1+2 is a calculated result from sum of the power MIMO Ant. 1 and MIMO Ant. 2.

1.5 Component List

Component	Sample 1 SKUC	Sample 2 SKUA	Sample 3 SKUB
CPU	N5000	N5000	N4000
BT/WIFI Module	9560D2W	9560D2W	9560D2W
RAM	HYNIX LPD4_2GB(200b_D4x32) H9HCNNNBPUMLHR-NME	HYNIX LPD4_2GB(200b_D4x32) H9HCNNNBPUMLHR-NME	MICRON LPD4_2GB(200b_D2x32) MT53E512M32D2NP-04 6 WT:E
EMMC	SANDISK NAND 128GB SDINADF4-128G-1220	SANDISK NAND 64GB SDINBDA4-64-1220V	SANDISK NAND 64GB SDINBDA4-64-1220V
Camera front	6SF009N2	6SF009N2	6SF009N2
LCD	ZC-116A-1227BT	ZC-116A-1227BT	ZC-116A-1227BT
Battery	AP16L5J	AP16L5J	AP16L5J

1.6 Modification of EUT

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



1.7 Testing Location

Sporton Lab is accredited to ISO 17025 by National Voluntary Laboratory Accreditation Program (NVLAP code: 600156-0).

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 designation No.	FCC Test Firm Registration No.
	TH01-SZ CO01-SZ	CN5018	337463

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 designation No.	FCC Test Firm Registration No.
	03CH03-SZ	CN5019	577730

1.8 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 558074 D01 15.247 Meas Guidance v05
- ♦ FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ♦ 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

- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: 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).
- b. AC power line Conducted Emission was tested under maximum output power.

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	1	2412	7	2442
	2	2417	8	2447
	3	2422	9	2452
	4	2427	10	2457
	5	2432	11	2462
	6	2437	12	2467
	-	-	13	2472

2.2 Test Mode

Final test modes are considering the modulation and worse data rates as below table.

1. For 802.11b/g SISO mode, we only test Antenna 1 for RSE by referring to the higher conducted power.
2. For 802.11n HT20/HT40 SISO & MIMO mode, we only test MIMO mode for RSE by referring to the higher conducted power.

SISO Antenna

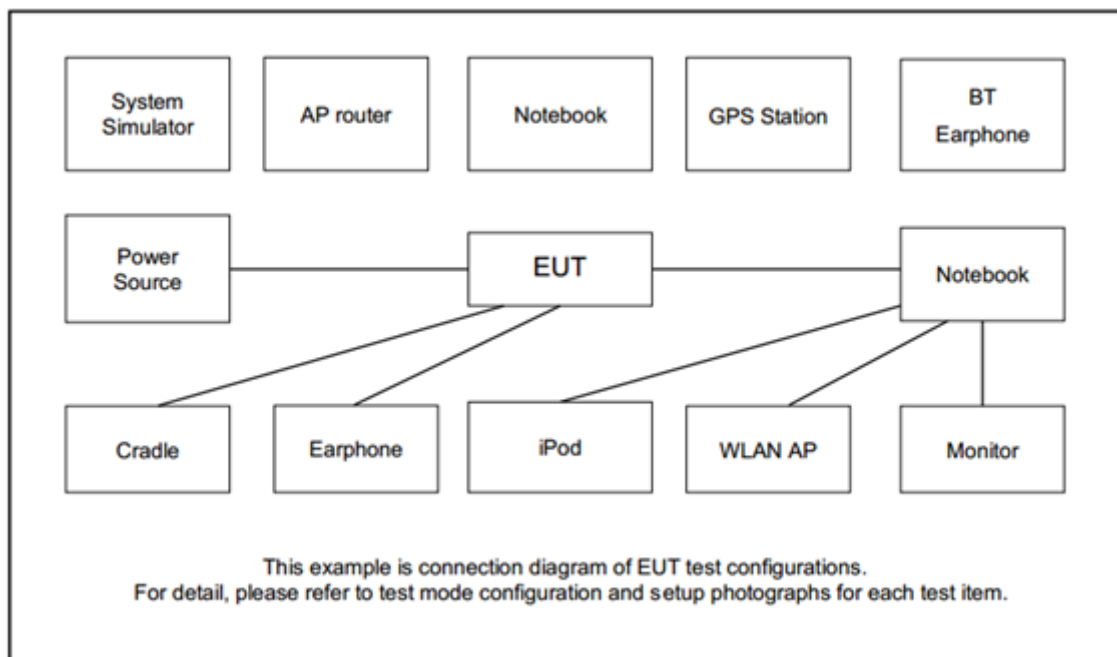
Modulation	Data Rate
802.11b	1 Mbps
802.11g	6 Mbps

MIMO Antenna

Modulation	Data Rate
802.11n HT20	MCS8
802.11n HT40	MCS8

Test Cases	
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 Mode 3 :Bluetooth Link + WLAN Link (2.4G) + Adapter 3 + Earphone Mode 4 :Bluetooth Link + WLAN Link (2.4G) + Adapter 4 + Earphone Mode 5 :Bluetooth Link + WLAN Link (2.4G) + Adapter 5 + Earphone
Remark: 1. The worst case of AC is mode 3; only the test data of it was reported. 2. For Radiated Test Cases, the full tests were performed with Adapter 1 and Earphone.	

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	WLAN AP	Dlink	DIR-820L	KA2IR820LA1	N/A	Unshielded,1.8m
2.	Notebook	Lenovo	E540	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
3.	Bluetooth Earphone	Samsung	EO-MG900	PYAHS-107W	N/A	N/A
4.	Earphone	apple	DCAY1V-A9007ZJW3-000	N/A	N/A	Unshielded,1.8m
5.	SD Card	N/A	MicroSD HC	FCC DoC	N/A	N/A
6.	Monitor	DELL	P2715QT	FCC DoC	N/A	N/A
7.	ipod	apple	MC69029/A	N/A	N/A	Unshielded,1.8m

2.5 EUT Operation Test Setup

For WLAN RF 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 Output Power Measurement

3.1.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting antenna with 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.

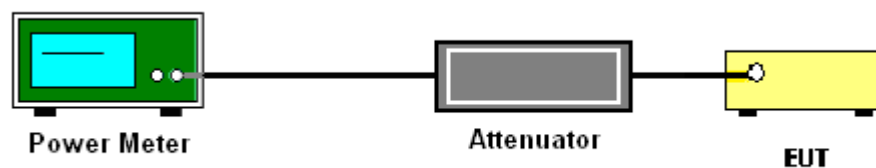
3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedures

1. The testing follows the Measurement Procedure of ANSI C63.10-2013 clause 11.9.1.3 PKPM1 Peak power meter method.
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.
5. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

3.1.4 Test Setup





3.1.5 Test Result of Peak Output Power

2.4GHz Band														
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		Pass /Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	
11b	1Mbps	1	1	2412	13.54	13.35		30.00	30.00	1.06	1.07	14.60	14.42	Pass
11b	1Mbps	1	7	2442	13.67	13.35		30.00	30.00	1.06	1.07	14.73	14.42	Pass
11b	1Mbps	1	11	2462	13.43	13.20		30.00	30.00	1.06	1.07	14.49	14.27	Pass
11b	1Mbps	1	12	2467	13.50	13.19		30.00	30.00	1.06	1.07	14.56	14.26	Pass
11b	1Mbps	1	13	2472	13.60	13.33		30.00	30.00	1.06	1.07	14.66	14.40	Pass
11g	6Mbps	1	1	2412	17.14	16.90		30.00	30.00	1.06	1.07	18.20	17.97	Pass
11g	6Mbps	1	7	2442	17.17	16.77		30.00	30.00	1.06	1.07	18.23	17.84	Pass
11g	6Mbps	1	11	2462	16.86	16.58		30.00	30.00	1.06	1.07	17.92	17.65	Pass
11g	6Mbps	1	12	2467	16.90	16.53		30.00	30.00	1.06	1.07	17.96	17.60	Pass
11g	6Mbps	1	13	2472	-0.26	-0.70		30.00	30.00	1.06	1.07	0.80	0.37	Pass
HT20	MCS0	1	1	2412	16.92	16.92		30.00	30.00	1.06	1.07	17.98	17.99	Pass
HT20	MCS0	1	6	2437	17.10	16.60		30.00	30.00	1.06	1.07	18.16	17.67	Pass
HT20	MCS0	1	11	2462	17.10	16.64		30.00	30.00	1.06	1.07	18.16	17.71	Pass
HT20	MCS0	1	12	2467	17.05	16.53		30.00	30.00	1.06	1.07	18.11	17.60	Pass
HT20	MCS0	1	13	2472	-2.30	-2.78		30.00	30.00	1.06	1.07	-1.24	-1.71	Pass
HT40	MCS0	1	3	2422	17.41	17.34		30.00	30.00	1.06	1.07	18.47	18.41	Pass
HT40	MCS0	1	6	2437	17.56	17.24		30.00	30.00	1.06	1.07	18.62	18.31	Pass
HT40	MCS0	1	9	2452	17.42	17.21		30.00	30.00	1.06	1.07	18.48	18.28	Pass
HT40	MCS0	1	10	2457	14.93	14.86		30.00	30.00	1.06	1.07	15.99	15.93	Pass
HT40	MCS0	1	11	2462	8.90	7.85		30.00	30.00	1.06	1.07	9.96	8.92	Pass

