FCC RF Test Report

APPLICANT	**:**	**BlackBerry Limited**
EQUIPMENT	**:**	**Smartphone**
BRAND NAME	**:**	**BlackBerry**
MODEL NAME	**:**	**RHG161LW**
MARKETING NAME	**:**	**SQC100-4**
FCC ID	**:**	**L6ARHG160LW**
STANDARD	**:**	**FCC Part 15 Subpart E §15.407**
CLASSIFICATION	**:**	**(NII) Unlicensed National Information Infrastructure**

The product was received on Jul. 14, 2014 and testing was completed on Oct. 21, 2014. We, SPORTON INTERNATIONAL 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 INC., the test report shall not be reproduced except in full.

Reviewed by: Joseph Lin / Supervisor

Approved by: Jones Tsai / Manager

SPORTON INTERNATIONAL INC.
No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR471420E	Rev. 01	Initial issue of report	Oct. 31, 2014

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	2.1049 15.403(i)	26dB & 99% Bandwidth	-	Pass	-
3.2	15.407(a)	Maximum Conducted Output Power	≤ 24 dBm (depend on band)	Pass	-
3.3	15.407(a)	Power Spectral Density	≤ 11 dBm (depend on band)	Pass	-
3.4	15.407(b)	Unwanted Emissions	≤ -17, -27 dBm (depend on band)&15.209(a)	Pass	Under limit 0.25 dB at 5350.000 MHz
3.5	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 8.00 dB at 0.190 MHz
3.6	15.407(g)	Frequency Stability	Within Operation Band	Pass	-
3.7	15.407(c)	Automatically Discontinue Transmission	Discontinue Transmission	Pass	-
3.8	15.203 & 15.407(a)	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

BlackBerry Limited
2300 University Street East, Waterloo, ON., CAN, N2K1A0

1.2 Manufacturer

FIH Mobile Limited
No. 4, Mingsheng St.,Tu-Cheng Dist., New Taipei City 23679, Taiwan

1.3 Feature of Equipment Under Test

Product Feature & Specification	
Equipment	Smartphone
Brand Name	BlackBerry
Model Name	RHG161LW
Marketing Name	SQC100-4
FCC ID	L6ARHG160LW
IMEI Code	004402242681074 for Conducted Emission 004402242681363 for Radiated Emission
EUT supports Radios application	GSM/EGPRS/WCDMA/HSPA/LTE/NFC WLAN 11b/g/n HT20 WLAN 11a/n HT20/HT40 Bluetooth v4.0 EDR/LE
HW Version	PVT 2
SW Version	BlackBerry 10.3.1.565/566
EUT Stage	Identical Prototype

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

Product Specification subjective to this standard	
Tx/Rx Frequency Range	5180 MHz ~ 5240 MHz 5260 MHz ~ 5320 MHz 5500 MHz ~ 5700 MHz
Maximum Output Power to Antenna	**<5180 MHz ~ 5240 MHz>** 802.11a : 16.07 dBm / 0.0405 W 802.11n HT20 : 15.93 dBm / 0.0392 W 802.11n HT40 : 15.38 dBm / 0.0345 W **<5260 MHz ~ 5320 MHz>** 802.11a : 16.12 dBm / 0.0409 W 802.11n HT20 : 16.03 dBm / 0.0401 W 802.11n HT40 : 15.38 dBm / 0.0345 W **<5500 MHz ~ 5700 MHz >** 802.11a : 16.46 dBm / 0.0443 W 802.11n HT20 : 16.40 dBm / 0.0437 W 802.11n HT40 : 15.20 dBm / 0.0331 W
99% Occupied Bandwidth	802.11a : 17.50 MHz 802.11n HT20 : 18.30 MHz 802.11n HT40 : 36.50 MHz
Antenna Type	**<5180 MHz ~ 5240 MHz>** PIFA Antenna with gain 2.88 dBi **<5260 MHz ~ 5320 MHz>** PIFA Antenna with gain 1.72 dBi **<5500 MHz ~ 5700 MHz >** PIFA Antenna with gain 3.75 dBi
Type of Modulation	OFDM (BPSK / QPSK / 16QAM / 64QAM)

1.5 Modification of EUT

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

1.6 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW1022 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

Test Site	SPORTON INTERNATIONAL INC.		
Test Site Location	No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-3273456 / FAX: +886-3-3284978		
Test Site No.	Sporton Site No.		
	TH02-HY	CO05-HY	03CH05-HY

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 E
- FCC KDB 789033 D02 General UNII Test Procedures New Rules v01
- ANSI C63.4-2003

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

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: conducted emission (150 kHz to 30 MHz) and radiated 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 cases (Y plane) were recorded in this report.

The final configuration from all the combinations and the worst-case data rates were investigated by measuring the maximum power across all the data rates and modulation modes under section 2.2.

Based on the worst configuration found above, the RF power setting is set individually to meet FCC compliance limit for the final conducted and radiated tests shown in section 2.3.

2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5150-5250 MHz Band 1 (U-NII-1)	36	5180	44	5220
	38	**5190**	**46**	**5230**
	40	5200	48	5240

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5250-5350 MHz Band 2 (U-NII-2A)	52	5260	60	5300
	54	**5270**	**62**	**5310**
	56	5280	64	5320

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5470-5725 MHz Band 3 (U-NII-2C)	100	5500	120	5600
	102	**5510**	124	5620
	104	5520	**126**	**5630**
	108	5540	128	5640
	110	**5550**	132	5660
	112	5560	**134**	**5670**
	116	5580	136	5680
	118	**5590**	140	5700

Note: The above Frequency and Channel in boldface were 802.11n HT40.

2.2 Pre-Scanned RF Power

Preliminary tests were performed in different data rate and data rate associated with the highest power were chosen for full test in the following tables. Final Output Power equals to Measured Output Power adds the duty factor.

5GHz 802.11a mode								
Data Rate (MHz)	6M bps	9M bps	12M bps	18M bps	24M bps	36M bps	48M bps	54M bps
Average Power (dBm)	**16.46**	16.42	16.40	15.54	15.53	15.28	15.48	15.35

5GHz 802.11n HT20 mode								
Data Rate (MHz)	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
Average Power (dBm)	**16.40**	16.37	15.43	15.40	14.38	14.29	14.31	14.32

5GHz 802.11n HT40 mode								
Data Rate (MHz)	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
Average Power (dBm)	**15.38**	15.35	14.56	14.67	14.74	14.85	14.79	14.77

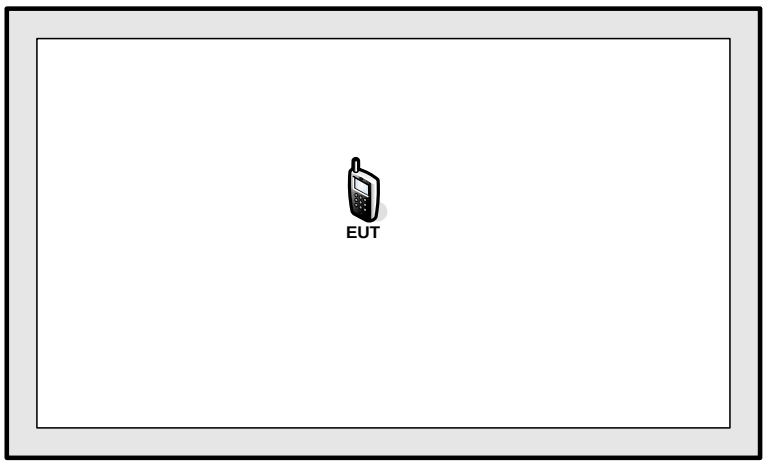
2.3 Test Mode

Final results of test modes, data rates and test channels are shown as following table.

