

ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LOW-POWER, NON-LICENSED TRANSMITTER

Test Report No. : W156R-D015
AGR No. : A155A-050
Applicant : LG Electronics USA
Address : 1000 Sylvan Avenue, Englewood Cliffs, New Jersey, United States, 7632
Manufacturer : LG Electronics Inc.
Address : 222 LG-ro, Jinwi-Myeon, Pyeongtaek-Si, Gyeonggi-Do, 451-713, Korea
Type of Equipment : WLAN Module
FCC ID. : BEJ9QK-TWFMB008D
Model Name : TWFM-B008D
Multiple Model Name : N/A
Serial number : N/A
Total page of Report : 30 pages (including this page)
Date of Incoming : May 08, 2015
Date of issue : June 15, 2015

SUMMARY

The equipment complies with the regulation; *FCC PART 15 SUBPART E Section 15.407*
 This test report only contains the result of a single test of the sample supplied for the examination.
 It is not a generally valid assessment of the features of the respective products of the mass-production.

Reviewed by: 

 Jae-Ho, Lee / Chief Engineer
 ONETECH Corp.

Approved by: 

 Sung-Ik, Han/ Managing Director
 ONETECH Corp.

CONTENTS

	PAGE
1. VERIFICATION OF COMPLIANCE	5
2. TEST SUMMARY	6
2.1 TEST ITEMS AND RESULTS	6
2.2 ADDITIONS, DEVIATIONS, EXCLUSIONS FROM STANDARDS.....	7
2.3 RELATED SUBMITTAL(S) / GRANT(S)	7
2.4 PURPOSE OF THE TEST	7
2.5 TEST METHODOLOGY.....	7
2.6 TEST FACILITY.....	7
3. GENERAL INFORMATION.....	8
3.1 PRODUCT DESCRIPTION.....	8
3.2 ALTERNATIVE TYPE(S)/MODEL(S); ALSO COVERED BY THIS TEST REPORT.....	9
4. EUT MODIFICATIONS.....	9
5. SYSTEM TEST CONFIGURATION	10
5.1 JUSTIFICATION.....	10
5.2 PERIPHERAL EQUIPMENT	10
5.3 MODE OF OPERATION DURING THE TEST	11
5.4 CONFIGURATION OF TEST SYSTEM.....	12
5.5 ANTENNA REQUIREMENT	12
ANTENNAS LIST	12
6. PRELIMINARY TEST	13
6.1 AC POWER LINE CONDUCTED EMISSIONS TESTS.....	13
6.2 GENERAL RADIATED EMISSIONS TESTS	13
7. RADIATED SPURIOUS EMISSIONS.....	14
7.1 OPERATING ENVIRONMENT	14
7.2 TEST SET-UP FOR CONDUCTED MEASUREMENT	14
7.3 TEST EQUIPMENT USED.....	14
7.4 TEST DATA FOR 5 150 MHZ ~ 5 250 MHZ BAND	15
7.4.1 Test data for 802.11a RLAN Mode	15
7.4.2 Test data for 802.11n_HT20 RLAN Mode.....	17
7.4.3 Test data for 802.11n_HT40 RLAN Mode.....	19
8. RADIATED RESTRICTED BAND EDGE MEASUREMENTS.....	21
8.1 OPERATING ENVIRONMENT	21

8.2 TEST SET-UP FOR CONDUCTED MEASUREMENT	21
8.3 TEST EQUIPMENT USED	21
8.4 TEST DATA FOR FREQUENCY 5 150 BAND	22
<i>8.4.1 Test data for 802.11a RLAN Mode</i>	22
<i>8.4.2 Test data for 802.11n_HT20 RLAN Mode</i>	25
<i>8.4.3 Test data for 802.11n_HT40 RLAN Mode</i>	28

Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
W156R-D015	June 15, 2015	Initial Issue	All

1. VERIFICATION OF COMPLIANCE

Applicant : LG Electronics USA
 Address : 1000 Sylvan Avenue, Englewood Cliffs, New Jersey, United States, 7632
 Contact Person : Yongduk Kwon / Research Engineer
 Telephone No. : +82-31-610-9606
 FCC ID : BEJ9QK-TWFMB008D
 Model Name : TWFM-B008D
 Serial Number : N/A
 Date : June 15, 2015

EQUIPMENT CLASS	Unlicensed National Information infrastructure(UNII)
E.U.T. DESCRIPTION	Modular Transmitter, WLAN Module
THIS REPORT CONCERNS	Class II Permissive Change
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC PART 15 SUBPART E Section 15.407
Modifications on the Equipment to Achieve Compliance	None
Final Test was Conducted On	3 m, Semi Anechoic Chamber