**2.4GHz Band**

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		Pass /Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	
HT20	MCS8	2	1	2412	16.94	16.95	19.96	30.00		1.07		21.03		Pass
HT20	MCS8	2	7	2442	17.11	16.61	19.88	30.00		1.07		20.95		Pass
HT20	MCS8	2	11	2462	17.12	16.67	19.91	30.00		1.07		20.98		Pass
HT20	MCS8	2	12	2467	17.10	16.58	19.86	30.00		1.07		20.93		Pass
HT20	MCS8	2	13	2472	-2.27	-2.75	0.51	30.00		1.07		1.58		Pass
HT40	MCS8	2	3	2422	17.43	17.40	20.43	30.00		1.07		21.50		Pass
HT40	MCS8	2	7	2442	17.57	17.26	20.43	30.00		1.07		21.50		Pass
HT40	MCS8	2	9	2452	17.44	17.22	20.34	30.00		1.07		21.41		Pass
HT40	MCS8	2	10	2457	15.00	14.89	17.96	30.00		1.07		19.03		Pass
HT40	MCS8	2	11	2462	8.91	7.88	11.44	30.00		1.07		12.51		Pass

Note: Measured power (dBm) has offset with cable loss.



Average Output Power (Report Only)

2.4GHz Band									
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)		Average Conducted Power (dBm)		
					Ant 1	Ant 2	Ant 1	Ant 2	SUM
11b	1Mbps	1	1	2412	0.14	0.14	11.78	11.56	
11b	1Mbps	1	7	2442	0.14	0.14	11.75	11.54	
11b	1Mbps	1	11	2462	0.14	0.14	11.65	11.42	
11b	1Mbps	1	12	2467	0.14	0.14	11.61	11.34	
11b	1Mbps	1	13	2472	0.14	0.14	11.64	11.44	
11g	6Mbps	1	1	2412	0.62	0.61	11.55	11.46	
11g	6Mbps	1	7	2442	0.62	0.61	11.70	11.48	
11g	6Mbps	1	11	2462	0.62	0.61	11.50	11.25	
11g	6Mbps	1	12	2467	0.62	0.61	11.54	11.22	
11g	6Mbps	1	13	2472	0.62	0.61	-5.52	-6.30	
HT20	MCS0	1	1	2412	0.61	0.61	11.53	11.51	
HT20	MCS0	1	6	2437	0.61	0.61	11.56	11.32	
HT20	MCS0	1	11	2462	0.61	0.61	11.41	11.23	
HT20	MCS0	1	12	2467	0.61	0.61	11.54	11.23	
HT20	MCS0	1	13	2472	0.61	0.61	-8.54	-9.25	
HT40	MCS0	1	3	2422	0.63	0.64	11.73	11.28	
HT40	MCS0	1	6	2437	0.63	0.64	11.59	11.35	
HT40	MCS0	1	9	2452	0.63	0.64	11.65	11.34	
HT40	MCS0	1	10	2457	0.63	0.64	9.07	8.80	
HT40	MCS0	1	11	2462	0.63	0.64	0.87	0.17	



2.4GHz Band									
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)		Average Conducted Power (dBm)		
					Ant 1	Ant 2	Ant 1	Ant 2	SUM
HT20	MCS8	2	1	2412	0.63	0.64	11.57	11.54	14.57
HT20	MCS8	2	7	2442	0.63	0.64	11.60	11.37	14.50
HT20	MCS8	2	11	2462	0.63	0.64	11.43	11.27	14.36
HT20	MCS8	2	12	2467	0.63	0.64	11.56	11.26	14.42
HT20	MCS8	2	13	2472	0.63	0.64	-8.53	-9.21	-5.84
HT40	MCS8	2	3	2422	0.66	0.66	11.76	11.32	14.56
HT40	MCS8	2	7	2442	0.66	0.66	11.65	11.38	14.53
HT40	MCS8	2	9	2452	0.66	0.66	11.70	11.36	14.55
HT40	MCS8	2	10	2457	0.66	0.66	9.11	8.85	11.99
HT40	MCS8	2	11	2462	0.66	0.66	0.90	0.20	3.58

Note: Measured power (dBm) has offset with cable loss.

3.2 Radiated Band Edges and Spurious Emission Measurement

3.2.1 Limit of Radiated band edge and Spurious Emission Measurement

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 measuring equipment is listed in the section 4 of this test report.

3.2.3 Test Procedures

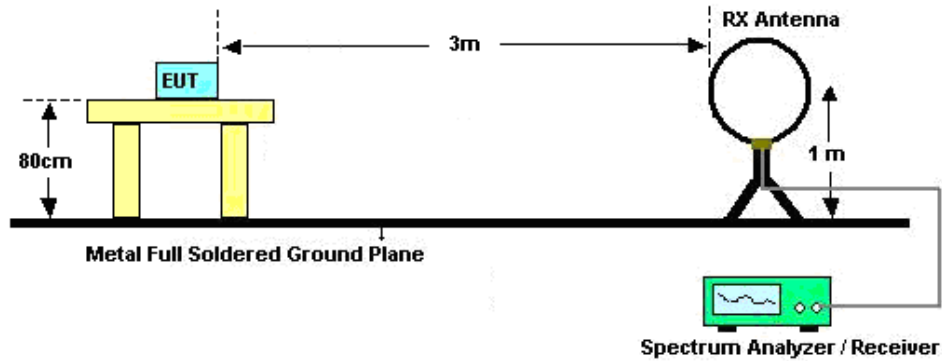
1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better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

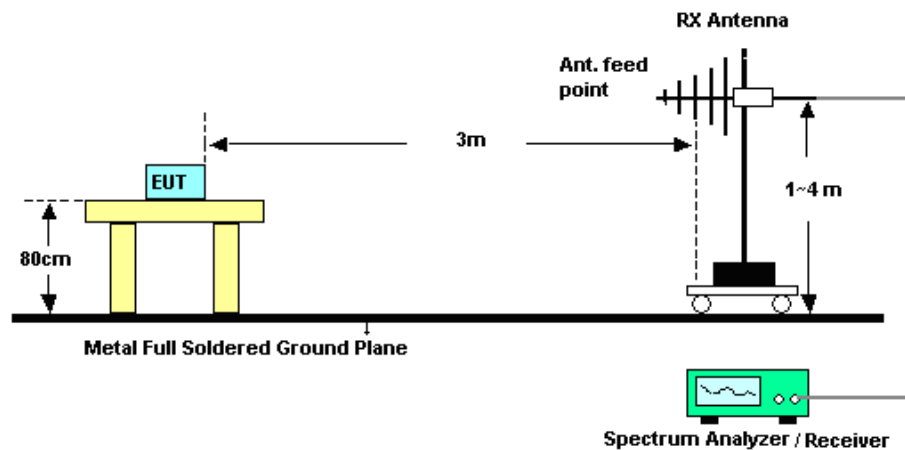
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW $\geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.2.4 Test Setup

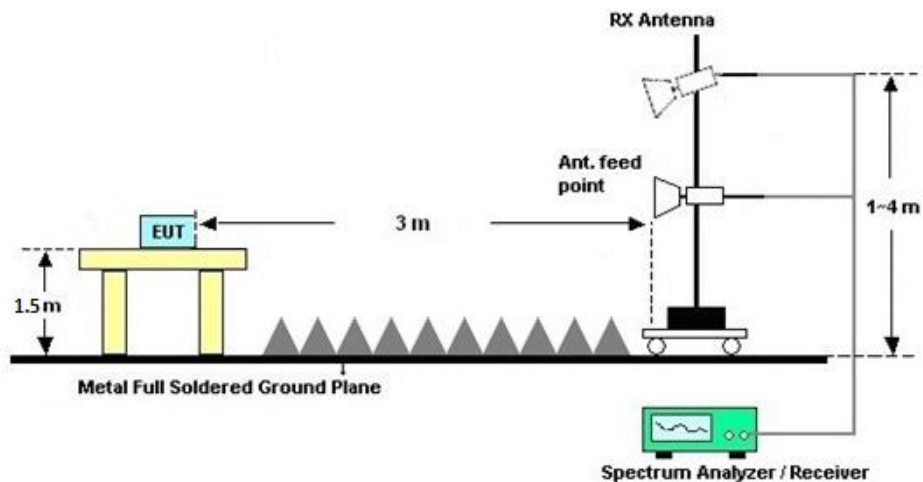
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



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

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 B.