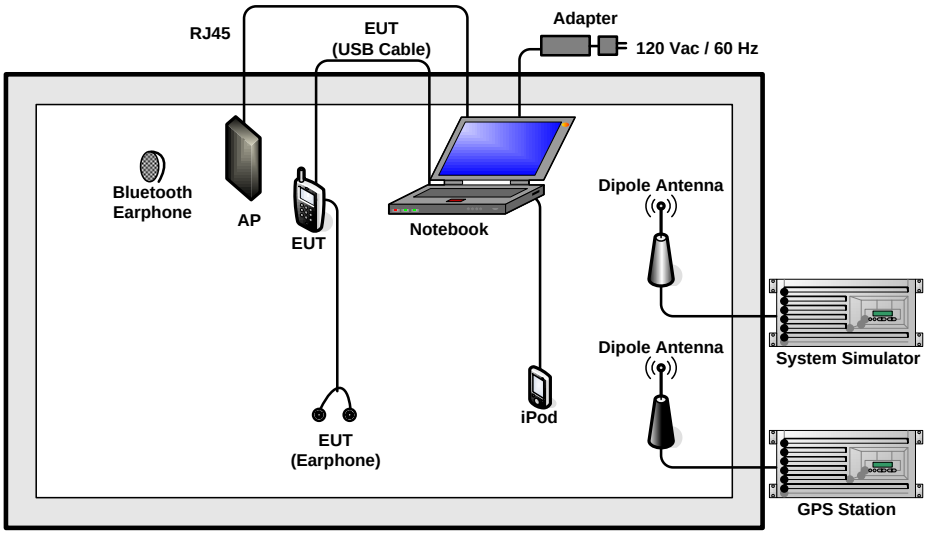
Test Cases				
	Test Items	**Mode**	**Data rate**	**Test Channel**
Conducted TCs	**26dB and 99% BW Power Spectral Density**	**802.11a**	**6Mbps**	**L/M/H**
		802.11n HT20	**MCS0**	**L/M/H**
		802.11n HT40	**MCS0**	**L/M/H**
	Output Power	**802.11a**	**6Mbps**	**L/M/H**
		802.11n HT20	**MCS0**	**L/M/H**
		802.11n HT40	**MCS0**	**L/M/H**
	Frequency Stability	**802.11a**	**6Mbps**	**L/H**
Radiated TCs	**Radiated Band Edge**	**802.11a**	**6Mbps**	**L/H**
		802.11n HT20	**MCS0**	**L/H**
		802.11n HT40	**MCS0**	**L/M/H**
	Radiated Spurious Emission	**802.11a**	**6Mbps**	**L/M/H**
		802.11n HT20	**MCS0**	**L/M/H**
		802.11n HT40	**MCS0**	**L/M/H**
AC Conducted Emission	Mode 1 : WCDMA Band II Idle + Bluetooth Link + WLAN (5GHz) Link + GPS Rx + Earphone 1 + USB Cable 2 (Data Link with Notebook)			

2.4 Connection Diagram of Test System

<WLAN Tx Mode>



<AC Conducted Emission Mode>



2.5 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	System Simulator	R&S	CMU 200	N/A	N/A	Unshielded, 1.8 m
2.	GPS Station	T&E	GS-50	N/A	N/A	Unshielded, 1.8 m
3.	WLAN AP	D-Link	DIR-865L	KA2IR865LA1	N/A	Unshielded, 1.8 m
4.	Notebook	DELL	Latitude E6320	FCC DoC/ Contains FCC ID: QDS-BRCM1054	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
5.	iPod	Apple	A1285	FCC DoC	Shielded, 1.0 m	N/A
6.	Bluetooth Earphone	Sony Ericsson	MW600	PY7DDA-2029	N/A	N/A
7.	SD Card	SanDisk	MicroSD HC	FCC DoC	N/A	N/A

2.6 EUT Operation Test Setup

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

2.7 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example :

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 4.2 + 10 = 14.2 (dB)

3 Test Result

3.1 26dB & 99% Occupied Bandwidth Measurement

3.1.1 Description of 26dB & 99% Occupied Bandwidth

This section is for reporting purpose only.

There is no restriction limits for bandwidth.

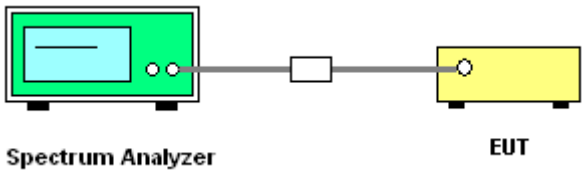
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v01. Section C) Emission bandwidth
2. Set RBW = approximately 1% of the emission bandwidth.
3. Set the VBW > RBW.
4. Detector = Peak.
5. Trace mode = max hold
6. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.
7. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1MHz and set the Video bandwidth (VBW) ≥ 3 * RBW.
8. Measure and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of 26dB & 99% Occupied Bandwidth Plots

Test Band :	5GHz band 1	Temperature :	25~26℃
Test Engineer :	Jet Lui, Kyle Jhuang, and Karl Hou	Relative Humidity :	50~51%

Mod.	Data Rate	N_{TX}	Channel	Freq. (MHz)	99% Bandwidth (MHz)	-	IC 99% Bandwidth EIRP Limit (dBm)	-
11a	6Mbps	1	36	5180	17.30		22.38	
11a	6Mbps	1	44	5220	17.25		22.37	
11a	6Mbps	1	48	5240	17.30		22.38	
HT20	MCS0	1	36	5180	18.00		22.55	
HT20	MCS0	1	44	5220	18.05	-	22.56	-
HT20	MCS0	1	48	5240	18.05		22.56	
HT40	MCS0	1	38	5190	36.40		23.01	
HT40	MCS0	1	46	5230	36.40		23.01	

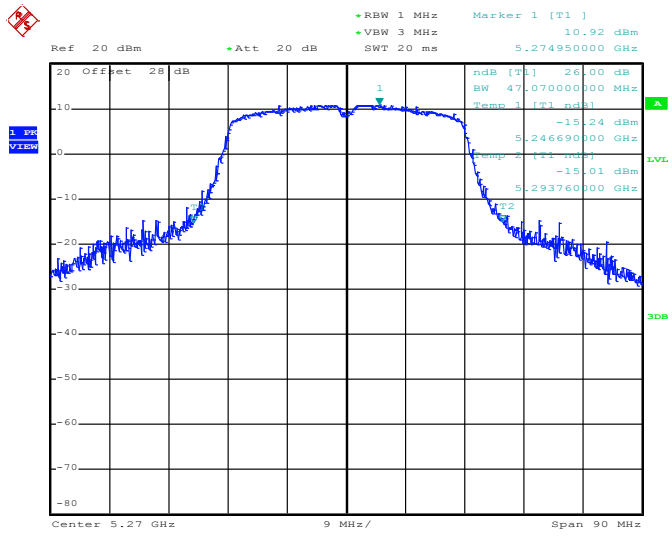
Test Band :	5GHz band 2	Temperature :	25~26℃
Test Engineer :	Jet Lui, Kyle Jhuang, and Karl Hou	Relative Humidity :	50~51%

