

FCC Test Report

(Co-Located)

Report No.: RF160719C17-4

FCC ID: QXO-4018WP

Test Model: 31025, 31026

Received Date: Jul. 19, 2016

Test Date: Oct. 19, 2016

Issued Date: Oct. 20, 2016

Applicant: Extreme Networks, Inc.

Address: 9 Northeastern Blvd. Salem, New Hampshire, United States, 03079

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

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Test Location: No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, TAIWAN (R.O.C.)



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Release Control Record

Issue No.	Description	Date Issued
RF160719C17-4	Original release	Oct. 20, 2016

1 Certificate of Conformity

Product: Wireless 802.11 abgn/ac Router

Brand: Extreme Networks

Test Model: 31025, 31026

Sample Status: Engineering sample

Applicant: Extreme Networks, Inc.

Test Date: Oct. 19, 2016

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)

47 CFR FCC Part 15, Subpart E (Section 15.407)

ANSI C63.10-2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Celine Chou , **Date:** Oct. 20, 2016
Celine Chou / Specialist

Approved by : Ken Liu , **Date:** Oct. 20, 2016
Ken Liu / Senior Manager

2 Summary of Test Results

Applied Standard:	47 CFR FCC Part 15, Subpart C (Section 15.247) 47 CFR FCC Part 15, Subpart E (Section 15.407)		
FCC Clause	Test Item	Result	Remarks
15.207 15.407(b)(6)	AC Power Conducted Emission	Pass	Meet the requirement of limit. Minimum passing margin is -9.10dB at 0.96641MHz.
15.205 / 15.209 / 15.247(d) 15.407(b) (1/2/3/4(i/ii)/6)	Radiated Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -0.5dB at 43.52MHz.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.44 dB
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	3.86 dB
	200MHz ~ 1000MHz	3.87 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Wireless 802.11 abgn/ac Router	
Brand	Extreme Networks	
Test Model	31025, 31026	
Status of EUT	Engineering sample	
Power Supply Rating	48Vdc or 54Vdc or 55Vdc (POE)	
Modulation Type	WLAN	CCK, DQPSK, DBPSK for DSSS 256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDM
	Bluetooth LE	GFSK
	Zigbee	O-QPSK
Modulation Technology	WLAN	DSSS, OFDM
Transfer Rate	WLAN	802.11b: 11/5.5/2/1Mbps 802.11a/g: 54/48/36/24/18/12/9/6Mbps 802.11n: up to 300Mbps 802.11ac: up to 867Mbps
	Bluetooth LE	1Mbps
	Zigbee	250kbps
Operating Frequency	WLAN	2.4GHz: 2412 ~ 2462MHz 5.0GHz: 5180 ~ 5240MHz, 5745 ~ 5825MHz
	Bluetooth LE	2402 ~ 2480MHz
	Zigbee	2405 ~ 2480MHz
Number of Channel	WLAN	2412 ~ 2462MHz: 11 for 802.11b, 802.11g, 802.11n (HT20) 7 for 802.11n (HT40) 5180 ~ 5240MHz: 4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20) 2 for 802.11n (HT40), 802.11ac (VHT40) 1 for 802.11ac (VHT80) 5745 ~ 5825MHz: 5 for 802.11a, 802.11n (HT20), 802.11ac (VHT20) 2 for 802.11n (HT40), 802.11ac (VHT40) 1 for 802.11ac (VHT80)
	Bluetooth LE	40
	Zigbee	16

Output Power	WLAN	CDD Mode: 2412 ~ 2462MHz: 220.653mW 5180 ~ 5240MHz: 201.915mW 5745 ~ 5825MHz: 195.961mW Beamforming Mode: 2412 ~ 2462MHz: 140.652mW 5180 ~ 5240MHz: 193.223mW 5745 ~ 5825MHz: 205.196mW
	Bluetooth LE	1.972mW
	Zigbee	2.113mW
Antenna Type	Refer to note	
Antenna Connector	Refer to note	
Accessory Device	NA	
Data Cable Supplied	NA	

Note:

1. All models are listed as below. Model: 31026 is representative for final test.

Brand	Model	Difference
Extreme Networks	31026	All models are electrically identical, different model names are for marketing purpose.
	31025	

Equipment	EUT	Description	Model
Wireless 802.11 abgn/ac Router	1	WS-AP3912i-ROW	31026
Wireless 802.11 abgn/ac Router	2	WS-AP3912i-FCC	31025

2. The EUT incorporates a MIMO function. Physically, the EUT provides 2 completed transmitters and 2 receivers.

Modulation Mode	TX Function	Beamforming
802.11b	2TX	Not Support
802.11g	2TX	Not Support
802.11a	2TX	Not Support
802.11n (HT20)	2TX	Support
802.11n (HT40)	2TX	Support
802.11ac (VHT20)	2TX	Support
802.11ac (VHT40)	2TX	Support
802.11ac (VHT80)	2TX	Support

*The modulation and bandwidth are similar for 802.11n mode for HT20/HT40 and 802.11ac mode for VHT20/VHT40, therefore investigated worst case to representative mode in test report. (Final test mode refer section 3.2.1)

* CDD mode is the worst case for final test after pretesting CDD mode and beamforming mode.