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

2. TEST SUMMARY

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
15.407(a)	26 dB Bandwidth	N/A (See Note 1)
15.407(a)	Maximum Conducted Output Power	N/A (See Note 1)
15.407(a)	Peak Power Spectral Density	N/A (See Note 1)
15.407(g)	Frequency Stability	N/A (See Note 1)
15.407(b)	Undesirable Emissions	Met the Limit / PASS
15.205, 15.407(b)	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Met the Limit / PASS
15.207	AC Conducted Emissions 150 kHz-30 MHz	N/A (See Note 1)
15.407(h)	Dynamic Frequency Selection	N/A (See Note 2)

Note 1: The test is not performed because it was C2PC.

Note 2: The test is not performed because EUT doesn't use the DFS band.

2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

2.3 Related Submittal(s) / Grant(s)

Antennas are added. (NP8350 V3_B, NP8350 V3) / C2PC.

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC PART 15 SUBPART E Section 15.407

2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 301-14, Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do, 464-862 Korea.

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-4112/ C-4617/ G-666/ T-1842 IC (Industry Canada) – Registration No. Site# 3736-3

-. Site Accreditation:

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation No. 85

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

3. GENERAL INFORMATION

3.1 Product Description

The LG Electronics USA, Model TWFM-B008D (referred to as the EUT in this report) is a WLAN Module. Product specification information described herein was obtained from product data sheet or user’s manual.

DEVICE TYPE	WLAN Module		
FREQUENCY RANGE	5 150 MHz ~ 5 250 MHz Band	5 180 MHz ~ 5 240 MHz_20 MHz BW	
		5 190 MHz ~ 5 230 MHz_40 MHz BW	
	5 725 MHz ~ 5 850 MHz Band	5 745 MHz ~ 5 825 MHz_20 MHz BW	
		5 755 MHz ~ 5 795 MHz_40 MHz BW	
MAX. RF OUTPUT POWER	Ant.0	5 150 MHz ~ 5 250 MHz Band	Wi-Fi 802.11a (10.06 dBm) Wi-Fi 802.11n_20 MHz (10.58 dBm) Wi-Fi 802.11n_40 MHz (12.47 dBm)
		5 725 MHz ~ 5 850 MHz Band	Wi-Fi 802.11a (13.48 dBm) Wi-Fi 802.11n_20 MHz (14.13 dBm) Wi-Fi 802.11n_40 MHz (13.84 dBm)
	Ant.1	5 150 MHz ~ 5 250 MHz Band	Wi-Fi 802.11a (9.58 dBm) Wi-Fi 802.11n_20 MHz (9.44 dBm) Wi-Fi 802.11n_40 MHz (12.57 dBm)
		5 725 MHz ~ 5 850 MHz Band	Wi-Fi 802.11a (13.33 dBm) Wi-Fi 802.11n_20 MHz (14.78 dBm) Wi-Fi 802.11n_40 MHz (13.89 dBm)
MODULATION TYPE	802.11a/g/n(HT20)/n(HT40): OFDM Modulation(BPSK/QPSK/16QAM/64QAM)		
Antenna Gain	2.4 GHz Band	NP8350 V3_B : -0.79 dBi	
		NP8350 V3 : -1.08 dBi	
	5.15 GHz Band	NP8350 V3_B : 3.69 dBi	
		NP8350 V3 : 1.14 dBi	
	5.8 GHz Band	NP8350 V3_B : 2.88 dBi	
		NP8350 V3 : 2.04 dBi	
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)	20 MHz		

3.2 Alternative type(s)/model(s); also covered by this test report.

-. None

4. EUT MODIFICATIONS

-. None

5. SYSTEM TEST CONFIGURATION

5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
Main Board	LG Electronics Inc.	TWFM-B008D	BEJ9QK-TWFM B008D

5.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

Model	Manufacturer	Description	Connected to
TWFM-B008D	LG Electronics Inc.	WLAN Module (EUT)	Note PC
Pavilion g6	HP	Notebook PC	EUT
Series PPP009L-E	LITE-ON TECHNOLOGY CO, LTD.	ADAPTER	Notebook PC

5.3 Mode of operation during the test

For the testing, software used to control the EUT for staying in continuous transmitting mode is programmed.

The worse case data rate for each modulation is determined 9 Mbps(Ant.0) / 9 Mbps(Ant.1) for IEEE 802.11a, 26 Mbps(Ant.0) / 26 Mbps(Ant.1) for HT20, 13.5 Mbps(Ant.0) / 13.5 Mbps(Ant.1) for HT40.