Mod.	Data Rate	N_{TX}	Channel	Freq. (MHz)	99% Bandwidth (MHz)	26dB Bandwidth (MHz)	IC 99% Bandwidth EIRP Limit (dBm)	FCC 26dB Bandwidth Power Limit (dBm)
11a	6Mbps	1	52	5260	17.25	22.85	29.37	23.98
11a	6Mbps	1	60	5300	17.30	23.6	29.38	23.98
11a	6Mbps	1	64	5320	17.25	22.45	29.37	23.98
HT20	MCS0	1	52	5260	18.00	21.15	29.55	23.98
HT20	MCS0	1	60	5300	18.00	21.20	29.55	23.98
HT20	MCS0	1	64	5320	17.95	21.05	29.54	23.98
HT40	MCS0	1	54	5270	36.50	47.07	30.00	23.98
HT40	MCS0	1	62	5310	36.50	46.35	30.00	23.98

Test Band :	5GHz band 3	Temperature :	25~26℃
Test Engineer :	Jet Lui, Kyle Jhuang, and Karl Hou	Relative Humidity :	50~51%

Mod.	Data Rate	N_{TX}	Channel	Freq. (MHz)	99% Bandwidth (MHz)	26dB Bandwidth (MHz)	IC 99% Bandwidth EIRP Limit (dBm)	FCC 26dB Bandwidth Power Limit (dBm)
11a	6Mbps	1	100	5500	17.45	27.40	29.42	23.98
11a	6Mbps	1	120	5600	17.50	23.30	29.43	23.98
11a	6Mbps	1	140	5700	17.35	22.55	29.39	23.98
HT20	MCS0	1	100	5500	18.30	27.70	29.62	23.98
HT20	MCS0	1	120	5600	18.25	27.75	29.61	23.98
HT20	MCS0	1	140	5700	18.20	24.00	29.60	23.98
HT40	MCS0	1	102	5510	36.50	46.71	30.00	23.98
HT40	MCS0	1	118	5590	36.50	46.35	30.00	23.98
HT40	MCS0	1	134	5670	36.40	45.99	30.00	23.98

Maximum 26dB Bandwidth



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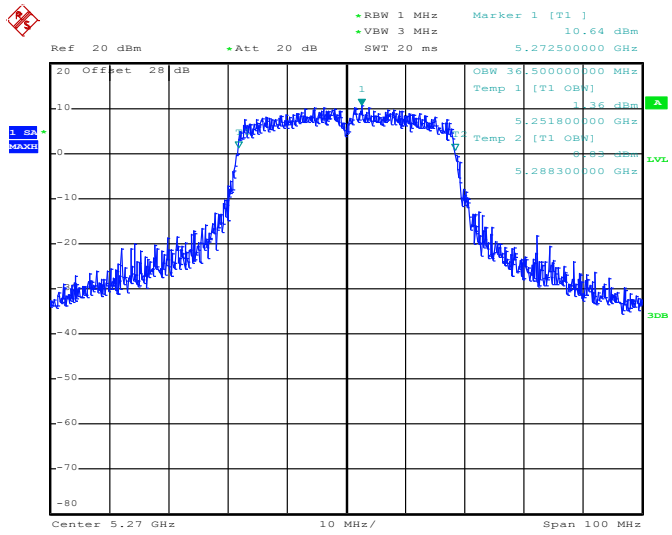
Maximum 99% Occupied Bandwidth



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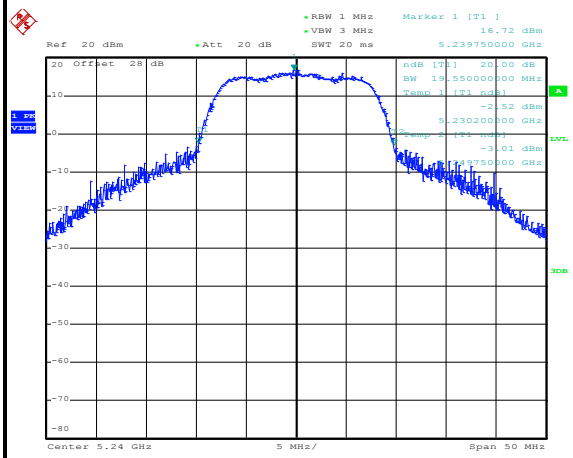
3.1.6 Test Result of 20dB Occupied Bandwidth

Mod.	Data Rate	NTX	Channel	Freq. (MHz)	20dB Bandwidth (MHz)	20dB Bandwidth Upper Frequency (FH) (MHz)	Upper Limit Line (MHz)	Pass/Fail
11a	6Mbps	1	48	5240	19.55	5249.75	5250	Pass
HT20	MCS0	1	48	5240	19.95	5249.95		Pass
HT40	MCS0	1	46	5230	39.87	5249.89		Pass

20dB Occupied Bandwidth

802.11a CH48 5240MHz



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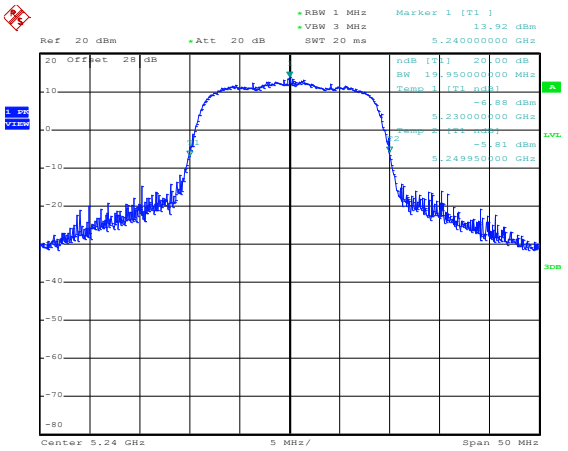
802.11n HT20 CH48 5240MHz



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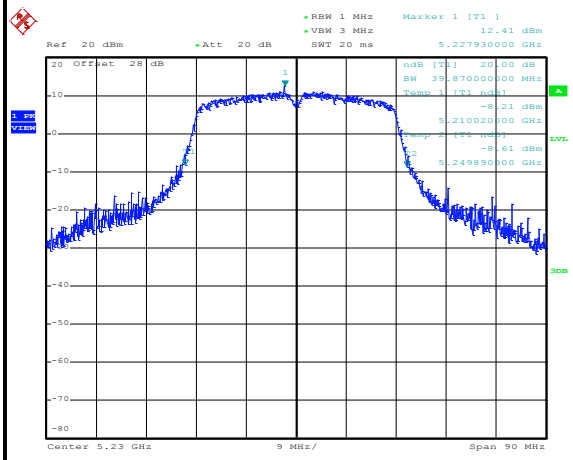
802.11n HT40 CH46 5230MHz



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3.2 Maximum Conducted Output Power Measurement

3.2.1 Limit of Maximum Conducted Output Power

<FCC 14-30 CFR 15.407>

For mobile and portable client devices in the 5.15–5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW.