3. The EUT with follow antennas gain is listed as table below.

Ant. No.	1	2	3	4	BT / Zigbee
Ant. Type	PIFA				
Frequency (MHz)	2400-2500		5150-5850		2400-2500
Gain (dBi)	3.67	4.31	5.72	5.99	3.51
Connector	IPEX				

4. The EUT consumes power from the following POE. (Support unit only)

POE	
Brand	SENAO
Model	EPA5006GP
Input Power	100-240Vac, 0.8A, 50-60Hz
Output Power	54Vdc, 0.6A
Power Line	0.5m non-shielded Power cable without core

5. The power setting are list as below:

WLAN 2.4GHz: CDD Mode					
	802.11b	802.11g	802.11n (HT20)		802.11n (HT40)
CH 1	21	17	16.5	CH 3	14
CH 6	21	21	21	CH 6	17
CH 11	21	17.5	17	CH 9	16
WLAN 2.4GHz: Beamforming Mode					
	802.11n (HT20)			802.11n (HT40)	
CH 1	15		CH 3	13	
CH 6	19		CH 6	14	
CH 11	15		CH 9	13	

WLAN 5GHz: CDD Mode						
	802.11a	802.11n (HT20)		802.11n (HT40)		802.11ac (VHT80)
CH 36	20	19.5	CH 38	17	CH 42	16.5
CH 40	20	20	CH 46	20	CH 155	19
CH 48	20	20	CH 151	20		
CH 149	20	20	CH 159	20		
CH 157	20	20				
CH 165	20	20				
WLAN 5GHz: Beamforming Mode						
	802.11n (HT20)			802.11n (HT40)		802.11ac (VHT80)
CH 36	19		CH 38	16	CH 42	16
CH 40	20		CH 46	20	CH 155	19
CH 48	20		CH 151	20		
CH 149	20		CH 159	20		
CH 157	20					
CH 165	20					

BT LE	
CH00	Default
CH19	Default
CH39	Default

Zigbee	
CH11	32
CH18	32
CH26	32

6. 2.4GHz, 5GHz, BT LE and Zigbee technology can transmit at same time.
7. Spurious emission of the simultaneous operation (2.4GHz, 5GHz, BT LE and Zigbee) has been evaluated and no non-compliance was found.

3.2 Description of Test Modes

For 2.4GHz

11 channels are provided for 802.11b, 802.11g and 802.11n (HT20):

Channel	Frequency	Channel	Frequency
1	2412MHz	7	2442MHz
2	2417MHz	8	2447MHz
3	2422MHz	9	2452MHz
4	2427MHz	10	2457MHz
5	2432MHz	11	2462MHz
6	2437MHz		

7 channels are provided for 802.11n (HT40):

Channel	Frequency	Channel	Frequency
3	2422MHz	7	2442MHz
4	2427MHz	8	2447MHz
5	2432MHz	9	2452MHz
6	2437MHz		

For 5180 ~ 5240MHz

4 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
36	5180 MHz	44	5220 MHz
40	5200 MHz	48	5240 MHz

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
42	5210MHz

For 5745 ~ 5825MHz:

5 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
149	5745MHz	161	5805MHz
153	5765MHz	165	5825MHz
157	5785MHz		

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
151	5755MHz	159	5795MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
155	5775MHz

For Bluetooth LE:

40 channels are provided to this EUT:

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

For Zigbee

16 channels are provided to this EUT:

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
11	2405	15	2425	19	2445	23	2465
12	2410	16	2430	20	2450	24	2470
13	2415	17	2435	21	2455	25	2475
14	2420	18	2440	22	2460	26	2480

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO			DESCRIPTION
	RE $\geq$ 1G	RE<1G	PLC	
-	√	√	√	-

Where **RE $\geq$ 1G**: Radiated Emission above 1GHz & Bandedge Measurement
RE<1G: Radiated Emission below 1GHz
PLC: Power Line Conducted Emission

Note: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Z-plane**.