- To get a maximum emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes and the worst case is “XY” axis.

5.4 Configuration of Test System

Line Conducted Test: The EUT was connected to USB and the power of USB was connected to Notebook PC. All supporting equipments were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions.

Radiated Emission Test: Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 meter open area test site.
The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

5.5 Antenna Requirement

For intentional device, according to section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Antenna Construction:

The transmitter antenna of the EUT is a PIFA antenna, so no consideration of replacement by the user.

Antennas list

Model	Type	Frequency band	Gain (dBi)	Note
NP8740	PCB antenna	2.4 GHz band	3.70	Original antenna
		5.15 GHz band	4.09	
		5.8 GHz band	5.58	
NP8350 V3_B		2.4 GHz band	-0.79	Additional antenna1 by C2PC (Tested)
		5.15 GHz band	3.69	
		5.8 GHz band	2.88	
NP8350 V3		2.4 GHz band	-1.08	Additional antenna2 by C2PC
		5.15 GHz band	1.14	
		5.8 GHz band	2.04	

6. PRELIMINARY TEST

6.1 AC Power line Conducted Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	-

6.2 General Radiated Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X

7. RADIATED SPURIOUS EMISSIONS

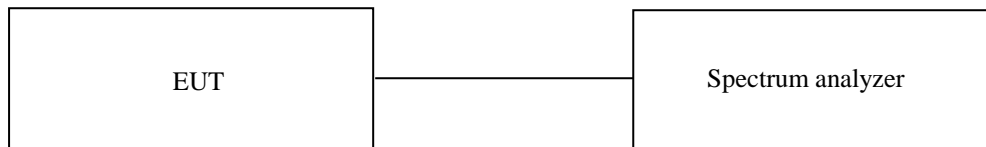
7.1 Operating environment

Temperature : 22 ~ 23 °C
 Relative humidity : 54 ~ 55 % R.H.

7.2 Test set-up for conducted measurement

The radiated emissions measurements were performed on the 3 m, open-field test site. The EUT was placed on a non-conductive turntable above the ground plane.

The frequency spectrum from 30 MHz to 40 GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.



7.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
■ - FSV40	Rohde & Schwarz	Signal Analyzer	101009	Jul. 30, 2014 (1Y)
■ - ESCI	Rohde & Schwarz	Test Receiver	101012	Nov. 03, 2014 (1Y)
■ - 310N	Sonoma Instrument	Pre-Amplifier	312544	Apr. 29, 2015 (1Y)
■ - SCU-18	Rohde & Schwarz	Pre-Amplifier	10041	Nov. 25, 2014 (1Y)
■ - DT3000	Innco System	Turn Table	930611	N/A
■ - MA4000-EP	Innco System	Antenna Master	3320611	N/A
■ - VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-421	Jul. 10, 2014 (2Y)
■ - BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D294	Sep. 05, 2013 (2Y)
■ - BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Sep. 05, 2013 (2Y)

All test equipment used is calibrated on a regular basis.