For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm 10 log B, where B is the 26 dB emission bandwidth in megahertz.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note that U-NII-2 band, devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

3.2.2 Measuring Instruments

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

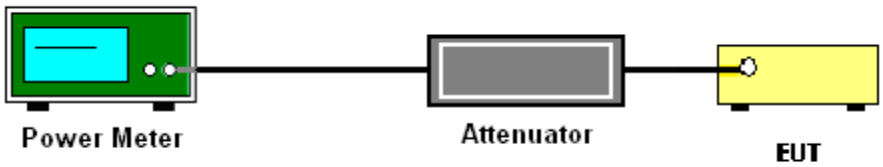
3.2.3 Test Procedures

The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v01.

Method PM (Measurement using an RF average power meter):

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit continuously with a consistent duty cycle at its maximum power control level.
3. Measure the average power of the transmitter, and the average power is corrected with duty factor, 10 log(1/x), where x is the duty cycle.

3.2.4 Test Setup



3.2.5 Test Result of Maximum Conducted Output Power

Test Band :	5GHz band 1	Temperature :	25~26℃
Test Engineer :	Jet Lui, Kyle Jhuang, and Karl Hou	Relative Humidity :	50~51%

Mod.	Data Rate	N_{TX}	Channel	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)	FCC Conducted Power Limit (dBm)	DG (dBi)	-	Pass/Fail
11a	6Mbps	1	36	5180	0.15	16.00	24.00	2.88	-	Pass
11a	6Mbps	1	44	5220	0.15	15.94	24.00	2.88		Pass
11a	6Mbps	1	48	5240	0.15	16.07	24.00	2.88		Pass
HT20	MCS0	1	36	5180	0.08	15.90	24.00	2.88		Pass
HT20	MCS0	1	44	5220	0.08	15.86	24.00	2.88		Pass
HT20	MCS0	1	48	5240	0.08	15.93	24.00	2.88		Pass
HT40	MCS0	1	38	5190	0.20	12.98	24.00	2.88		Pass
HT40	MCS0	1	46	5230	0.20	15.38	24.00	2.88		Pass

Note:

1. Final Output Power equals to Measured Output Power adds the duty factor.
2. For the band 5150-5250 MHz, the maximum average output power shall not exceed lesser of 250 mW.

Test Band :	5GHz band 2	Temperature :	25~26℃
Test Engineer :	Jet Lui, Kyle Jhuang, and Karl Hou	Relative Humidity :	50~51%

Mod.	Data Rate	N_{TX}	Channel	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)	FCC Conducted Power Limit (dBm)	DG (dBi)	-	Pass/Fail
11a	6Mbps	1	52	5260	0.15	16.00	23.98	1.72	-	Pass
11a	6Mbps	1	60	5300	0.15	16.10	23.98	1.72		Pass
11a	6Mbps	1	64	5320	0.15	16.12	23.98	1.72		Pass
HT20	MCS0	1	52	5260	0.08	15.90	23.98	1.72		Pass
HT20	MCS0	1	60	5300	0.08	15.97	23.98	1.72		Pass
HT20	MCS0	1	64	5320	0.08	16.03	23.98	1.72		Pass
HT40	MCS0	1	54	5270	0.20	15.28	23.98	1.72		Pass
HT40	MCS0	1	62	5310	0.20	15.38	23.98	1.72		Pass

Note:

1. Final Output Power equals to Measured Output Power adds the duty factor.
2. For the 5250-5350 MHz bands, the maximum conducted output power shall not exceed the lesser of 250 mW (24dBm) or 11 dBm + 10log (B).

Test Band :	5GHz band 3	Temperature :	25~26℃
Test Engineer :	Jet Lui, Kyle Jhuang, and Karl Hou	Relative Humidity :	50~51%

Mod.	Data Rate	N_{TX}	Channel	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)	FCC Conducted Power Limit (dBm)	DG (dBi)	-	Pass/Fail
11a	6Mbps	1	100	5500	0.15	16.46	23.98	3.75		Pass
11a	6Mbps	1	120	5600	0.15	15.86	23.98	3.75		Pass
11a	6Mbps	1	140	5700	0.15	15.16	23.98	3.75		Pass
HT20	MCS0	1	100	5500	0.08	16.40	23.98	3.75		Pass
HT20	MCS0	1	120	5600	0.08	15.80	23.98	3.75	-	Pass
HT20	MCS0	1	140	5700	0.08	15.06	23.98	3.75		Pass
HT40	MCS0	1	102	5510	0.20	14.29	23.98	3.75		Pass
HT40	MCS0	1	118	5590	0.20	15.20	23.98	3.75		Pass
HT40	MCS0	1	134	5670	0.20	14.61	23.98	3.75		Pass

Note:

1. Final Output Power equals to Measured Output Power adds the duty factor.
2. For the 5470-5725 MHz bands, the maximum conducted output power shall not exceed the lesser of 250 mW (24dBm) or 11 dBm + 10log (B).

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

<FCC 14-30 CFR 15.407>

For mobile and portable client devices in the 5.15–5.25 GHz band, the maximum power spectral density shall not exceed 11dBm in any 1 megahertz band.

For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

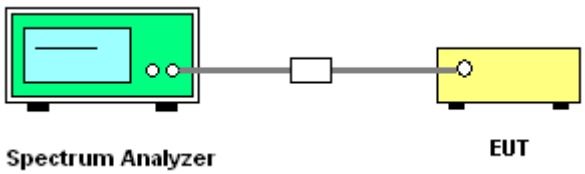
The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v01.
Section F) Maximum power spectral density.

 # Method SA-2 #

(trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction).

1. The testing follows Method SA-2 of FCC KDB 789033 D02 General UNII Test Procedures New Rules v01.
   - Measure the duty cycle.
   - Set span to encompass the entire emission bandwidth (EBW) of the signal.
   - Set RBW = 1 MHz.
   - Set VBW ≥ 3 MHz.
   - Number of points in sweep ≥ 2 Span / RBW.
   - Sweep time = auto.
   - Detector = RMS
   - Trace average at least 100 traces in power averaging mode.
   - Add 10 log(1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times. For example, add 10 log(1/0.25) = 6 dB if the duty cycle is 25 percent.
2. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
3. Each plot has already offset with cable loss, and attenuator loss. Measure the PPSD and record it.