3.2.7 Duty Cycle

Please refer to Appendix C.

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

Please refer to Appendix B.

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.

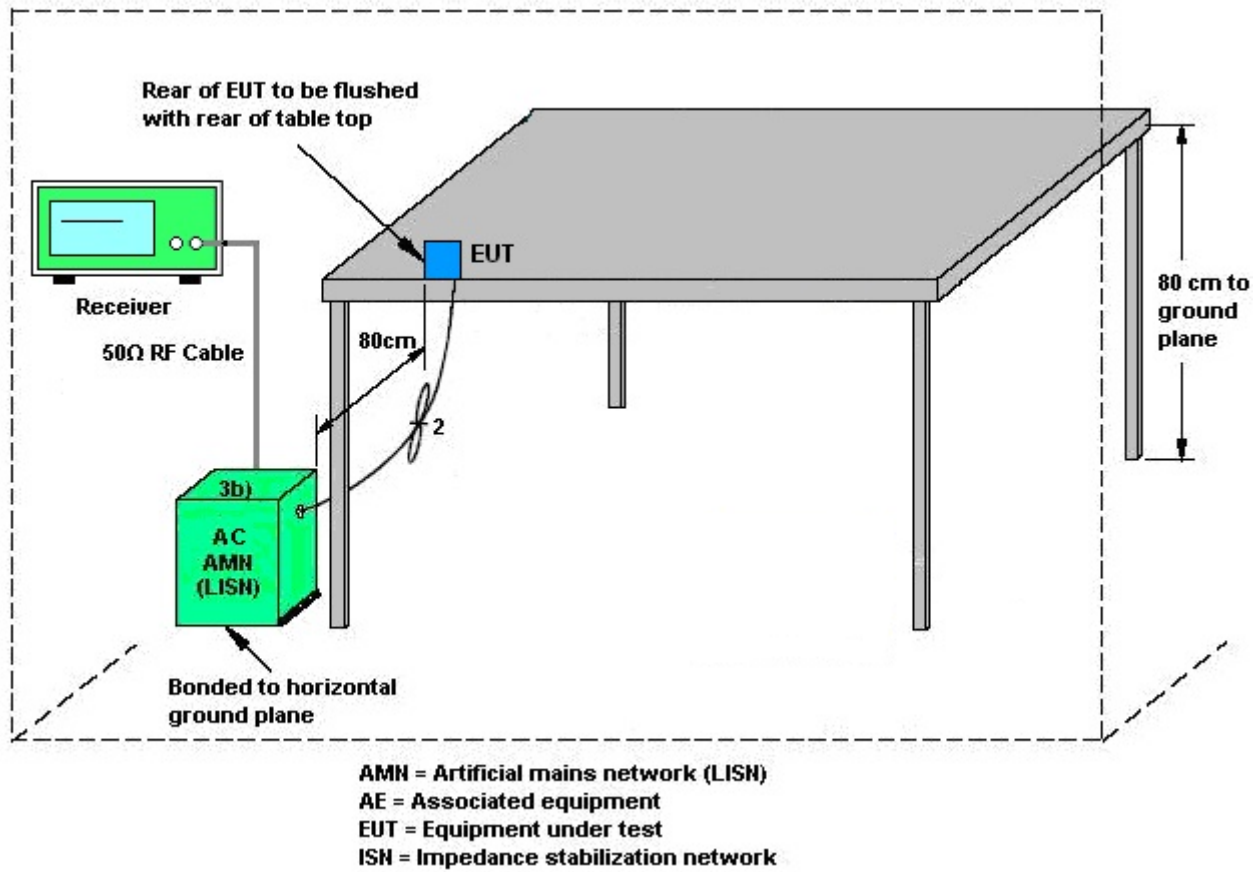
3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.3.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room, and it 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.

3.3.4 Test Setup



3.3.5 Test Result of AC Conducted Emission

Please refer to Appendix A.

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

<CDD Modes >

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

For CDD transmissions, directional gain is calculated as

Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

For power spectral density (PSD) measurements on all devices,

Array Gain = $10 \log(N_{ANT}/N_{SS}=1)$ dB.

For power measurements on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$.

Directional gain may be calculated by using the formulas applicable to equal gain antennas with G_{ANT} set equal to the gain of the antenna having the highest gain;

The EUT supports CDD mode.

For power, the directional gain G_{ANT} is set equal to the antenna having the highest gain, i.e., F)2)f)i).

For PSD, the directional gain calculation is following F)2)f)ii) of KDB 662911 D01 v02r01.

The power and PSD limit should be modified if the directional gain of EUT is over 6 dBi,

The directional gain "DG" is calculated as following table.

<CDD Modes>						
			DG for Power	DG for PSD	Power Limit Reduction	PSD Limit Reduction
	Ant. 1 (dBi)	Ant. 2 (dBi)	(dBi)	(dBi)	(dB)	(dB)
2.4 GHz	1.06	1.07	1.07	4.08	0.00	0.00

Power Limit Reduction = $DG(\text{Power}) - 6\text{dBi}$, (0dB)

PSD Limit Reduction = $DG(\text{PSD}) - 6\text{dBi}$, (0.46dB)



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	Sep. 11, 2018	Dec. 25, 2018	Conducted (TH01-SZ)
Power Meter	Anritsu	ML2495A	1218010	50MHz Bandwidth	Dec. 26, 2017	Sep. 11, 2018	Dec. 25, 2018	Conducted (TH01-SZ)
EMI Test Receiver&SA	KEYSIGHT	N9038A	MY54450083	20Hz~8.4GHz	Apr. 19, 2018	Sep. 17, 2018	Apr. 18, 2019	Radiation (03CH03-SZ)
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY55150246	10Hz~44GHz;	Apr. 19, 2018	Sep. 17, 2018	Apr. 18, 2019	Radiation (03CH03-SZ)
Loop Antenna	R&S	HFH2-Z2	100354	9kHz~30MHz	May 14, 2018	Sep. 17, 2018	May 13, 2019	Radiation (03CH03-SZ)
Bilog Antenna	TeseQ	CBL6112D	35408	30MHz~2GHz	Apr. 19, 2018	Sep. 17, 2018	Apr. 18, 2019	Radiation (03CH03-SZ)
Double Ridge Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-1355	1GHz~18GHz	Mar. 29 2018	Sep. 17, 2018	Mar. 28, 2019	Radiation (03CH03-SZ)
SHF-EHF Horn	com-power	AH-840	101071	18Ghz~40GHz	Mar. 30 2018	Sep. 17, 2018	Mar. 29, 2019	Radiation (03CH03-SZ)
Amplifier	Burgeon	BPA-530	102210	0.01Hz~3000MHz	Oct. 19, 2017	Sep. 17, 2018	Oct. 18, 2018	Radiation (03CH03-SZ)
HF Amplifier	MITEQ	AMF-7D-00101800-30-10P-R	1943528	1GHz~18GHz	Oct. 19, 2017	Sep. 17, 2018	Oct. 18, 2018	Radiation (03CH03-SZ)
Amplifier	Agilent Technologies	83017A	MY39501302	500MHz~26.5GHz	Dec. 27, 2017	Sep. 17, 2018	Dec. 26, 2018	Radiation (03CH03-SZ)
HF Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz	Jul. 30, 2018	Sep. 17, 2018	Jul. 30, 2019	Radiation (03CH03-SZ)
AC Power Source	Chroma	61601	616010001985	N/A	NCR	Sep. 17, 2018	NCR	Radiation (03CH03-SZ)
Turn Table	EM	EM1000	N/A	0~360 degree	NCR	Sep. 17, 2018	NCR	Radiation (03CH03-SZ)
Antenna Mast	EM	EM1000	N/A	1 m~4 m	NCR	Sep. 17, 2018	NCR	Radiation (03CH03-SZ)
EMI Receiver	R&S	ESR7	101630	9kHz~7GHz;	Dec. 26, 2017	Aug. 22, 2018	Dec. 25, 2018	Conduction (CO01-SZ)
AC LISN	EMCO	3816/2SH	00103912	9kHz~30MHz	Dec. 26, 2017	Aug. 22, 2018	Dec. 25, 2018	Conduction (CO01-SZ)
AC LISN (for auxiliary equipment)	MessTec	3816/2SH	00103892	9kHz~30MHz	Nov. 01, 2017	Aug. 22, 2018	Oct. 31, 2018	Conduction (CO01-SZ)
AC Power Source	Chroma	61602	616020000891	100Vac~250Vac	Jul. 18, 2018	Aug. 22, 2018	Jul. 17, 2019	Conduction (CO01-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% ($U = 2Uc(y)$)	2.6dB
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.0dB
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