7.4 Test data for 5 150 MHz ~ 5 250 MHz Band

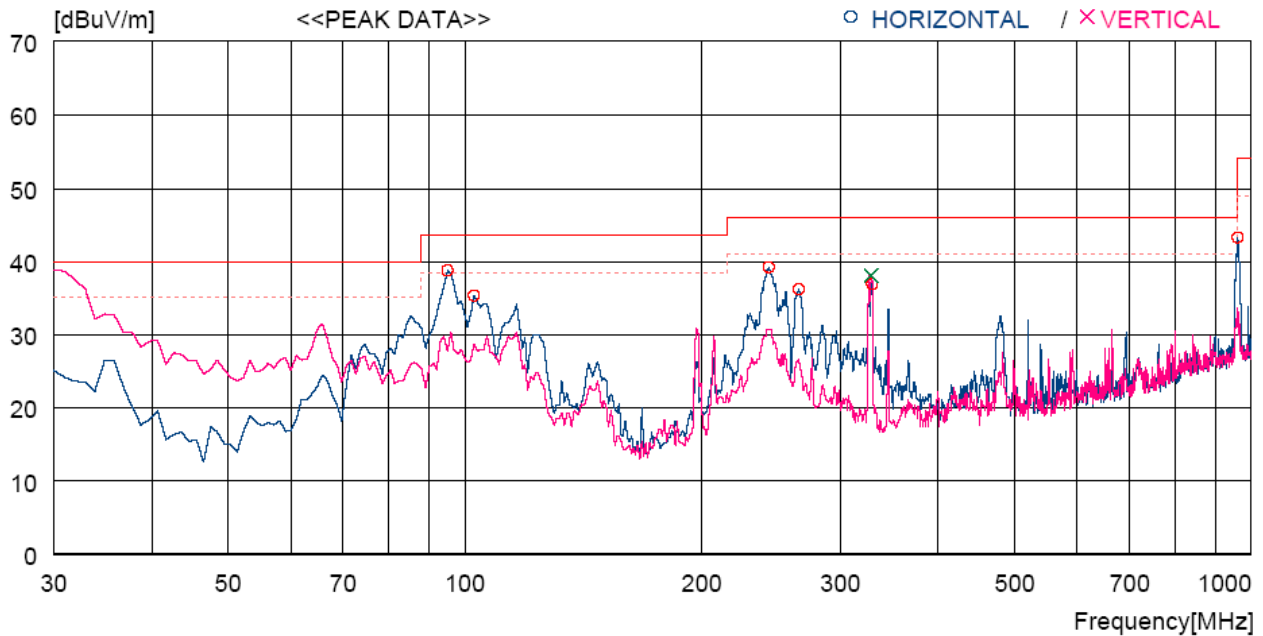
7.4.1 Test data for 802.11a RLAN Mode

7.4.1.1 Test data for 30 MHz ~ 1 000 MHz

Humidity Level : 54 ~ 55 % R.H. Temperature: 22 ~ 23 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247
 Result : PASSED

EUT : WLAN Module Date: June 09, 2015
 Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

-.Ant0, Ant1 and Multiple transmit with Low, Middle and High Channels were tested, but the worst data were recorded.



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	94.990	51.4	12.5	7.9	33.1	38.7	43.5	4.8	200	0
2	102.750	47.0	13.4	8.0	33.1	35.3	43.5	8.2	300	359
3	243.400	49.7	13.4	9.1	33.0	39.2	46.0	6.8	100	359
4	265.710	46.0	13.9	9.3	33.0	36.2	46.0	9.8	100	359
5	329.730	44.9	15.4	9.6	33.0	36.9	46.0	9.1	100	138
6	961.187	38.7	23.8	12.6	31.9	43.2	54.0	10.8	100	359
----- Vertical -----										
7	328.760	46.1	15.4	9.6	33.0	38.1	46.0	7.9	200	359

7.4.1.2 Test data for Below 30 MHz

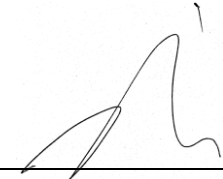
- Test Date : June 09, 2015
- Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)
- Frequency range : 9 kHz ~ 30 MHz
- Measurement distance : 3 m
- Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

7.4.1.3 Test data for above 1 GHz

- Test Date : June 09, 2015
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Frequency range : 1 GHz ~ 40 GHz
- Measurement distance : 3 m
- Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									



Tested by: Jun-Hui, Lee / Senior Engineer

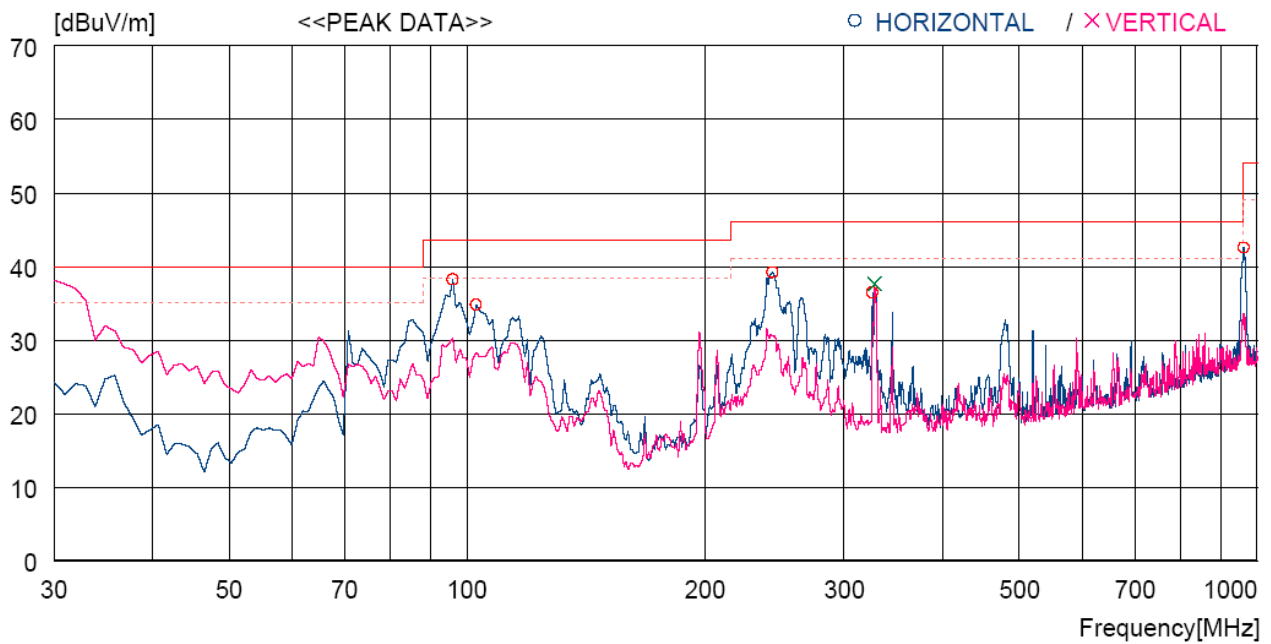
7.4.2 Test data for 802.11n_HT20 RLAN Mode