3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Test Band :	5GHz band 1	Temperature :	25~26℃
Test Engineer :	Jet Lui, Kyle Jhuang, and Karl Hou	Relative Humidity :	50~51%

Mod.	Data Rate	N_{TX}	CH	Freq. (MHz)	Duty Factor (dB)	Average Power Density (dBm/MHz)	Average PSD Limit (dBm)	DG (dBi)	-	Pass/Fail
11a	6Mbps	1	36	5180	0.15	4.74	11.00	2.88	-	Pass
11a	6Mbps	1	44	5220	0.15	4.84	11.00	2.88	-	Pass
11a	6Mbps	1	48	5240	0.15	4.58	11.00	2.88	-	Pass
HT20	MCS0	1	36	5180	0.08	4.45	11.00	2.88	-	Pass
HT20	MCS0	1	44	5220	0.08	4.58	11.00	2.88	-	Pass
HT20	MCS0	1	48	5240	0.08	4.34	11.00	2.88	-	Pass
HT40	MCS0	1	38	5190	0.20	-2.29	11.00	2.88	-	Pass
HT40	MCS0	1	46	5230	0.20	0.43	11.00	2.88	-	Pass

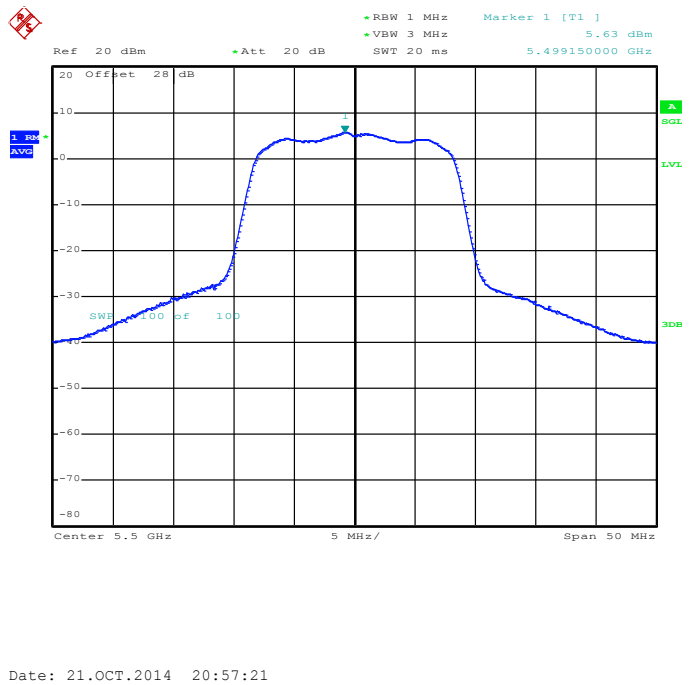
Test Band :	5GHz band 2	Temperature :	25~26℃
Test Engineer :	Jet Lui, Kyle Jhuang, and Karl Hou	Relative Humidity :	50~51%

Mod.	Data Rate	N_{TX}	CH	Freq. (MHz)	Duty Factor (dB)	Average Power Density (dBm/MHz)	Average PSD Limit (dBm)	DG (dBi)	Pass/Fail
11a	6Mbps	1	52	5260	0.15	4.58	11.00	1.72	Pass
11a	6Mbps	1	60	5300	0.15	4.93	11.00	1.72	Pass
11a	6Mbps	1	64	5320	0.15	4.95	11.00	1.72	Pass
HT20	MCS0	1	52	5260	0.08	4.29	11.00	1.72	Pass
HT20	MCS0	1	60	5300	0.08	4.60	11.00	1.72	Pass
HT20	MCS0	1	64	5320	0.08	4.62	11.00	1.72	Pass
HT40	MCS0	1	54	5270	0.20	0.37	11.00	1.72	Pass
HT40	MCS0	1	62	5310	0.20	0.66	11.00	1.72	Pass

Test Band :	5GHz band 3	Temperature :	25~26℃
Test Engineer :	Jet Lui, Kyle Jhuang, and Karl Hou	Relative Humidity :	50~51%

Mod.	Data Rate	N_{TX}	CH	Freq. (MHz)	Duty Factor (dB)	Average Power Density (dBm/MHz)	Average PSD Limit (dBm)	DG (dBi)	Pass/Fail
11a	6Mbps	1	100	5500	0.15	5.78	11.00	3.75	Pass
11a	6Mbps	1	120	5600	0.15	4.50	11.00	3.75	Pass
11a	6Mbps	1	140	5700	0.15	4.21	11.00	3.75	Pass
HT20	MCS0	1	100	5500	0.08	5.53	11.00	3.75	Pass
HT20	MCS0	1	120	5600	0.08	4.28	11.00	3.75	Pass
HT20	MCS0	1	140	5700	0.08	3.99	11.00	3.75	Pass
HT40	MCS0	1	102	5510	0.20	-0.72	11.00	3.75	Pass
HT40	MCS0	1	118	5590	0.20	0.47	11.00	3.75	Pass
HT40	MCS0	1	134	5670	0.20	-0.10	11.00	3.75	Pass

Worst Case Power Spectral Density(dBm/MHz)



Note: Average Power Density (dB) = Measured value+ Duty Factor

3.4 Unwanted Radiated Emission Measurement

This section as specified in FCC Part 15.407(b) is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement. The unwanted emissions shall comply with 15.407(b)(1) to (6), and restricted bands per FCC Part15.205.

3.4.1 Limit of Unwanted Emissions

(1) For transmitters operating in the 5150-5250 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of –27dBm/MHz..

For transmitters operating in the 5250-5350 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5250-5350 MHz band that generate emissions in the 5150-5250 MHz band must meet all applicable technical requirements for operation in the 5150-5250 MHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5150-5250 MHz band.

For transmitters operating in the 5470-5725MHz band: all emissions outside of the 5470-5725MHz band shall not exceed an EIRP of -27 dBm/MHz.

(2) Unwanted spurious emissions fallen in restricted bands per FCC Part15.205 shall comply with the general field strength limits set forth in § 15.209 as below table,

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

Note: The following formula is used to convert the EIRP to field strength.

$$E=\frac{1000000\sqrt{30P}}{3}$$ μV/m, where P is the eirp (Watts)

EIRP (dBm)	Field Strength at 3m (dBµV/m)
-17	78.3
- 27	68.3

(3) KDB789033 v01 G)2)c) As specified in 15.407(b), emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz (or -17 dBm/MHz as specified in 15.407(b)(4)). However, an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit.

3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v01. Section G) Unwanted emissions measurement.

   (1) Procedure for Unwanted Emissions Measurements Below 1000MHz

   - RBW = 120 kHz
   - VBW = 300 kHz
   - Detector = Peak
   - Trace mode = max hold

   (2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz

   - RBW = 1 MHz
   - VBW ≥ 3 MHz
   - Detector = Peak
   - Sweep time = auto
   - Trace mode = max hold

   (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

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

Band	Duty Cycle(%)	T(μs)	1/T(kHz)	VBW Setting
802.11a	96.55	1400	0.71	1kHz
802.11n HT20	97.74	2160	0.46	1kHz
802.11n HT40	95.5	1060	0.94	1kHz

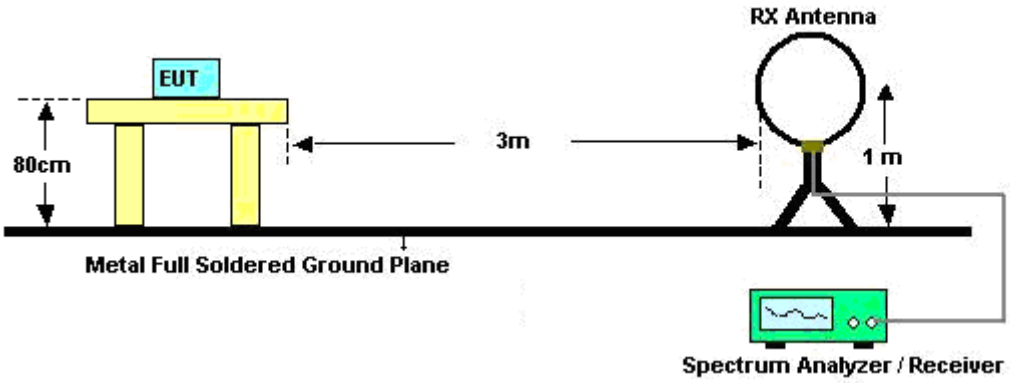
2. The EUT was placed on a rotatable table top 0.8 meter above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
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.