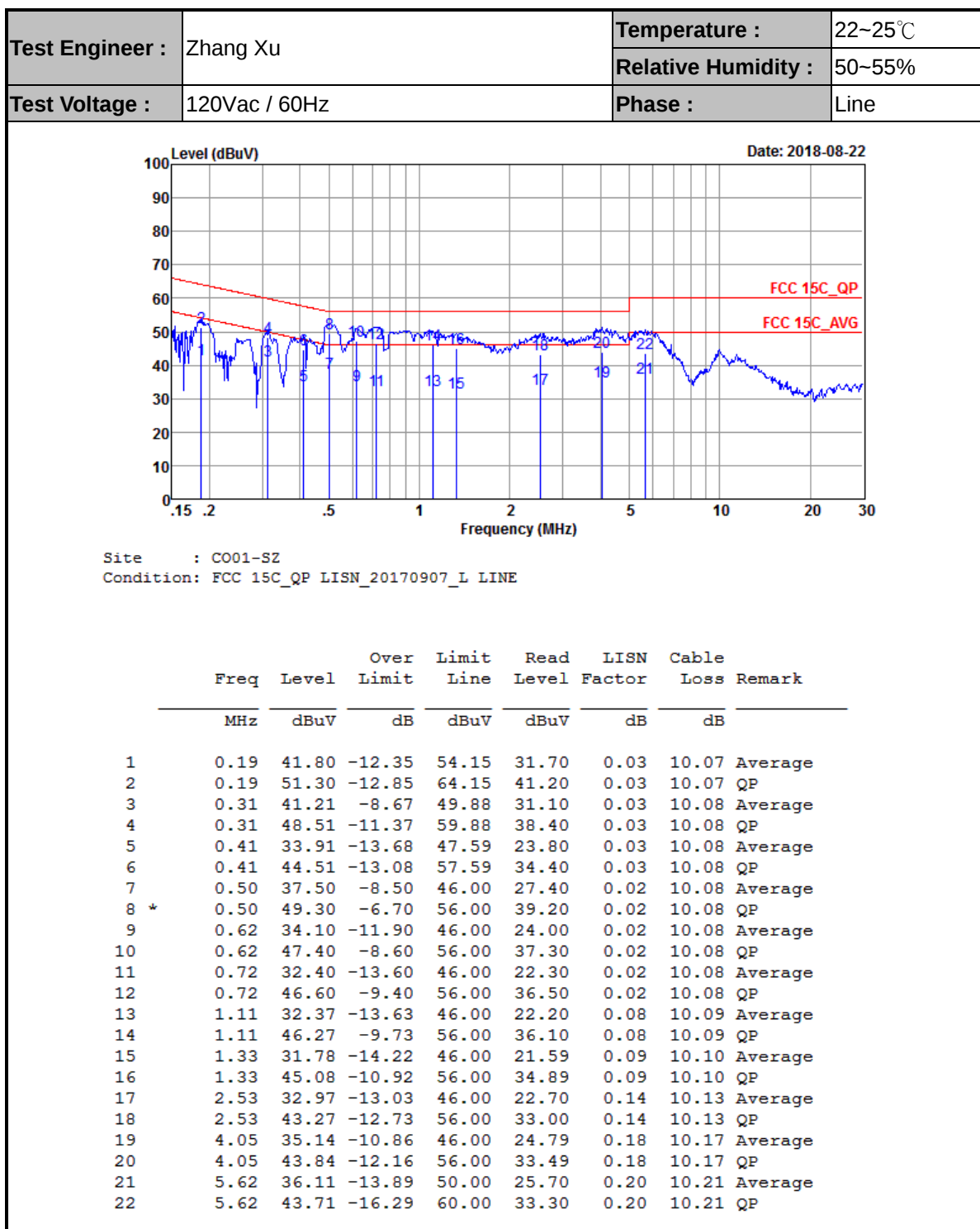
Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.8dB
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.6dB
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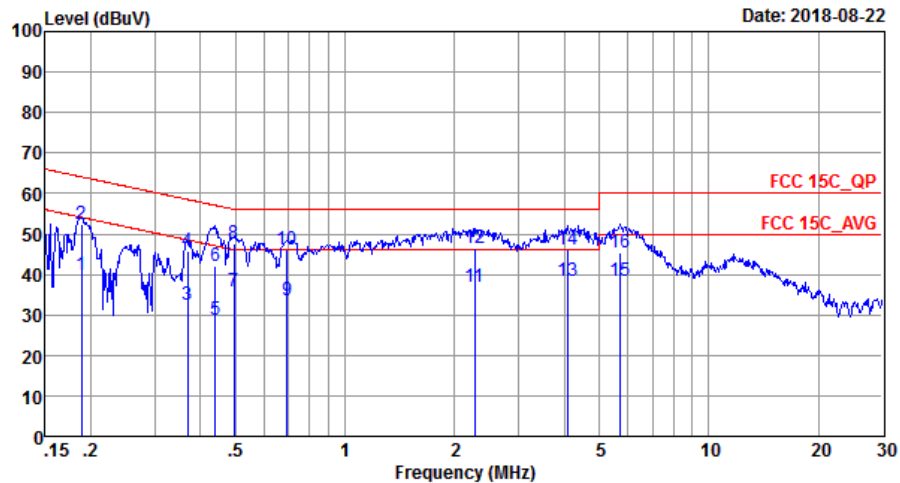


Appendix A. AC Conducted Emission Test Results





Test Engineer :	Zhang Xu	Temperature :	22~25℃
		Relative Humidity :	50~55%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral



Site : C001-SZ
Condition: FCC 15C_QP LISN_20170907_N NEUTRAL

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.19	39.90	-14.21	54.11	29.80	0.03	10.07	Average
2	0.19	52.40	-11.71	64.11	42.30	0.03	10.07	QP
3	0.37	32.50	-16.02	48.52	22.40	0.02	10.08	Average
4	0.37	45.70	-12.82	58.52	35.60	0.02	10.08	QP
5	0.44	28.90	-18.17	47.07	18.80	0.02	10.08	Average
6	0.44	41.90	-15.17	57.07	31.80	0.02	10.08	QP
7	0.49	35.80	-10.30	46.10	25.70	0.02	10.08	Average
8	0.49	47.70	-8.40	56.10	37.60	0.02	10.08	QP
9	0.69	33.40	-12.60	46.00	23.30	0.02	10.08	Average
10	0.69	46.00	-10.00	56.00	35.90	0.02	10.08	QP
11	2.27	36.96	-9.04	46.00	26.80	0.04	10.12	Average
12	2.27	46.46	-9.54	56.00	36.30	0.04	10.12	QP
13 *	4.09	38.52	-7.48	46.00	28.30	0.05	10.17	Average
14	4.09	46.22	-9.78	56.00	36.00	0.05	10.17	QP
15	5.71	38.38	-11.62	50.00	28.10	0.07	10.21	Average
16	5.71	45.38	-14.62	60.00	35.10	0.07	10.21	QP



Appendix B. Radiated Spurious Emission

2.4GHz 2400~2483.5MHz

WIFI 802.11b (Band Edge @ 3m)