7.4.2.1 Test data for 30 MHz ~ 1 000 MHz

Humidity Level : 54 ~ 55 % R.H. Temperature: 22 ~ 23 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247
 Result : PASSED

EUT : WLAN Module Date: June 09, 2015
 Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

-.Ant0, Ant1 and Multiple transmit with Low, Middle and High Channels were tested, but the worst data were recorded.



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	95.960	50.7	12.7	7.9	33.1	38.2	43.5	5.3	200	173
2	102.750	46.4	13.4	8.0	33.1	34.7	43.5	8.8	300	167
3	243.400	49.7	13.4	9.1	33.0	39.2	46.0	6.8	100	359
4	325.850	44.5	15.3	9.6	33.0	36.4	46.0	9.6	100	359
5	960.217	38.1	23.8	12.6	32.0	42.5	54.0	11.5	100	359
----- Vertical -----										
6	327.790	45.6	15.4	9.6	33.0	37.6	46.0	8.4	200	359

7.4.2.1 Test data for Below 30 MHz

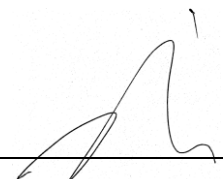
- Test Date : June 09, 2015
- Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)
- Frequency range : 9 kHz ~ 30 MHz
- Measurement distance : 3 m
- Operating mode : Transmitting mode

Frequency (MHz)	Reading (dB μ V)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
It was not observed any emissions from the EUT.									

7.4.2.3 Test data for above 1 GHz

- Test Date : June 09, 2015
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Frequency range : 1 GHz ~ 40 GHz
- Measurement distance : 3 m
- Operating mode : Transmitting mode

Frequency (MHz)	Reading (dB μ V)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
It was not observed any emissions from the EUT.									



Tested by: Jun-Hui, Lee / Senior Engineer

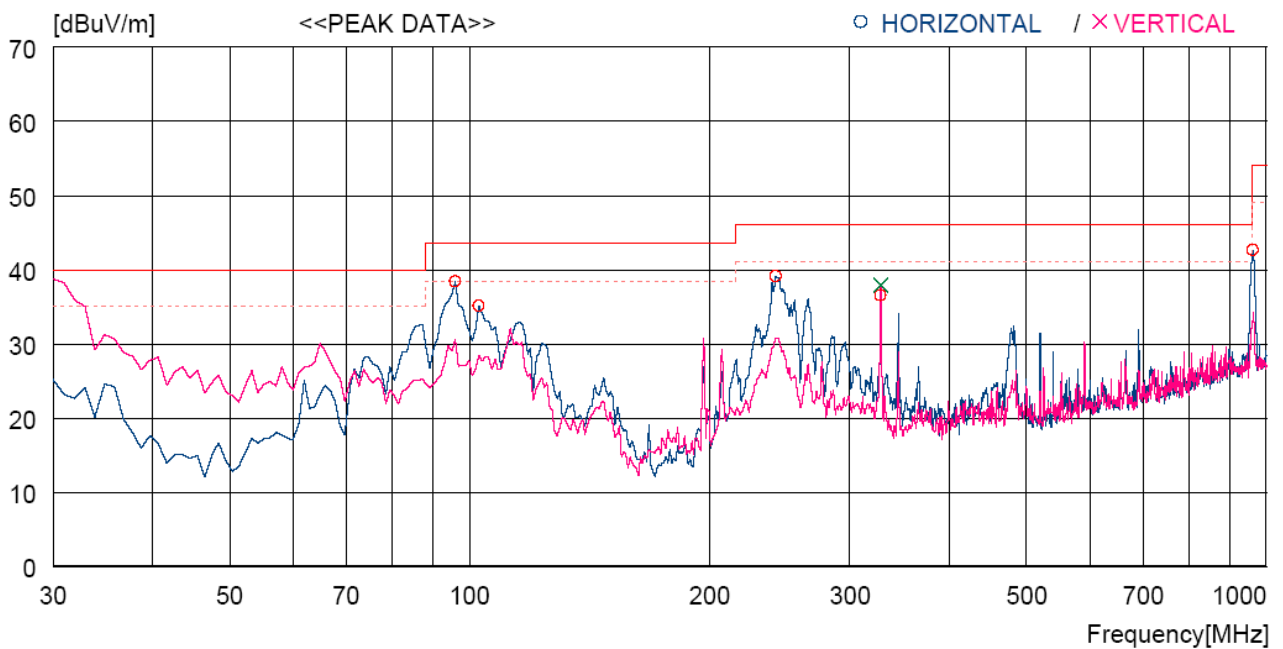
7.4.3 Test data for 802.11n_HT40 RLAN Mode