Radiated Emission Test (Above 1GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	FREQ. RANGE (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY
-	802.11b + 802.11n (HT20) + BT LE	2412 ~ 2462	1 to 11	1 + 40 + 0	DBPSK
		5180 ~ 5240	36 to 48		BPSK
		5745 ~ 5825	149 to 165		BPSK
		2402 ~ 2480	0 to 39		GFSK
-	802.11b + 802.11n (HT20) + Zigbee	2412 ~ 2462	1 to 11	1 + 40 + 26	DBPSK
		5180 ~ 5240	36 to 48		BPSK
		5745 ~ 5825	149 to 165		BPSK
		2405 ~ 2480	11 to 26		O-QPSK

Radiated Emission Test (Below 1GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	FREQ. RANGE (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY
-	802.11b + 802.11n (HT20) + BT LE	2412 ~ 2462	1 to 11	1 + 40 + 0	DBPSK
		5180 ~ 5240	36 to 48		BPSK
		5745 ~ 5825	149 to 165		BPSK
		2402 ~ 2480	0 to 39		GFSK
-	802.11b + 802.11n (HT20) + Zigbee	2412 ~ 2462	1 to 11	1 + 40 + 26	DBPSK
		5180 ~ 5240	36 to 48		BPSK
		5745 ~ 5825	149 to 165		BPSK
		2405 ~ 2480	11 to 26		O-QPSK

Power Line Conducted Emission Test:

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	FREQ. RANGE (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY
-	802.11b + 802.11n (HT20) + BT LE	2412 ~ 2462	1 to 11	1 + 40 + 0	DBPSK
		5180 ~ 5240	36 to 48		BPSK
		5745 ~ 5825	149 to 165		BPSK
		2402 ~ 2480	0 to 39		GFSK
-	802.11b + 802.11n (HT20) + Zigbee	2412 ~ 2462	1 to 11	1 + 40 + 26	DBPSK
		5180 ~ 5240	36 to 48		BPSK
		5745 ~ 5825	149 to 165		BPSK
		2405 ~ 2480	11 to 26		O-QPSK

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (POE)	TESTED BY
RE $\geq$ 1G	18deg. C, 70%RH	54Vdc	James Yang
RE<1G	18deg. C, 70%RH	54Vdc	James Yang
PLC	20deg. C, 60%RH	54Vdc	Jones Chang

3.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

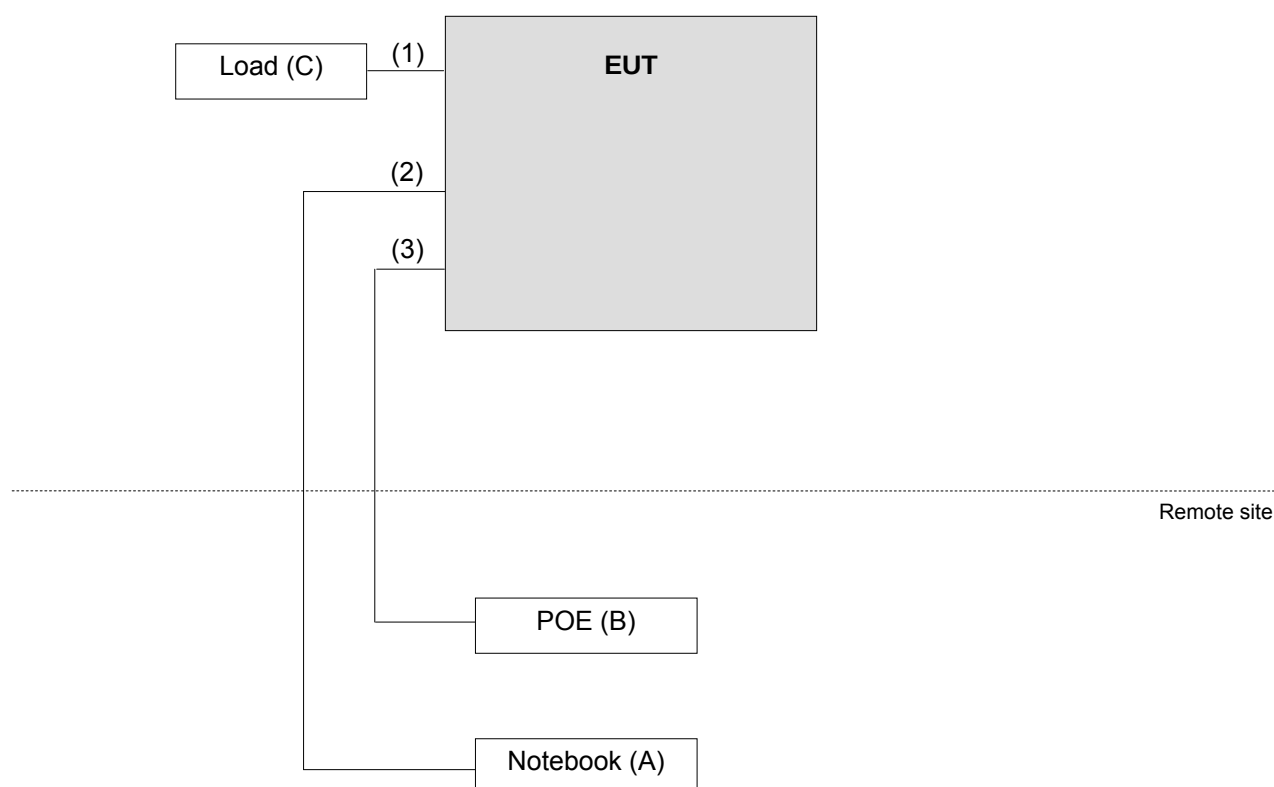
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook	DELL	E5410	1HC2XM1	FCC DoC Approved	-
B.	POE	SENAO	EPA5006GP	N/A	N/A	Provided by manufacturer
C.	Load	N/A	N/A	N/A	N/A	-