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		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2390	62.08	-11.92	74	60.5	27.8	5.06	31.28	141	230	P	H
		2357.04	42.51	-11.49	54	40.97	27.85	5.02	31.33	141	230	A	H
	*	2412	102.94	-	-	101.37	27.77	5.06	31.26	141	230	P	H
	*	2412	99.1	-	-	97.53	27.77	5.06	31.26	141	230	A	H
		2390	61.18	-12.82	74	59.6	27.8	5.06	31.28	121	0	P	V
		2356.935	41.89	-12.11	54	40.35	27.85	5.02	31.33	121	0	A	V
	*	2412	100.77	-	-	99.2	27.77	5.06	31.26	121	0	P	V
	*	2412	97.77	-	-	96.2	27.77	5.06	31.26	121	0	A	V
802.11b CH 07 2442MHz		2334.78	52.37	-21.63	74	50.84	27.88	4.98	31.33	138	212	P	H
		2365.02	41.44	-12.56	54	39.88	27.85	5.02	31.31	138	212	A	H
	*	2442	102.76	-	-	101.17	27.71	5.12	31.24	138	212	P	H
	*	2442	98.77	-	-	97.18	27.71	5.12	31.24	138	212	A	H
		2497.55	52.46	-21.54	74	50.84	27.63	5.19	31.2	138	212	P	H
		2488.87	40.89	-13.11	54	39.29	27.63	5.19	31.22	138	212	A	H
		2331.98	52.06	-21.94	74	50.52	27.91	4.98	31.35	100	253	P	V
		2376.08	40.88	-13.12	54	39.34	27.83	5.02	31.31	100	253	A	V
	*	2442	99.16	-	-	97.57	27.71	5.12	31.24	100	253	P	V
	*	2442	95.26	-	-	93.67	27.71	5.12	31.24	100	253	A	V
		2497.55	53.2	-20.8	74	51.58	27.63	5.19	31.2	100	253	P	V
		2489.57	40.54	-13.46	54	38.92	27.63	5.19	31.2	100	253	A	V



802.11b CH 11 2462MHz	*	2462	102.35	-	-	100.78	27.69	5.12	31.24	126	208	P	H
	*	2462	98.47	-	-	96.9	27.69	5.12	31.24	126	208	A	H
		2483.72	60.89	-13.11	74	59.26	27.66	5.19	31.22	126	208	P	H
		2487.68	42.02	-11.98	54	40.42	27.63	5.19	31.22	126	208	A	H
	*	2462	97.99	-	-	96.42	27.69	5.12	31.24	102	289	P	V
	*	2462	95	-	-	93.43	27.69	5.12	31.24	102	289	A	V
		2483.72	58.36	-15.64	74	56.73	27.66	5.19	31.22	102	289	P	V
		2488.04	41.65	-12.35	54	40.05	27.63	5.19	31.22	102	289	A	V
802.11b CH 12 2467MHz	*	2467	101.74	-	-	100.08	27.69	5.19	31.22	131	207	P	H
	*	2467	97.83	-	-	96.17	27.69	5.19	31.22	131	207	A	H
		2484.24	65.95	-8.05	74	64.32	27.66	5.19	31.22	131	207	P	H
		2484.36	51.36	-2.64	54	49.73	27.66	5.19	31.22	131	207	A	H
	*	2467	97.94	-	-	96.28	27.69	5.19	31.22	129	210	P	V
	*	2467	94.86	-	-	93.2	27.69	5.19	31.22	129	210	A	V
		2484	62.91	-11.09	74	61.28	27.66	5.19	31.22	129	210	P	V
		2484.32	48.37	-5.63	54	46.74	27.66	5.19	31.22	129	210	A	V
802.11b CH 13 2472MHz	*	2472	101.11	-	-	99.48	27.66	5.19	31.22	134	206	P	H
	*	2472	98.14	-	-	96.51	27.66	5.19	31.22	134	206	A	H
		2483.92	69.68	-4.32	74	68.05	27.66	5.19	31.22	134	206	P	H
		2487.68	52.61	-1.39	54	51.01	27.63	5.19	31.22	134	206	A	H
	*	2472	98.18	-	-	96.55	27.66	5.19	31.22	136	210	P	V
	*	2472	95.21	-	-	93.58	27.66	5.19	31.22	136	210	A	V
		2483.56	66.31	-7.69	74	64.68	27.66	5.19	31.22	136	210	P	V
		2486.84	48.7	-5.3	54	47.07	27.66	5.19	31.22	136	210	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz

WIFI 802.11b (Harmonic @ 3m)

WIFI Ant. 1	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)
802.11b CH 01 2412MHz		4824	40.46	-33.54	74	59.09	31.12	8.59	58.34	145	274	P	H
		4824	39.79	-34.21	74	58.42	31.12	8.59	58.34	191	220	P	V
802.11b CH 07 2442MHz		4884	39.01	-34.99	74	57.55	31.17	8.62	58.33	112	229	P	H
		7326	45.29	-28.71	74	58.38	36.08	10.24	59.41	174	100	P	H
		4884	38.85	-35.15	74	57.39	31.17	8.62	58.33	156	360	P	V
		7326	45.42	-28.58	74	58.51	36.08	10.24	59.41	120	106	P	V
802.11b CH 11 2462MHz		4924	40.33	-33.67	74	58.8	31.22	8.64	58.33	145	274	P	H
		7386	45.24	-28.76	74	58.19	36.29	10.2	59.44	145	274	P	H
		4924	40.65	-33.35	74	59.12	31.22	8.64	58.33	166	210	P	V
		7386	44.29	-29.71	74	57.24	36.29	10.2	59.44	166	210	P	V
802.11b CH 12 2467MHz		4934	38.93	-35.07	74	57.4	31.22	8.64	58.33	156	360	P	H
		7401	45.87	-28.13	74	58.78	36.34	10.2	59.45	156	360	P	H
		4934	39.8	-34.2	74	58.27	31.22	8.64	58.33	120	87	P	V
		7401	44.85	-29.15	74	57.76	36.34	10.2	59.45	120	87	P	V
802.11b CH 13 2472MHz		4944	38.75	-35.25	74	57.21	31.23	8.64	58.33	156	360	P	H
		7416	44.93	-29.07	74	57.79	36.34	10.25	59.45	156	360	P	H
		4944	41.85	-32.15	74	60.31	31.23	8.64	58.33	156	360	P	V
		7416	44.77	-29.23	74	57.63	36.34	10.25	59.45	156	360	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz
WIFI 802.11g (Band Edge @ 3m)

WIFI Ant. 1	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)
802.11g CH 01 2412MHz		2354.94	52.2	-21.8	74	50.66	27.85	5.02	31.33	164	230	P	H
		2387.91	42.57	-11.43	54	40.99	27.8	5.06	31.28	164	230	A	H
	*	2412	103.23	-	-	101.66	27.77	5.06	31.26	164	230	P	H
	*	2412	95.65	-	-	94.08	27.77	5.06	31.26	164	230	A	H
		2379.93	52.46	-21.54	74	50.92	27.83	5.02	31.31	164	358	P	V
		2389.38	42.66	-11.34	54	41.08	27.8	5.06	31.28	164	358	A	V
	*	2412	102.51	-	-	100.94	27.77	5.06	31.26	164	358	P	V
	*	2412	95.12	-	-	93.55	27.77	5.06	31.26	164	358	A	V
802.11g CH 07 2442MHz		2379.3	51.13	-22.87	74	49.59	27.83	5.02	31.31	137	230	P	H
		2389.38	41.45	-12.55	54	39.87	27.8	5.06	31.28	137	230	A	H
	*	2442	103.04	-	-	101.45	27.71	5.12	31.24	137	230	P	H
	*	2442	95.33	-	-	93.74	27.71	5.12	31.24	137	230	A	H
		2484.53	50.81	-23.19	74	49.18	27.66	5.19	31.22	137	230	P	H
		2483.62	41.5	-12.5	54	39.87	27.66	5.19	31.22	137	230	A	H
		2379.58	51.17	-22.83	74	49.63	27.83	5.02	31.31	100	305	P	V
		2386.3	41.4	-12.6	54	39.82	27.8	5.06	31.28	100	305	A	V
	*	2442	102.18	-	-	100.59	27.71	5.12	31.24	100	305	P	V
	*	2442	94.33	-	-	92.74	27.71	5.12	31.24	100	305	A	V
		2485.65	50.86	-23.14	74	49.23	27.66	5.19	31.22	100	305	P	V
		2483.83	41.54	-12.46	54	39.91	27.66	5.19	31.22	100	305	A	V