7.4.3.1 Test data for 30 MHz ~ 1 000 MHz

Humidity Level : 22 ~ 23 % R.H. Temperature: 54 ~ 55 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247
 Result : PASSED

EUT : WLAN Module Date: June 09, 2015
 Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

-.Ant0, Ant1 and Multiple transmit with Low, Middle and High Channels were tested, but the worst data were recorded.



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	95.960	50.9	12.7	7.9	33.1	38.4	43.5	5.1	300	359
2	102.750	46.8	13.4	8.0	33.1	35.1	43.5	8.4	200	0
3	242.430	49.6	13.4	9.1	33.0	39.1	46.0	6.9	100	146
4	327.790	44.5	15.4	9.6	33.0	36.5	46.0	9.5	100	359
5	961.187	38.1	23.8	12.6	31.9	42.6	54.0	11.4	100	359
----- Vertical -----										
6	327.790	45.9	15.4	9.6	33.0	37.9	46.0	8.1	200	359

7.4.3.2 Test data for Below 30 MHz


- Test Date : June 09, 2015
- Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)
- Frequency range : 9 kHz ~ 30 MHz
- Measurement distance : 3 m
- Operating mode : Transmitting mode

Frequency (MHz)	Reading (dB μ V)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
It was not observed any emissions from the EUT.									

7.4.3.3 Test data for above 1 GHz

- Test Date : June 09, 2015
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Frequency range : 1 GHz ~ 40 GHz
- Measurement distance : 3 m
- Operating mode : Transmitting mode

Frequency (MHz)	Reading (dB μ V)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
It was not observed any emissions from the EUT.									



Tested by: Jun-Hui, Lee / Senior Engineer

8. RADIATED RESTRICTED BAND EDGE MEASUREMENTS

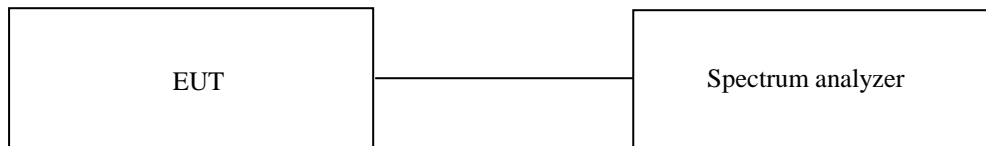
8.1 Operating environment

Temperature : 24 °C
 Relative humidity : 50 % R.H.

8.2 Test set-up for conducted measurement

The radiated emissions measurements were performed on the 3 m, open-field test site. The EUT was placed on a non-conductive turntable above the ground plane.

The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.



8.3 Test equipment used

■ - FSV40	Rohde & Schwarz	Signal Analyzer	101009	Jul. 30, 2014 (1Y)
■ - ESCI	Rohde & Schwarz	Test Receiver	101012	Nov. 03, 2014 (1Y)
■ - 310N	Sonoma Instrument	Pre-Amplifier	312544	Apr. 29, 2015 (1Y)
■ - SCU-18	Rohde & Schwarz	Pre-Amplifier	10041	Nov. 25, 2014 (1Y)
■ - DT3000	Innco System	Turn Table	930611	N/A
■ - MA4000-EP	Innco System	Antenna Master	3320611	N/A
■ - VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-421	Jul. 10, 2014 (2Y)
■ - BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D294	Sep. 05, 2013 (2Y)
■ - BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Sep. 05, 2013 (2Y)

All test equipment used is calibrated on a regular basis.