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item A acted as communication partner to transfer data.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	RJ45 Cable	4	1.8	N	0	Cat5e
2.	RJ45 Cable	1	3	N	0	Cat5e
3.	RJ45 Cable	1	3	N	0	Cat5e

3.3.1 Configuration of System under Test



3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specification of the EUT declared by the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C (15.247)

FCC Part 15, Subpart E (15.407)

ANSI C63.10-2013

All test items have been performed and recorded as per the above standards.

Note: The EUT is also considered as a kind of computer peripheral, because the connection to computer is necessary for typical use. It has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC). The test report has been issued separately.

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

Frequencies (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:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

Limits of unwanted emission out of the restricted bands

Applicable To			Limit	
789033 D02 General UNII Test Procedure New Rules v01r03			Field Strength at 3m	
			PK:74 (dBµV/m)	AV:54 (dBµV/m)
Frequency Band	Applicable To		EIRP Limit	Equivalent Field Strength at 3m
5150~5250 MHz	15.407(b)(1)		PK:-27 (dBm/MHz)	PK:68.2(dBµV/m)
5250~5350 MHz	15.407(b)(2)			
5470~5725 MHz	15.407(b)(3)			
5725~5850 MHz	☒	15.407(b)(4)(i)	PK:-27 (dBm/MHz) ^{*1} PK:10 (dBm/MHz) ^{*2} PK:15.6 (dBm/MHz) ^{*3} PK:27 (dBm/MHz) ^{*4}	PK: 68.2(dBµV/m) ^{*1} PK:105.2 (dBµV/m) ^{*2} PK: 110.8(dBµV/m) ^{*3} PK:122.2 (dBµV/m) ^{*4}
	☐	15.407(b)(4)(ii)	Emission limits in section 15.247(d)	
^{*1} beyond 75 MHz or more above of the band edge.			^{*2} below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above.	
^{*3} below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above.			^{*4} from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.	

Note: The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

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

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESIB7	100187	Apr. 18, 2016	Apr. 17, 2017
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100041	Sep. 02, 2015	Sep. 01, 2016
BILOG Antenna SCHWARZBECK	VULB9168	9168-171	Jan. 07, 2016	Jan. 06, 2017
HORN Antenna SCHWARZBECK	9120D	209	Jan. 20, 2016	Jan. 19, 2017
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Jan. 18, 2016	Jan. 17, 2017
Preamplifier Agilent	8447D	2944A10738	Aug. 22, 2016	Aug. 21, 2017
Preamplifier Agilent	8449B	3008A01964	Aug. 22, 2016	Aug. 21, 2017
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH3-03 (214378)	Aug. 22, 2016	Aug. 21, 2017
RF signal cable HUBER+SUHNER	SUCOFLEX 106	Cable-CH3-03 (309224+12738)	Aug. 22, 2016	Aug. 21, 2017
Software BV ADT	ADT_Radiated_ V7.6.15.9.4	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	013303	NA	NA
Antenna Tower Controller BV ADT	AT100	AT93021702	NA	NA
Turn Table BV ADT	TT100	TT93021702	NA	NA
Turn Table Controller BV ADT	SC100	SC93021702	NA	NA
26GHz ~ 40GHz Amplifier	EM26400	815221	Oct. 18, 2015	Oct. 17, 2016

- Note:
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. The test was performed in HwaYa Chamber 3.
 3. The horn antenna and preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
 4. The FCC Site Registration No. is 988962.
 5. The IC Site Registration No. is IC 7450F-3.