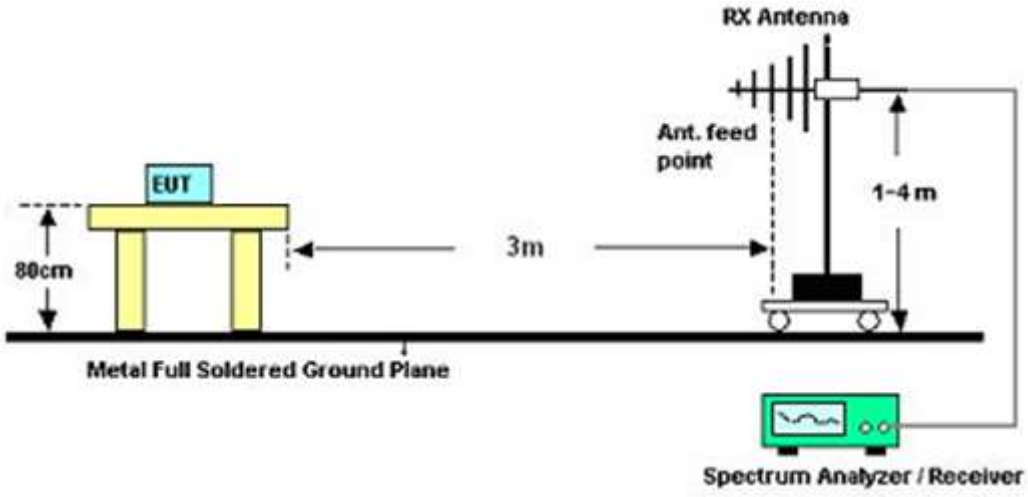
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

3.4.4 Test Setup

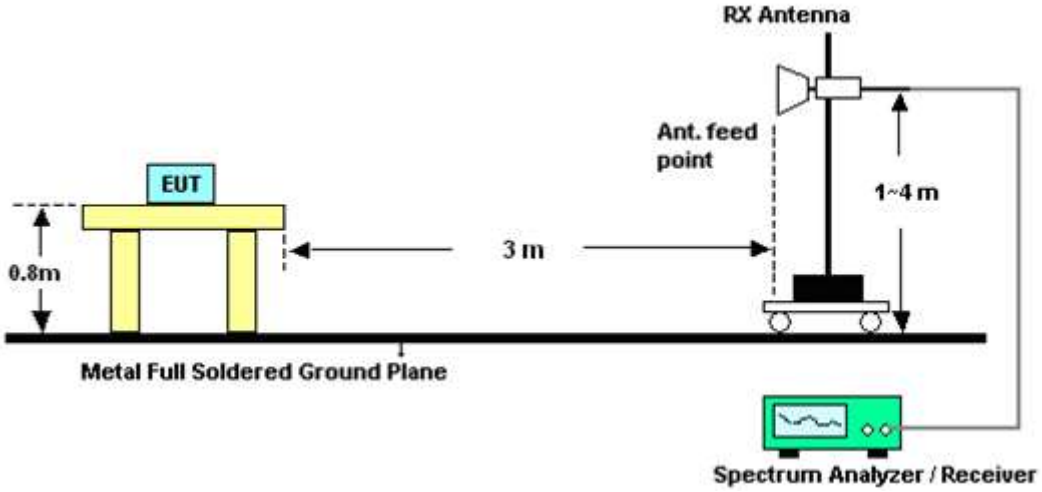
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.4.5 Test Results of Radiated 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 per 15.31(o) was not reported.

3.4.6 Test Result

Please refer appendix A.

3.5 AC Conducted Emission Measurement

3.5.1 Limit of AC Conducted Emission

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

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

*Decreases with the logarithm of the frequency.