802.11g CH 11 2462MHz	*	2462	102.5	-	-	100.93	27.69	5.12	31.24	219	234	P	H
	*	2462	94.67	-	-	93.1	27.69	5.12	31.24	219	234	A	H
		2485.48	51.86	-22.14	74	50.23	27.66	5.19	31.22	219	234	P	H
		2484.6	42.56	-11.44	54	40.93	27.66	5.19	31.22	219	234	A	H
	*	2462	100.83	-	-	99.26	27.69	5.12	31.24	161	342	P	V
	*	2462	92.93	-	-	91.36	27.69	5.12	31.24	161	342	A	V
		2486.96	51.88	-22.12	74	50.25	27.66	5.19	31.22	161	342	P	V
		2485.68	42.59	-11.41	54	40.96	27.66	5.19	31.22	161	342	A	V
802.11g CH 12 2467MHz	*	2467	100.87	-	-	99.21	27.69	5.19	31.22	100	230	P	H
	*	2467	93.44	-	-	91.78	27.69	5.19	31.22	100	230	A	H
		2483.6	55.06	-18.94	74	53.43	27.66	5.19	31.22	100	230	P	H
		2483.52	45.46	-8.54	54	43.83	27.66	5.19	31.22	100	230	A	H
	*	2467	101.44	-	-	99.78	27.69	5.19	31.22	115	299	P	V
	*	2467	93.71	-	-	92.05	27.69	5.19	31.22	115	299	A	V
		2483.76	55.48	-18.52	74	53.85	27.66	5.19	31.22	115	299	P	V
		2483.52	45.49	-8.51	54	43.86	27.66	5.19	31.22	115	299	A	V
802.11g CH 13 2472MHz	*	2472	81.62	-	-	79.99	27.66	5.19	31.22	100	209	P	H
	*	2472	74.33	-	-	72.7	27.66	5.19	31.22	100	209	A	H
		2483.56	61.03	-12.97	74	59.4	27.66	5.19	31.22	100	209	P	H
		2483.56	49.98	-4.02	54	48.35	27.66	5.19	31.22	100	209	A	H
	*	2472	83.11	-	-	81.48	27.66	5.19	31.22	119	197	P	V
	*	2472	76.51	-	-	74.88	27.66	5.19	31.22	119	197	A	V
		2484.68	62.07	-11.93	74	60.44	27.66	5.19	31.22	119	197	P	V
		2483.52	52.11	-1.89	54	50.48	27.66	5.19	31.22	119	197	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz

WIFI 802.11g (Harmonic @ 3m)

WIFI Ant. 1	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)
802.11g		4824	39.41	-34.59	74	58.04	31.12	8.59	58.34	145	274	P	H
CH 01 2412MHz		4824	38.96	-35.04	74	57.59	31.12	8.59	58.34	191	220	P	V
802.11g		4884	41.1	-32.9	74	59.64	31.17	8.62	58.33	174	100	P	H
CH 07 2442MHz		7326	45.07	-28.93	74	58.16	36.08	10.24	59.41	174	100	P	H
		4884	40.13	-33.87	74	58.67	31.17	8.62	58.33	120	106	P	V
		7326	45.96	-28.04	74	59.05	36.08	10.24	59.41	120	106	P	V
802.11g		4924	39.06	-34.94	74	57.53	31.22	8.64	58.33	133	180	P	H
CH 11 2462MHz		7386	44.86	-29.14	74	57.81	36.29	10.2	59.44	145	274	P	H
		4924	39.48	-34.52	74	57.95	31.22	8.64	58.33	156	360	P	V
		7386	44.63	-29.37	74	57.58	36.29	10.2	59.44	156	360	P	V
802.11g		4934	40.73	-33.27	74	59.2	31.22	8.64	58.33	133	180	P	H
CH 12 2467MHz		7401	45.15	-28.85	74	58.06	36.34	10.2	59.45	145	274	P	H
		4934	40.84	-33.16	74	59.31	31.22	8.64	58.33	174	102	P	V
		7401	45.02	-28.98	74	57.93	36.34	10.2	59.45	165	232	P	V
802.11g		4944	39.91	-34.09	74	58.37	31.23	8.64	58.33	145	274	P	H
CH 13 2472MHz		7416	45.34	-28.66	74	58.2	36.34	10.25	59.45	145	274	P	H
		4944	39.42	-34.58	74	57.88	31.23	8.64	58.33	174	102	P	V
		7416	45.23	-28.77	74	58.09	36.34	10.25	59.45	174	102	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz

WIFI 802.11n HT20 (Band Edge @ 3m)

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)
802.11n HT20 CH 01 2412MHz		2389.905	56.03	-17.97	74	54.45	27.8	5.06	31.28	178	142	P	H
		2389.905	47.09	-6.91	54	45.51	27.8	5.06	31.28	178	142	A	H
	*	2412	107.78	-	-	106.21	27.77	5.06	31.26	178	142	P	H
	*	2412	100.57	-	-	99	27.77	5.06	31.26	178	142	A	H
		2354.31	50.96	-23.04	74	49.42	27.85	5.02	31.33	104	272	P	V
		2389.59	42.84	-11.16	54	41.26	27.8	5.06	31.28	104	272	A	V
	*	2412	104.55	-	-	102.98	27.77	5.06	31.26	104	272	P	V
	*	2412	97.18	-	-	95.61	27.77	5.06	31.26	104	272	A	V
802.11n HT20 CH 07 2442MHz		2385.46	52.34	-21.66	74	50.73	27.83	5.06	31.28	100	178	P	H
		2389.66	42.17	-11.83	54	40.59	27.8	5.06	31.28	100	178	A	H
	*	2442	108.35	-	-	106.76	27.71	5.12	31.24	100	178	P	H
	*	2442	99.49	-	-	97.9	27.71	5.12	31.24	100	178	A	H
		2489.5	51.05	-22.95	74	49.43	27.63	5.19	31.2	100	178	P	H
		2483.9	42.06	-11.94	54	40.43	27.66	5.19	31.22	100	178	A	H
		2328.9	50.77	-23.23	74	49.23	27.91	4.98	31.35	346	249	P	V
		2360.54	41.72	-12.28	54	40.16	27.85	5.02	31.31	346	249	A	V
	*	2442	102.33	-	-	100.74	27.71	5.12	31.24	346	249	P	V
	*	2442	94.58	-	-	92.99	27.71	5.12	31.24	346	249	A	V
		2486.91	50.45	-23.55	74	48.82	27.66	5.19	31.22	346	249	P	V
		2484.11	41.7	-12.3	54	40.07	27.66	5.19	31.22	346	249	A	V



802.11n HT20 CH 11 2462MHz	*	2462	106.89	-	-	105.32	27.69	5.12	31.24	100	177	P	H
	*	2462	98.81	-	-	97.24	27.69	5.12	31.24	100	177	A	H
		2484.48	52.34	-21.66	74	50.71	27.66	5.19	31.22	100	177	P	H
		2484.68	43.6	-10.4	54	41.97	27.66	5.19	31.22	100	177	A	H
	*	2462	99.51	-	-	97.94	27.69	5.12	31.24	334	247	P	V
	*	2462	91.64	-	-	90.07	27.69	5.12	31.24	334	247	A	V
		2483.64	51.34	-22.66	74	49.71	27.66	5.19	31.22	334	247	P	V
		2484.2	42.63	-11.37	54	41	27.66	5.19	31.22	334	247	A	V
802.11n HT20 CH 12 2467MHz	*	2467	106.96	-	-	105.3	27.69	5.19	31.22	100	176	P	H
	*	2467	97.11	-	-	95.45	27.69	5.19	31.22	100	176	A	H
		2483.52	56.01	-17.99	74	54.38	27.66	5.19	31.22	100	176	P	H
		2483.52	46.75	-7.25	54	45.12	27.66	5.19	31.22	100	176	A	H
	*	2467	101.58	-	-	99.92	27.69	5.19	31.22	336	217	P	V
	*	2467	94.13	-	-	92.47	27.69	5.19	31.22	336	217	A	V
		2483.52	56.13	-17.87	74	54.5	27.66	5.19	31.22	336	217	P	V
		2483.56	47.11	-6.89	54	45.48	27.66	5.19	31.22	336	217	A	V
802.11n HT20 CH 13 2472MHz	*	2472	85.32	-	-	83.69	27.66	5.19	31.22	100	175	P	H
	*	2472	77.87	-	-	76.24	27.66	5.19	31.22	100	175	A	H
		2483.8	59.77	-14.23	74	58.14	27.66	5.19	31.22	100	175	P	H
		2483.52	51	-3	54	49.37	27.66	5.19	31.22	100	175	A	H
	*	2472	82.9	-	-	81.27	27.66	5.19	31.22	346	221	P	V
	*	2472	74.89	-	-	73.26	27.66	5.19	31.22	346	221	A	V
		2483.56	57.12	-16.88	74	55.49	27.66	5.19	31.22	346	221	P	V
		2483.52	49.45	-4.55	54	47.82	27.66	5.19	31.22	346	221	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