4.1.3 Test Procedures

- a. The EUT was placed on the top of a rotating table 0.8 meters (for below 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

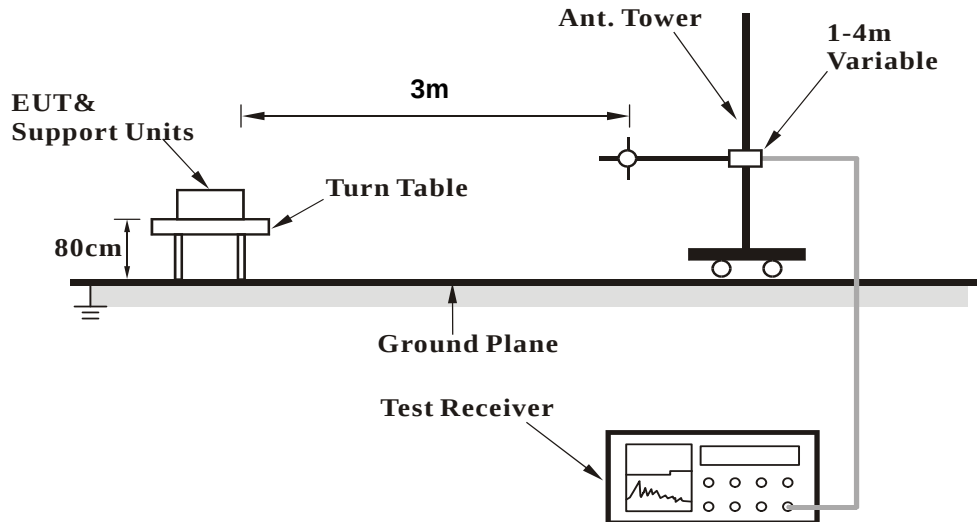
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average (Duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor ($10 \log(1/\text{duty cycle})$).
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

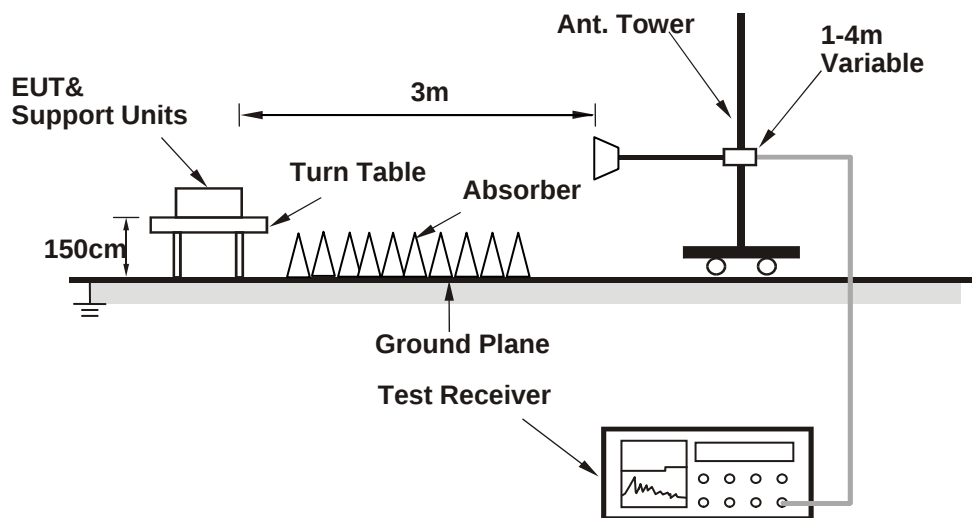
No deviation.

4.1.5 Test Setup

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



For the actual test configuration, please refer to the attached file (Test Setup Photo)

4.1.6 EUT Operating Conditions

- Placed the EUT on the testing table.
- Prepared a notebook to act as a communication partner and placed it outside of testing area.
- The communication partner connected with EUT via a RJ45 cable and ran a test program (provided by manufacturer) to enable EUT under transmission condition continuously at specific channel frequency.
- The communication partner sent data to EUT by command "PING".

4.1.7 Test Results

Above 1GHz Data:

802.11b + 802.11n (HT20) + BT LE

CHANNEL	CH 1 + CH 40 + CH 0	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	61.5 PK	74.0	-12.5	1.48 H	133	30.6	30.9
2	2390.00	50.8 AV	54.0	-3.2	1.48 H	133	19.9	30.9
3	*2402.00	98.2 PK			1.15 H	302	67.2	31.0
4	*2402.00	96.1 AV			1.15 H	302	65.1	31.0
5	*2412.00	113.5 PK			1.87 H	33	82.4	31.1
6	*2412.00	109.2 AV			1.87 H	33	78.1	31.1
7	2788.50	46.5 PK	74.0	-27.5	2.51 H	95	47.0	-0.5
8	2788.50	34.9 AV	54.0	-19.1	2.51 H	95	35.4	-0.5
9	4804.00	58.6 PK	74.0	-15.4	2.05 H	344	54.2	4.4
10	4804.00	41.6 AV	54.0	-12.4	2.05 H	344	37.2	4.4
11	4824.00	50.8 PK	74.0	-23.2	1.18 H	102	46.3	4.5
12	4824.00	39.8 AV	54.0	-14.2	1.18 H	102	35.3	4.5
13	*5200.00	119.3 PK			1.98 H	355	80.6	38.7
14	*5200.00	108.5 AV			1.98 H	355	69.8	38.7
15	#7206.00	57.9 PK	74.0	-16.1	1.95 H	310	46.1	11.8
16	#7206.00	49.2 AV	54.0	-4.8	1.95 H	310	37.4	11.8
17	#10400.00	61.5 PK	74.0	-12.5	2.35 H	179	43.9	17.6
18	#10400.00	48.2 AV	54.0	-5.8	2.35 H	179	30.6	17.6

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

CHANNEL	CH 1 + CH 40 + CH 0	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	62.9 PK	74.0	-11.1	1.98 V	15	32.0	30.9
2	2390.00	52.7 AV	54.0	-1.3	1.98 V	15	21.8	30.9
3	*2402.00	89.2 PK				301	58.2	31.0
4	*2402.00	85.1 AV				301	54.1	31.0
5	*2412.00	116.8 PK			1.94 V	14	85.7	31.1
6	*2412.00	112.6 AV			1.94 V	14	81.5	31.1
7	2887.50	55.1 PK	74.0	-18.9	2.30 V	6	55.6	-0.5
8	2887.50	41.6 AV	54.0	-12.4	2.30 V	6	42.1	-0.5
9	4804.00	47.8 PK	74.0	-26.2	1.88 V	354	43.4	4.4
10	4804.00	36.5 AV	54.0	-17.5	1.88 V	354	32.1	4.4
11	4824.00	41.3 PK	74.0	-32.7	1.98 V	288	36.8	4.5
12	4824.00	31.2 AV	54.0	-22.8	1.98 V	288	26.7	4.5
13	*5200.00	117.8 PK			3.20 V	325	79.1	38.7
14	*5200.00	107.2 AV			3.20 V	325	68.5	38.7
15	#7206.00	56.3 PK	74.0	-17.7	2.00 V	344	44.5	11.8
16	#7206.00	43.8 AV	54.0	-10.2	2.00 V	344	32.0	11.8
17	#10400.00	61.5 PK	74.0	-12.5	2.15 V	330	43.9	17.6
18	#10400.00	48.6 AV	54.0	-5.4	2.15 V	330	31.0	17.6

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

802.11b + 802.11n (HT20) + Zigbee

CHANNEL	CH 1 + CH 40 + CH 26	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	60.2 PK	74.0	-13.8	1.52 H	131	29.3	30.9
2	2390.00	49.6 AV	54.0	-4.4	1.52 H	131	18.7	30.9
3	*2412.00	113.1 PK			1.88 H	31	82.0	31.1
4	*2412.00	109.7 AV			1.88 H	31	78.6	31.1
5	*2480.00	97.1 PK	74.0	23.1	1.66 H	316	65.8	31.3
6	*2480.00	92.8 AV	54.0	38.8	1.66 H	316	61.5	31.3
7	2483.50	65.1 PK	74.0	-8.9	1.58 H	321	33.8	31.3
8	2483.50	53.0 AV	54.0	-1.0	1.58 H	321	21.7	31.3
9	2789.60	47.8 PK	74.0	-26.2	2.73 H	117	48.2	-0.4
10	2789.60	35.2 AV	54.0	-18.8	2.73 H	117	35.6	-0.4
11	4824.00	50.1 PK	74.0	-23.9	1.19 H	100	45.6	4.5
12	4824.00	39.9 AV	54.0	-14.1	1.19 H	100	35.4	4.5
13	4960.00	50.4 PK	74.0	-23.6	2.41 H	330	45.7	4.7
14	4960.00	39.1 AV	54.0	-14.9	2.41 H	330	34.4	4.7
15	*5200.00	119.3 PK			2.00 H	1	80.6	38.7
16	*5200.00	108.5 AV			2.00 H	1	69.8	38.7
17	7440.00	58.1 PK	74.0	-15.9	2.45 H	315	45.7	12.4
18	7440.00	46.2 AV	54.0	-7.8	2.45 H	315	33.8	12.4
19	#10400.00	61.1 PK	74.0	-12.9	2.35 H	181	43.5	17.6
20	#10400.00	48.2 AV	54.0	-5.8	2.35 H	181	30.6	17.6