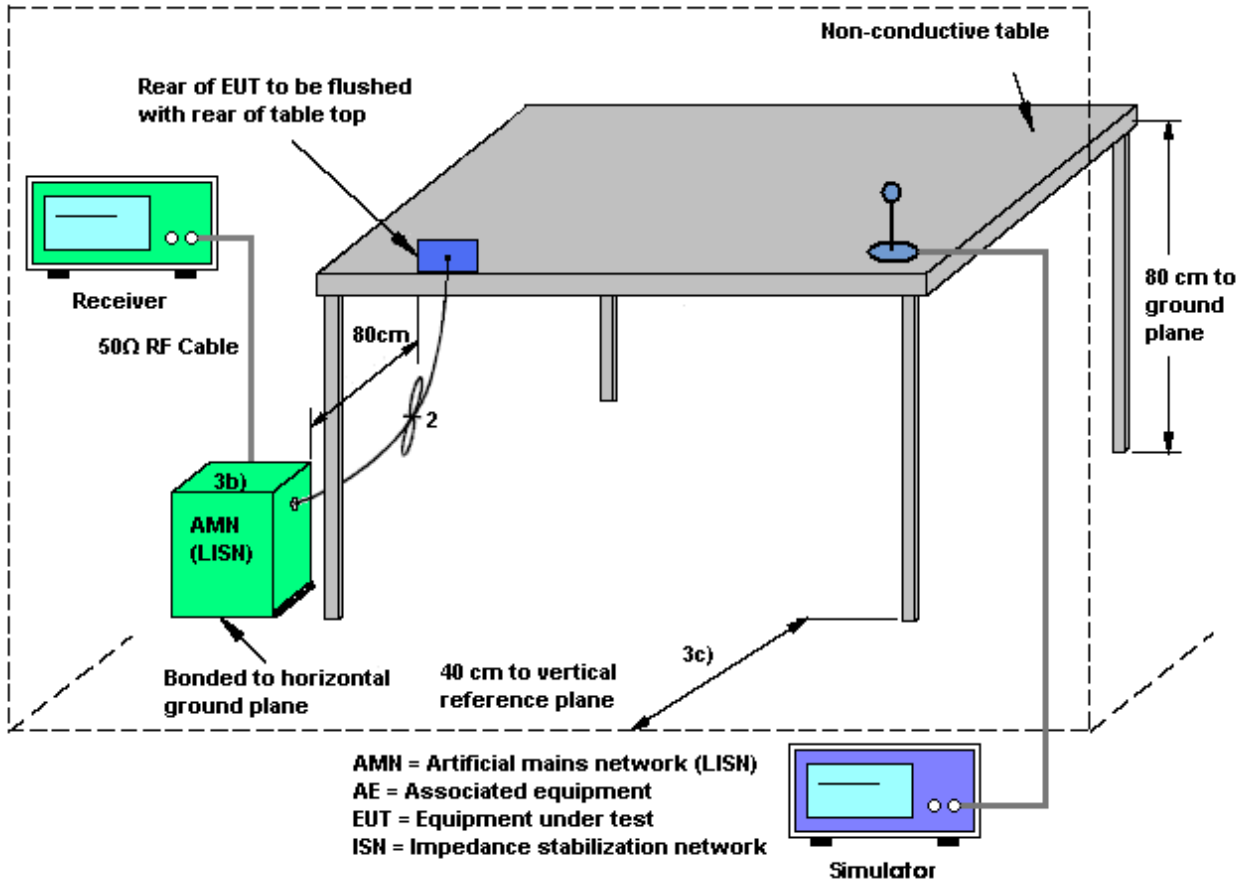
3.5.2 Measuring Instruments

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

3.5.3 Test Procedures

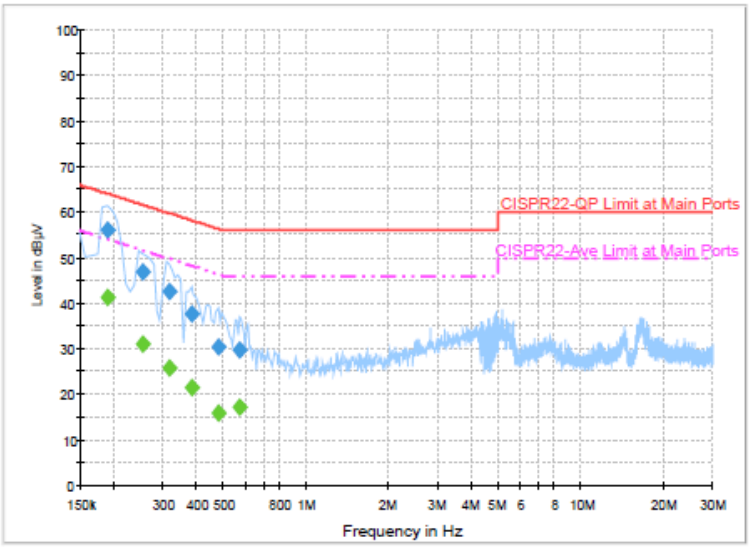
1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
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 with Maximum Hold Mode.

3.5.4 Test Setup



3.5.5 Test Result of AC Conducted Emission

Test Mode :	Mode 1	**Temperature :**	20~22℃
Test Engineer :	Kai-Chun Chu	**Relative Humidity :**	46~48%
Test Voltage :	120Vac / 60Hz	**Phase :**	Line
Function Type :	WCDMA Band II Idle + Bluetooth Link + WLAN (5GHz) Link + GPS Rx + Earphone 1 + USB Cable 2 (Data Link with Notebook)		



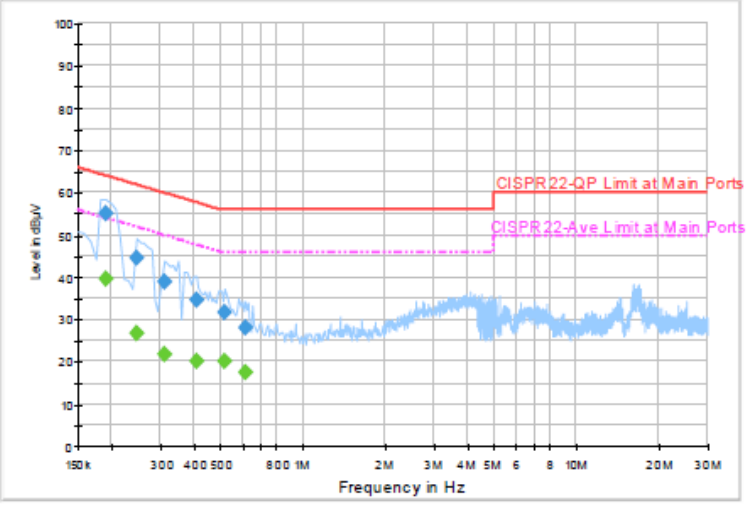
Final Result : QuasiPeak

Frequency (MHz)	QuasiPeak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.190000	56.0	Off	L1	19.3	8.0	64.0
0.254000	47.0	Off	L1	19.4	14.6	61.6
0.318000	42.5	Off	L1	19.4	17.3	59.8
0.382000	37.5	Off	L1	19.4	20.7	58.2
0.478000	30.5	Off	L1	19.5	25.9	56.4
0.574000	29.8	Off	L1	19.4	26.2	56.0

Final Result : Average

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.190000	41.1	Off	L1	19.3	12.9	54.0
0.254000	31.0	Off	L1	19.4	20.6	51.6
0.318000	25.7	Off	L1	19.4	24.1	49.8
0.382000	21.6	Off	L1	19.4	26.6	48.2
0.478000	15.7	Off	L1	19.5	30.7	46.4
0.574000	17.2	Off	L1	19.4	28.8	46.0

Test Mode :	Mode 1	Temperature :	20~22℃
Test Engineer :	Kai-Chun Chu	Relative Humidity :	46~48%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	WCDMA Band II Idle + Bluetooth Link + WLAN (5GHz) Link + GPS Rx + Earphone 1 + USB Cable 2 (Data Link with Notebook)		



Final Result : QuasiPeak

Frequency (MHz)	QuasiPeak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.190000	55.1	Off	N	19.3	8.9	64.0
0.246000	44.5	Off	N	19.4	17.4	61.9
0.310000	39.0	Off	N	19.4	21.0	60.0
0.406000	34.6	Off	N	19.4	23.1	57.7
0.518000	31.7	Off	N	19.4	24.3	56.0
0.614000	27.9	Off	N	19.4	28.1	56.0

Final Result : Average

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.190000	39.6	Off	N	19.3	14.4	54.0
0.246000	26.7	Off	N	19.4	25.2	51.9
0.310000	21.8	Off	N	19.4	28.2	50.0
0.406000	20.0	Off	N	19.4	27.7	47.7
0.518000	20.0	Off	N	19.4	26.0	46.0
0.614000	17.4	Off	N	19.4	28.6	46.0

3.6 Frequency Stability Measurement

3.6.1 Limit of Frequency Stability

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

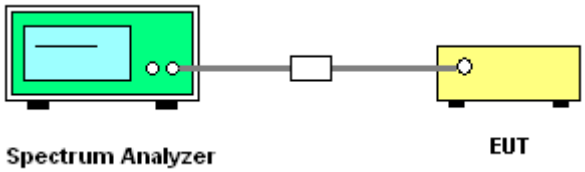
3.6.2 Measuring Instruments

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

3.6.3 Test Procedures

1. To ensure emission at the band edge is maintained within the authorized band, those values shall be measured by radiation emissions at upper and lower frequency points, and finally compensated by frequency deviation as procedures below.
2. The EUT was operated at the maximum output power, and connected to the spectrum analyzer, which is set to maximum hold function and peak detector. The peak value of the power envelope was measured and noted. The upper and lower frequency points were respectively measured relatively 10dB lower than the measured peak value.
3. The frequency deviation was calculated by adding the upper frequency point and the lower frequency point divided by two. Those detailed values of frequency deviation are provided in table below.