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

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)
802.11n HT20 CH 01 2412MHz		4824	39.86	-34.14	74	58.49	31.12	8.59	58.34	145	274	P	H
		4824	39.87	-34.13	74	58.5	31.12	8.59	58.34	191	220	P	V
802.11n HT20 CH 07 2442MHz		4884	41.34	-32.66	74	59.88	31.17	8.62	58.33	154	360	P	H
		7326	46.56	-27.44	74	59.65	36.08	10.24	59.41	154	360	P	H
		4884	39.03	-34.97	74	57.57	31.17	8.62	58.33	122	146	P	V
		7326	44.24	-29.76	74	57.33	36.08	10.24	59.41	122	146	P	V
802.11n HT20 CH 11 2462MHz		4924	40.32	-33.68	74	58.79	31.22	8.64	58.33	133	180	P	H
		7386	44.83	-29.17	74	57.78	36.29	10.2	59.44	133	180	P	H
		4924	39.38	-34.62	74	57.85	31.22	8.64	58.33	154	360	P	V
		7386	45.12	-28.88	74	58.07	36.29	10.2	59.44	154	360	P	V
802.11n HT20 CH 12 2467MHz		4934	40.37	-33.63	74	58.84	31.22	8.64	58.33	145	274	P	H
		7401	45.74	-28.26	74	58.65	36.34	10.2	59.45	145	274	P	H
		4934	40.01	-33.99	74	58.48	31.22	8.64	58.33	165	232	P	V
		7401	45.06	-28.94	74	57.97	36.34	10.2	59.45	165	232	P	V
802.11n HT20 CH 13 2472MHz		4944	39.83	-34.17	74	58.29	31.23	8.64	58.33	133	180	P	H
		7416	45.53	-28.47	74	58.39	36.34	10.25	59.45	133	180	P	H
		4944	39.74	-34.26	74	58.2	31.23	8.64	58.33	165	232	P	V
		7416	45.78	-28.22	74	58.64	36.34	10.25	59.45	165	232	P	V
Remark		1. No other spurious found. 2. All results are PASS against Peak and Average limit line.											



2.4GHz 2400~2483.5MHz

WIFI 802.11n HT40 (Band Edge @ 3m)

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)
802.11n HT40 CH 03 2422MHz		2389.38	54.11	-19.89	74	52.53	27.8	5.06	31.28	101	141	P	H
		2389.8	46.13	-7.87	54	44.55	27.8	5.06	31.28	101	141	A	H
	*	2422	103.25	-	-	101.71	27.74	5.06	31.26	101	141	P	H
	*	2422	95.04	-	-	93.5	27.74	5.06	31.26	101	141	A	H
		2491.74	50.35	-23.65	74	48.73	27.63	5.19	31.2	101	141	P	H
		2486.91	41.87	-12.13	54	40.24	27.66	5.19	31.22	101	141	A	H
		2388.82	51.98	-22.02	74	50.4	27.8	5.06	31.28	344	256	P	V
		2389.94	43.2	-10.8	54	41.62	27.8	5.06	31.28	344	256	A	V
	*	2422	97.48	-	-	95.94	27.74	5.06	31.26	344	256	P	V
	*	2422	89.65	-	-	88.11	27.74	5.06	31.26	344	256	A	V
		2486.63	49.9	-24.1	74	48.27	27.66	5.19	31.22	344	256	P	V
		2492.02	41.27	-12.73	54	39.65	27.63	5.19	31.2	344	256	A	V
802.11n HT40 CH 07 2442MHz		2382.38	51.28	-22.72	74	49.74	27.83	5.02	31.31	100	141	P	H
		2385.18	43.19	-10.81	54	41.58	27.83	5.06	31.28	100	141	A	H
	*	2442	103.76	-	-	102.17	27.71	5.12	31.24	100	141	P	H
	*	2442	94.19	-	-	92.6	27.71	5.12	31.24	100	141	A	H
		2485.58	52.21	-21.79	74	50.58	27.66	5.19	31.22	100	141	P	H
		2484.25	43.42	-10.58	54	41.79	27.66	5.19	31.22	100	141	A	H
		2374.68	51.43	-22.57	74	49.89	27.83	5.02	31.31	336	253	P	V
		2375.66	41.77	-12.23	54	40.23	27.83	5.02	31.31	336	253	A	V
	*	2442	97.21	-	-	95.62	27.71	5.12	31.24	336	253	P	V
	*	2442	89.36	-	-	87.77	27.71	5.12	31.24	336	253	A	V
		2493.07	49.83	-24.17	74	48.21	27.63	5.19	31.2	336	253	P	V
		2486.63	42.04	-11.96	54	40.41	27.66	5.19	31.22	336	253	A	V



802.11n HT40 CH 09 2452MHz		2373.84	50.99	-23.01	74	49.45	27.83	5.02	31.31	100	142	P	H
		2382.38	42.16	-11.84	54	40.62	27.83	5.02	31.31	100	142	A	H
	*	2452	103.71	-	-	102.12	27.71	5.12	31.24	100	142	P	H
	*	2452	93.89	-	-	92.3	27.71	5.12	31.24	100	142	A	H
		2488.31	54.94	-19.06	74	53.34	27.63	5.19	31.22	100	142	P	H
		2484.67	45.81	-8.19	54	44.18	27.66	5.19	31.22	100	142	A	H
		2326.38	50.24	-23.76	74	48.7	27.91	4.98	31.35	347	218	P	V
		2346.68	41.62	-12.38	54	40.05	27.88	5.02	31.33	347	218	A	V
	*	2452	98.26	-	-	96.67	27.71	5.12	31.24	347	218	P	V
	*	2452	90.27	-	-	88.68	27.71	5.12	31.24	347	218	A	V
		2488.8	53.83	-20.17	74	52.23	27.63	5.19	31.22	347	218	P	V
		2484.32	45.27	-8.73	54	43.64	27.66	5.19	31.22	347	218	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



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)
802.11n HT40 CH 10 2457MHz		2342.06	51.07	-22.93	74	49.54	27.88	4.98	31.33	239	4	P	H
		2387.14	42.13	-11.87	54	40.55	27.8	5.06	31.28	239	4	A	H
	*	2457	97.02	-	-	95.45	27.69	5.12	31.24	239	4	P	H
	*	2457	88.31	-	-	86.74	27.69	5.12	31.24	239	4	A	H
		2484.11	61.27	-12.73	74	59.64	27.66	5.19	31.22	239	4	P	H
		2486.7	49.82	-4.18	54	48.19	27.66	5.19	31.22	239	4	A	H
		2388.82	51.74	-22.26	74	50.16	27.8	5.06	31.28	113	330	P	V
		2388.82	42.28	-11.72	54	40.7	27.8	5.06	31.28	113	330	A	V
	*	2457	98.8	-	-	97.23	27.69	5.12	31.24	113	330	P	V
	*	2457	90.29	-	-	88.72	27.69	5.12	31.24	113	330	A	V
		2484.81	64.52	-9.48	74	62.89	27.66	5.19	31.22	113	330	P	V
		2493.14	52.6	-1.4	54	50.98	27.63	5.19	31.2	113	330	A	V
802.11n HT40 CH 11 2462MHz		2329.04	50.94	-23.06	74	49.4	27.91	4.98	31.35	294	143	P	H
		2333.1	41.48	-12.52	54	39.92	27.91	4.98	31.33	294	143	A	H
	*	2462	92.83	-	-	91.26	27.69	5.12	31.24	294	143	P	H
	*	2462	84.82	-	-	83.25	27.69	5.12	31.24	294	143	A	H
		2483.5	63.86	-10.14	74	62.23	27.66	5.19	31.22	294	143	P	H
		2483.62	50.81	-3.19	54	49.18	27.66	5.19	31.22	294	143	A	H
		2316.16	50.19	-23.81	74	48.62	27.94	4.98	31.35	345	217	P	V
		2318.68	41.64	-12.36	54	40.1	27.91	4.98	31.35	345	217	A	V
	*	2462	89.73	-	-	88.16	27.69	5.12	31.24	345	217	P	V
	*	2462	81.43	-	-	79.86	27.69	5.12	31.24	345	217	A	V
		2483.83	58.74	-15.26	74	57.11	27.66	5.19	31.22	345	217	P	V
		2483.5	47.11	-6.89	54	45.48	27.66	5.19	31.22	345	217	A	V



2.4GHz 2400~2483.5MHz
WIFI 802.11n HT40 (Harmonic @ 3m)