8.4 Test data for Frequency 5 150 band

8.4.1 Test data for 802.11a RLAN Mode

8.4.1.1 Test data for Antenna 0

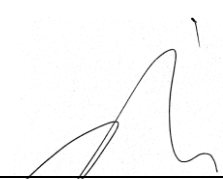
- Test Date : June 07, 2015
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Measurement distance : 3 m
- Result : Pass

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
5 150.00	39.52	Peak	H	31.00	11.50	42.20	39.82	74.00	34.18
	25.86	Average	H				26.16	54.00	27.84
	41.50	Peak	V				41.80	74.00	32.20
	27.53	Average	V				27.83	54.00	26.17
5 350.00	38.18	Peak	H	31.30	11.70	42.20	38.98	74.00	35.02
	23.43	Average	H				24.23	54.00	29.77
	37.26	Peak	V				38.06	74.00	35.94
	26.84	Average	V				27.64	54.00	26.36

Tabulated test data for Restricted Band

Remark - "H": Horizontal, "V": Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Emission Level (dB}\mu\text{V/m)}$$



Tested by: Jun-Hui, Lee / Senior Engineer

8.4.1.2 Test data for Antenna 1

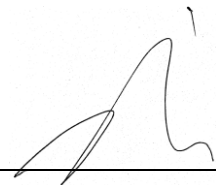
- Test Date : June 07, 2015
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Measurement distance : 3 m
- Result : Pass

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
5 150.00	41.09	Peak	H	31.00	11.50	42.20	41.39	74.00	32.61
	27.82	Average	H				28.12	54.00	25.88
	44.83	Peak	V				45.13	74.00	28.87
	27.25	Average	V				27.55	54.00	26.45
5 350.00	36.26	Peak	H	31.30	11.70	42.20	37.06	74.00	36.94
	22.77	Average	H				23.57	54.00	30.43
	37.59	Peak	V				38.39	74.00	35.61
	23.05	Average	V				23.85	54.00	30.15

Tabulated test data for Restricted Band

Remark - “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dBµV/m)} - \text{Emission Level (dBµV/m)}$$



Tested by: Jun-Hui, Lee / Senior Engineer

8.4.1.3 Test data for Multiple transmit

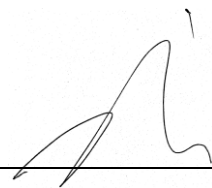
- Test Date : June 07, 2015
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Measurement distance : 3 m
- Result : Pass

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
5 150.00	40.54	Peak	H	31.00	11.50	42.20	40.84	74.00	33.16
	27.71	Average	H				28.01	54.00	25.99
	48.20	Peak	V				48.50	74.00	25.50
	30.31	Average	V				30.61	54.00	23.39
5 350.00	36.87	Peak	H	31.30	11.70	42.20	37.67	74.00	36.33
	23.11	Average	H				23.91	54.00	30.09
	37.23	Peak	V				38.03	74.00	35.97
	23.56	Average	V				24.36	54.00	29.64

Tabulated test data for Restricted Band

Remark - “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dBµV/m)} - \text{Emission Level (dBµV/m)}$$



Tested by: Jun-Hui, Lee / Senior Engineer

8.4.2 Test data for 802.11n_HT20 RLAN Mode

8.4.2.1 Test data for Antenna 0

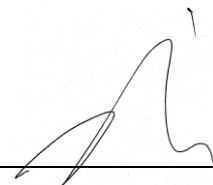
- Test Date : June 07, 2015
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Measurement distance : 3 m
- Result : Pass

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
5 150.00	37.44	Peak	H	31.00	11.50	42.20	37.74	74.00	36.26
	26.45	Average	H				26.75	54.00	27.25
	41.86	Peak	V				42.16	74.00	31.84
	28.80	Average	V				29.10	54.00	24.90
5 350.00	39.14	Peak	H	31.30	11.70	42.20	39.94	74.00	34.06
	22.32	Average	H				23.12	54.00	30.88
	37.68	Peak	V				38.48	74.00	35.52
	24.52	Average	V				25.32	54.00	28.68

Tabulated test data for Restricted Band

Remark - “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Emission Level (dB}\mu\text{V/m)}$$



Tested by: Jun-Hui, Lee / Senior Engineer

8.4.2.2 Test data for Antenna 1

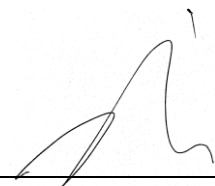
- Test Date : June 07, 2015
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Measurement distance : 3 m
- Result : Pass

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
5 150.00	40.82	Peak	H	31.00	11.50	42.20	41.12	74.00	32.88
	24.69	Average	H				24.99	54.00	29.01
	45.28	Peak	V				45.58	74.00	28.42
	28.87	Average	V				29.17	54.00	24.83
5 350.00	37.26	Peak	H	31.30	11.70	42.20	38.06	74.00	35.94
	23.54	Average	H				24.34	54.00	29.66
	38.02	Peak	V				38.82	74.00	35.18
	23.19	Average	V				23.99	54.00	30.01