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

CHANNEL	CH 1 + CH 40 + CH 26	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	62.9 PK	74.0	-11.1	1.48 V	130	32.0	30.9
2	2390.00	52.9 AV	54.0	-1.1	1.48 V	130	22.0	30.9
3	*2412.00	116.8 PK			1.98 V	330	85.7	31.1
4	*2412.00	112.3 AV			1.98 V	330	81.2	31.1
5	*2480.00	89.7 PK			3.20 V	322	58.4	31.3
6	*2480.00	85.2 AV			3.20 V	322	53.9	31.3
7	2483.50	60.8 PK	74.0	-13.2	3.15 V	324	29.5	31.3
8	2483.50	47.4 AV	54.0	-6.6	3.15 V	324	16.1	31.3
9	2789.60	52.7 PK	74.0	-21.3	1.56 V	8	53.1	-0.4
10	2789.60	40.8 AV	54.0	-13.2	1.56 V	8	41.2	-0.4
11	4824.00	41.5 PK	74.0	-32.5	1.94 V	289	37.0	4.5
12	4824.00	31.8 AV	54.0	-22.2	1.94 V	289	27.3	4.5
13	4960.00	46.0 PK	74.0	-28.0	2.87 V	336	41.3	4.7
14	4960.00	33.5 AV	54.0	-20.5	2.87 V	336	28.8	4.7
15	*5200.00	117.8 PK			3.15 V	330	79.1	38.7
16	*5200.00	107.2 AV			3.15 V	330	68.5	38.7
17	7440.00	58.6 PK	74.0	-15.4	3.31 V	341	46.2	12.4
18	7440.00	46.1 AV	54.0	-7.9	3.31 V	341	33.7	12.4
19	#10400.00	61.2 PK	74.0	-12.8	2.01 V	302	43.6	17.6
20	#10400.00	48.7 AV	54.0	-5.3	2.01 V	302	31.1	17.6

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

Below 1GHz data

802.11b + 802.11n (HT20) + BT LE

CHANNEL	CH 1 + CH 40 + CH 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	43.51	28.8 QP	40.0	-11.2	1.50 H	58	43.6	-14.8
2	111.56	33.5 QP	43.5	-10.0	1.50 H	69	50.6	-17.1
3	158.22	29.7 QP	43.5	-13.8	1.50 H	233	43.4	-13.7
4	348.76	28.9 QP	46.0	-17.1	1.01 H	200	40.2	-11.3
5	438.20	31.2 QP	46.0	-14.8	1.50 H	191	40.2	-9.0
6	933.99	31.5 QP	46.0	-14.5	1.01 H	214	30.0	1.5
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	43.52	38.5 QP	40.0	-1.5	1.50 V	280	53.3	-14.8
2	68.79	34.6 QP	40.0	-5.4	1.00 V	136	50.8	-16.2
3	140.72	30.0 QP	43.5	-13.5	1.00 V	287	44.5	-14.5
4	432.37	30.8 QP	46.0	-15.2	1.00 V	142	39.9	-9.1
5	585.97	34.1 QP	46.0	-11.9	1.00 V	339	39.9	-5.8
6	918.44	31.7 QP	46.0	-14.3	1.00 V	143	30.5	1.2

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

802.11b + 802.11n (HT20) + Zigbee

CHANNEL	CH 1 + CH 40 + CH 26	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	43.51	28.7 QP	40.0	-11.3	1.49 H	74	43.5	-14.8
2	111.56	32.4 QP	43.5	-11.1	1.49 H	52	49.5	-17.1
3	214.61	26.4 QP	43.5	-17.1	1.00 H	66	42.4	-16.0
4	366.26	32.6 QP	46.0	-13.4	1.00 H	103	43.4	-10.8
5	578.19	30.9 QP	46.0	-15.1	1.49 H	4	37.1	-6.2
6	932.05	30.8 QP	46.0	-15.2	1.00 H	239	29.4	1.4
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	43.52	39.5 QP	40.0	-0.5	1.00 V	276	54.3	-14.8
2	177.67	29.1 QP	43.5	-14.4	1.00 V	296	43.9	-14.8
3	288.49	22.4 QP	46.0	-23.6	1.49 V	196	34.8	-12.4
4	426.53	31.6 QP	46.0	-14.4	1.00 V	118	40.8	-9.2
5	578.19	36.5 QP	46.0	-9.5	1.00 V	325	42.7	-6.2
6	797.89	32.2 QP	46.0	-13.8	1.49 V	41	33.7	-1.5

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCS30	100289	Dec. 23, 2015	Dec. 22, 2016
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond2-01	Dec. 26, 2015	Dec. 25, 2016
LISN ROHDE & SCHWARZ (EUT)	ESH2-Z5	100100	Jan. 11, 2016	Jan. 10, 2017
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100312	Jul. 26, 2016	Jul. 25, 2017
Software ADT	BV ADT_Cond_ V7.3.7.3	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The test was performed in HwaYa Shielded Room 2.