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)
802.11n HT40 CH 03 2422MHz		4844	39.79	-34.21	74	58.4	31.13	8.6	58.34	144	264	P	H
		7266	47.16	-26.84	74	60.36	35.93	10.25	59.38	144	264	P	H
		4844	40.12	-33.88	74	58.73	31.13	8.6	58.34	154	360	P	V
		7266	45.55	-28.45	74	58.75	35.93	10.25	59.38	154	360	P	V
802.11n HT40 CH 07 2442MHz		4884	40.05	-33.95	74	58.59	31.17	8.62	58.33	154	360	P	H
		7326	45.28	-28.72	74	58.37	36.08	10.24	59.41	154	360	P	H
		4884	39.62	-34.38	74	58.16	31.17	8.62	58.33	194	215	P	V
		7326	44.78	-29.22	74	57.87	36.08	10.24	59.41	194	215	P	V
802.11n HT40 CH 09 2452MHz		4904	39.59	-34.41	74	58.1	31.2	8.62	58.33	159	146	P	H
		7356	45.62	-28.38	74	58.64	36.19	10.22	59.43	159	246	P	H
		4904	39.04	-34.96	74	57.55	31.2	8.62	58.33	167	254	P	V
		7356	45.67	-28.33	74	58.69	36.19	10.22	59.43	171	154	P	V
802.11n HT40 CH 10 2457MHz		4914	38.98	-35.02	74	57.49	31.2	8.62	58.33	154	360	P	H
		7371	45.82	-28.18	74	58.79	36.24	10.22	59.43	154	360	P	H
		4914	39.37	-34.63	74	57.88	31.2	8.62	58.33	154	360	P	V
		7371	46.55	-27.45	74	59.52	36.24	10.22	59.43	154	360	P	V
802.11n HT40 CH 11 2462MHz		4924	39.89	-34.11	74	58.36	31.22	8.64	58.33	133	180	P	H
		7386	45.03	-28.97	74	57.98	36.29	10.2	59.44	145	274	P	H
		4924	40.57	-33.43	74	59.04	31.22	8.64	58.33	154	360	P	V
		7386	45.43	-28.57	74	58.38	36.29	10.2	59.44	166	210	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz

Emission below 1GHz

2.4GHz WIFI 802.11b (LF)

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		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz 802.11b LF		30	22.74	-17.26	40	29.58	25.2	0.56	32.6	130	85	P	H
		138.64	24.15	-19.35	43.5	37.64	17.46	1.23	32.18	-	-	P	H
		184.23	21.95	-21.55	43.5	36.87	15.26	1.38	31.56	-	-	P	H
		239.52	23.99	-22.01	46	36.73	17.6	1.62	31.96	-	-	P	H
		263.77	27.95	-18.05	46	38.44	19.88	1.7	32.07	-	-	P	H
		966.05	30.2	-23.8	54	30.71	27.26	3.42	31.19	-	-	P	H
		30.97	33.77	-6.23	40	41.18	24.62	0.57	32.6	142	97	P	V
		49.4	28.71	-11.29	40	45.93	14.67	0.71	32.6	-	-	P	V
		184.23	22.97	-20.53	43.5	37.89	15.26	1.38	31.56	-	-	P	V
		263.77	26.54	-19.46	46	37.03	19.88	1.7	32.07	-	-	P	V
		288.02	24.88	-21.12	46	35.84	19.28	1.78	32.02	-	-	P	V
		677.96	28.48	-17.52	46	32.06	25.2	2.82	31.6	-	-	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 not under limit 6dB .
P/A	Peak or Average
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		(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)

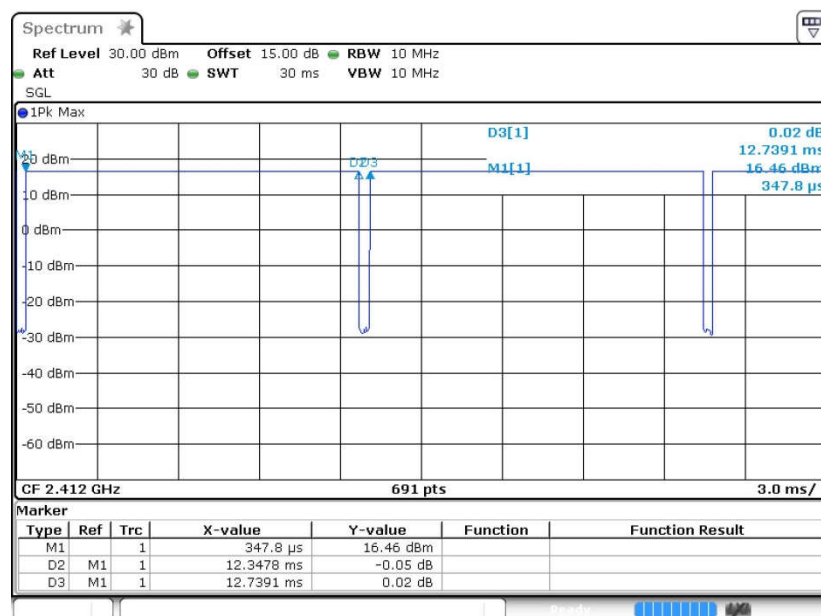
= -10.46(dB)

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

Appendix C. Duty Cycle Plots

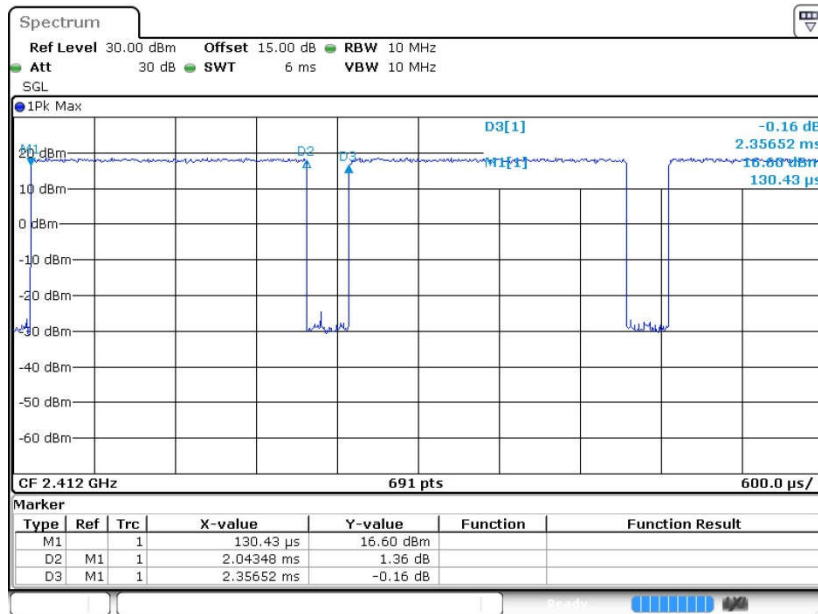
Antenna	Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
1	802.11b	96.93	12.348	0.081	100Hz
1	802.11g	86.72	2.043	0.489	1KHz
1+2	802.11n HT20	86.49	0.974	1.027	3KHz
1+2	802.11n HT40	85.86	0.493	2.029	3KHz

802.11b Ant. 1

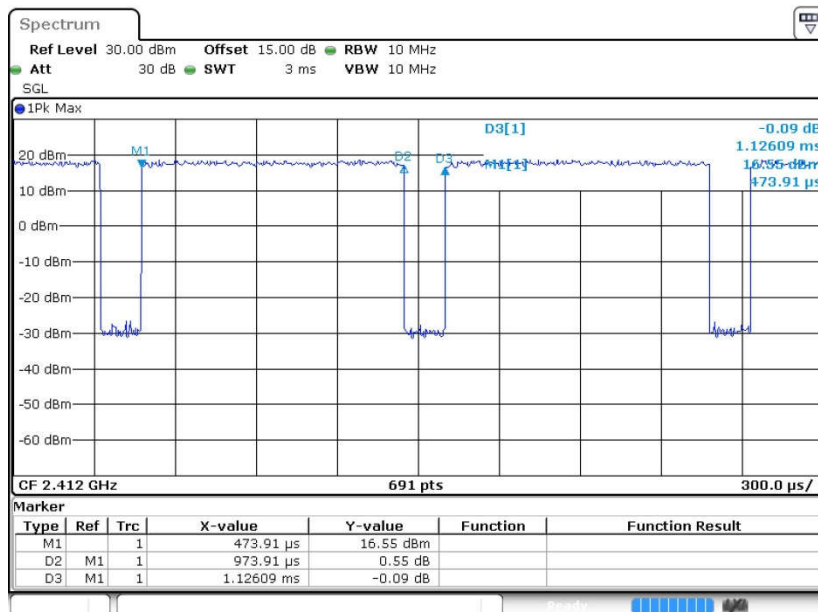




802.11g Ant. 1



802.11n HT20 Ant. 1+2





802.11n HT40 Ant. 1+2