Tabulated test data for Restricted Band

Remark - "H": Horizontal, "V": Vertical

$$\text{Margin (dB)} = \text{Limits (dBµV/m)} - \text{Emission Level (dBµV/m)}$$



Tested by: Jun-Hui, Lee / Senior Engineer

8.4.2.3 Test data for Multiple transmit

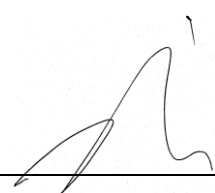
- Test Date : June 07, 2015
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Measurement distance : 3 m
- Result : Pass

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
5 150.00	43.28	Peak	H	31.00	11.50	42.20	43.58	74.00	30.42
	27.51	Average	H				27.81	54.00	26.19
	48.07	Peak	V				48.37	74.00	25.63
	30.15	Average	V				30.45	54.00	23.55
5 350.00	37.48	Peak	H	31.30	11.70	42.20	38.28	74.00	35.72
	22.96	Average	H				23.76	54.00	30.24
	37.69	Peak	V				38.49	74.00	35.51
	23.37	Average	V				24.17	54.00	29.83

Tabulated test data for Restricted Band

Remark - “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dBµV/m)} - \text{Emission Level (dBµV/m)}$$



Tested by: Jun-Hui, Lee / Senior Engineer

8.4.3 Test data for 802.11n_HT40 RLAN Mode

8.4.3.1 Test data for Antenna 0

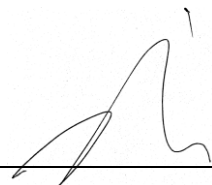
- Test Date : June 07, 2015
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Measurement distance : 3 m
- Result : Pass

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
5 150.00	42.65	Peak	H	31.00	11.50	42.20	42.95	74.00	31.05
	25.70	Average	H				26.00	54.00	28.00
	47.17	Peak	V				47.47	74.00	26.53
	28.98	Average	V				29.28	54.00	24.72
5 350.00	37.30	Peak	H	31.30	11.70	42.20	38.10	74.00	35.90
	23.41	Average	H				24.21	54.00	29.79
	37.09	Peak	V				37.89	74.00	36.11
	22.77	Average	V				23.57	54.00	30.43

Tabulated test data for Restricted Band

Remark - “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Emission Level (dB}\mu\text{V/m)}$$



Tested by: Jun-Hui, Lee / Senior Engineer

8.4.3.2 Test data for Antenna 1

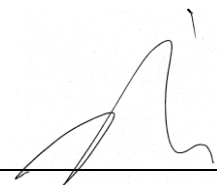
- Test Date : June 07, 2015
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Measurement distance : 3 m
- Result : Pass

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
5 150.00	39.21	Peak	H	31.00	11.50	42.20	39.51	74.00	34.49
	22.87	Average	H				23.17	54.00	30.83
	45.99	Peak	V				46.29	74.00	27.71
	27.12	Average	V				27.42	54.00	26.58
5 350.00	37.51	Peak	H	31.30	11.70	42.20	38.31	74.00	35.69
	22.78	Average	H				23.58	54.00	30.42
	37.62	Peak	V				38.42	74.00	35.58
	23.68	Average	V				24.48	54.00	29.52

Tabulated test data for Restricted Band

Remark - “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dBµV/m)} - \text{Emission Level (dBµV/m)}$$



Tested by: Jun-Hui, Lee / Senior Engineer

8.4.3.3 Test data for Multiple transmit

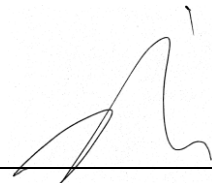
- Test Date : June 07, 2015
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Measurement distance : 3 m
- Result : Pass

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
5 150.00	44.17	Peak	H	31.00	11.50	42.20	44.47	74.00	29.53
	26.50	Average	H				26.80	54.00	27.20
	48.23	Peak	V				48.53	74.00	25.47
	28.68	Average	V				28.98	54.00	25.02
5 350.00	37.28	Peak	H	31.30	11.70	42.20	38.08	74.00	35.92
	23.49	Average	H				24.29	54.00	29.71
	36.73	Peak	V				37.53	74.00	36.47
	22.38	Average	V				23.18	54.00	30.82

Tabulated test data for Restricted Band

Remark - “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dBµV/m)} - \text{Emission Level (dBµV/m)}$$



Tested by: Jun-Hui, Lee / Senior Engineer