3.6.4 Test Setup



3.6.5 Test Result of Frequency Stability

Test Band :	5GHz band 1,2,3	Temperature :	25~26℃
Test Engineer :	Jet Lui, Kyle Jhuang, and Karl Hou	Relative Humidity :	50~51%

Mod.	Data Rate	NTX	Channel	Freq. (MHz)	Center Frequency (MHz)	Frequency Deviation (MHz)	Frequency Stability (ppm)	Temperature (˚C)	Voltage (V)
11a	6Mbps	1	36	5180	5180.050	0.050	9.65	20	3.2
11a	6Mbps	1	36	5180	5180.050	0.050	9.65	20	4.2
11a	6Mbps	1	36	5180	5180.050	0.050	9.65	20	3.7
11a	6Mbps	1	36	5180	5180.000	0.000	0.00	-30	3.7
11a	6Mbps	1	36	5180	5180.050	0.050	9.65	50	3.7

Mod.	Data Rate	NTX	Channel	Freq. (MHz)	Center Frequency (MHz)	Frequency Deviation (MHz)	Frequency Stability (ppm)	Temperature (˚C)	Voltage (V)
11a	6Mbps	1	64	5320	5320.050	0.050	9.40	20	3.2
11a	6Mbps	1	64	5320	5320.050	0.050	9.40	20	4.2
11a	6Mbps	1	64	5320	5320.100	0.100	18.80	20	3.7
11a	6Mbps	1	64	5320	5320.025	0.025	4.70	-30	3.7
11a	6Mbps	1	64	5320	5320.000	0.000	0.00	50	3.7

Mod.	Data Rate	NTX	Channel	Freq. (MHz)	Center Frequency (MHz)	Frequency Deviation (MHz)	Frequency Stability (ppm)	Temperature (˚C)	Voltage (V)
11a	6Mbps	1	100	5500	5500.050	0.050	9.09	20	3.2
11a	6Mbps	1	100	5500	5500.075	0.075	13.64	20	4.2
11a	6Mbps	1	100	5500	5500.050	0.050	9.09	20	3.7
11a	6Mbps	1	100	5500	5500.000	0.000	0.00	-30	3.7
11a	6Mbps	1	100	5500	5499.950	-0.050	-9.09	50	3.7

Note: Center Frequency = (Low Frequency + High Frequency) / 2.

3.7 Automatically Discontinue Transmission

3.7.1 Limit of Automatically Discontinue Transmission

The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signaling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization to describe how this requirement is met.

3.7.2 Measuring Instruments

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

3.7.3 Test Result of Automatically Discontinue Transmission

While the EUT is not transmitting any information, the EUT can automatically discontinue transmission and become standby mode for power saving. The EUT can detect the controlling signal of ACK message transmitting from remote device and verify whether it shall resend or discontinue transmission.

3.8 Antenna Requirements

3.8.1 Standard Applicable

According to FCC 47 CFR Section 15.407(a)(1)(2) ,if transmitting antenna directional gain is greater than 6 dBi, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.8.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.8.3 Antenna Gain

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

4 List of Measuring Equipments

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	Rohde & Schwarz	FSP40	100055	9kHz~40GHz	Jun. 09, 2014	Aug. 05, 2014~ Oct. 21, 2014	Jun. 08, 2015	Conducted (TH02-HY)
Power Meter	Anritsu	ML2495A	0932001	300MHz~40GHz	Oct. 08, 2013	Aug. 05, 2014~ Sep. 29, 2014	Oct. 07, 2014	Conducted (TH02-HY)
Power Meter	Anritsu	ML2495A	0932001	300MHz~40GHz	Oct. 02, 2014	Oct. 02, 2014~ Oct. 21, 2014	Oct. 01, 2015	Conducted (TH02-HY)
Power Sensor	Anritsu	MA2411B	0846202	300MHz~40GHz	Oct. 08, 2013	Aug. 05, 2014~ Sep. 29, 2014	Oct. 07, 2014	Conducted (TH02-HY)
Power Sensor	Anritsu	MA2411B	0846202	300MHz~40GHz	Oct. 02, 2014	Oct. 02, 2014~ Oct. 21, 2014	Oct. 01, 2015	Conducted (TH02-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP40	100055	9kHz~40GHz	Jun. 09, 2014	Aug. 31, 2014~ Oct. 03, 2014	Jun. 08, 2015	Radiation (03CH05-HY)
Bilog Antenna	Schaffner	CBL6111C	2725	30MHz~1GHz	Oct. 10, 2013	Aug. 31, 2014~ Oct. 03, 2014	Oct. 09, 2014	Radiation (03CH05-HY)
Double Ridged Guide Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1241	1GHz~18GHz	Apr. 16, 2014	Aug. 31, 2014~ Oct. 03, 2014	Apr. 15, 2015	Radiation (03CH05-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	18GHz~40GHz	Oct. 03, 2013	Aug. 31, 2014~ Sep. 02, 2014	Oct. 02, 2014	Radiation (03CH05-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	18GHz~40GHz	Oct. 02, 2014	Oct. 02, 2014~ Oct. 03, 2014	Oct. 01, 2015	Radiation (03CH05-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Jul. 28, 2014	Aug. 31, 2014~ Oct. 03, 2014	Jul. 27, 2015	Radiation (03CH05-HY)
Preamplifier	MITEQ	AMF-7D-00101800-30-10P	1590074	100kHz~18GHz	Jul. 07, 2014	Aug. 31, 2014~ Oct. 03, 2014	Jul. 06, 2015	Radiation (03CH05-HY)
Preamplifier	EMCI	EMC011830	980148	DC~18GHz	Jun. 23, 2014	Aug. 31, 2014~ Oct. 03, 2014	Jun. 22, 2015	Radiation (03CH05-HY)
Preamplifier	COM-POWER	PA-103	161075	9kHz~30MHz	Apr. 15, 2014	Aug. 31, 2014~ Oct. 03, 2014	Apr. 14, 2015	Radiation (03CH05-HY)
Preamplifier	Miteq	TTA0204	1872107	18GHz~40GHz	May 23, 2014	Aug. 31, 2014~ Oct. 03, 2014	May 22, 2015	Radiation (03CH05-HY)
Turn Table	HD	HD100	420/611	0 - 360 degree	N/A	Aug. 31, 2014~ Oct. 03, 2014	N/A	Radiation (03CH05-HY)
Antenna Mast	HD	HD100	240/666	1 m - 4 m	N/A	Aug. 31, 2014~ Oct. 03, 2014	N/A	Radiation (03CH05-HY)
EMI Test Receiver	Rohde & Schwarz	ESCS 30	100356	9kHz ~ 2.75GHz	Nov. 15, 2013	Aug. 21, 2014	Nov. 14, 2014	Conduction (CO05-HY)
LISN (for auxiliary equipment)	Rohde & Schwarz	ENV216	100081	9kHz ~ 30MHz	Dec. 12, 2013	Aug. 21, 2014	Dec. 11, 2014	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz ~ 30MHz	Dec. 04, 2013	Aug. 21, 2014	Dec. 03, 2014	Conduction (CO05-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Aug. 21, 2014	N/A	Conduction (CO05-HY)

5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.26**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.10**