3. The VCCI Site Registration No. is C-2047.

4.2.3 Test Procedures

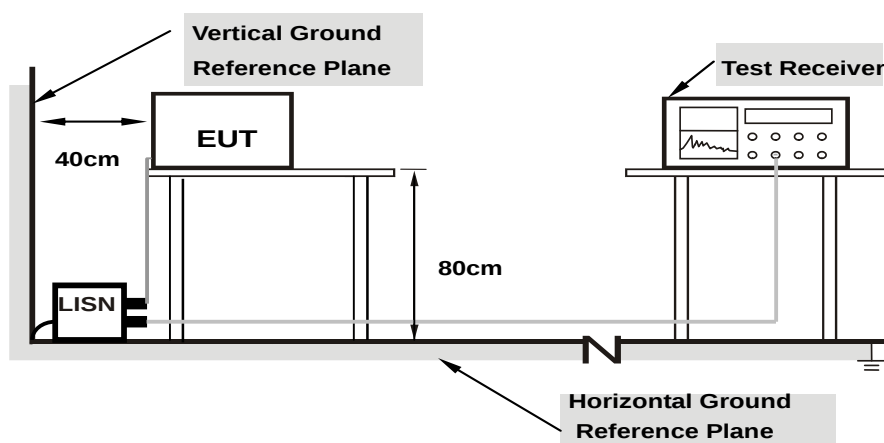
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) were not recorded.

NOTE: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.2.6 EUT Operating Conditions

Same as 4.1.6.

4.2.7 Test Results

802.11b + 802.11n (HT20) + BT LE

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	CH 1 + CH 40 + CH 0		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.12	35.57	21.02	45.69	31.14	66.00	56.00	-20.31	-24.86
2	0.17344	10.14	30.31	16.97	40.45	27.11	64.79	54.79	-24.34	-27.68
3	0.45859	10.19	32.33	27.07	42.52	37.26	56.72	46.72	-14.20	-9.46
4	0.68906	10.20	20.62	15.73	30.82	25.93	56.00	46.00	-25.18	-20.07
5	0.96641	10.22	27.03	26.68	37.25	36.90	56.00	46.00	-18.75	-9.10
6	25.72266	10.50	30.03	28.69	40.53	39.19	60.00	50.00	-19.47	-10.81

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

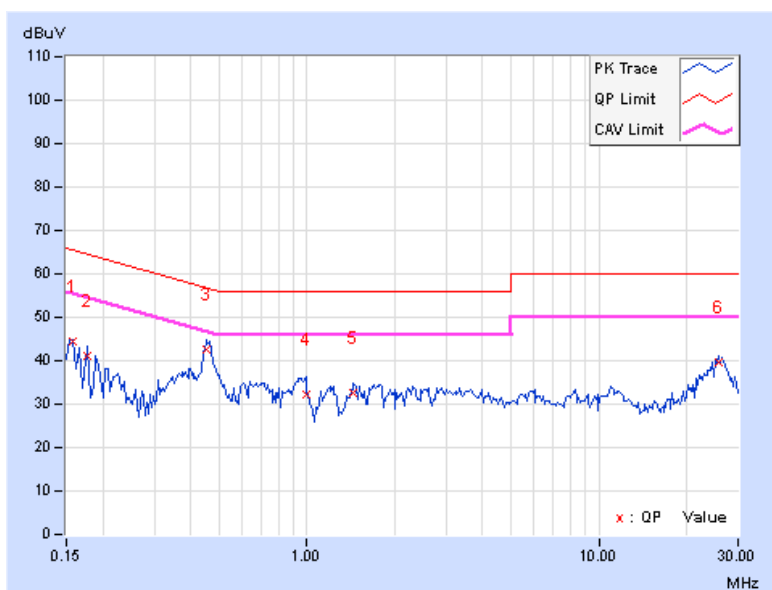


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	CH 1 + CH 40 + CH 0		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15781	10.13	34.22	21.41	44.35	31.54	65.58	55.58	-21.23	-24.04
2	0.17734	10.15	30.92	18.38	41.07	28.53	64.61	54.61	-23.54	-26.08
3	0.45469	10.19	32.37	26.74	42.56	36.93	56.79	46.79	-14.23	-9.86
4	0.98984	10.21	22.09	17.66	32.30	27.87	56.00	46.00	-23.70	-18.13
5	1.44531	10.25	22.35	19.04	32.60	29.29	56.00	46.00	-23.40	-16.71
6	25.71875	10.64	28.99	26.53	39.63	37.17	60.00	50.00	-20.37	-12.83

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



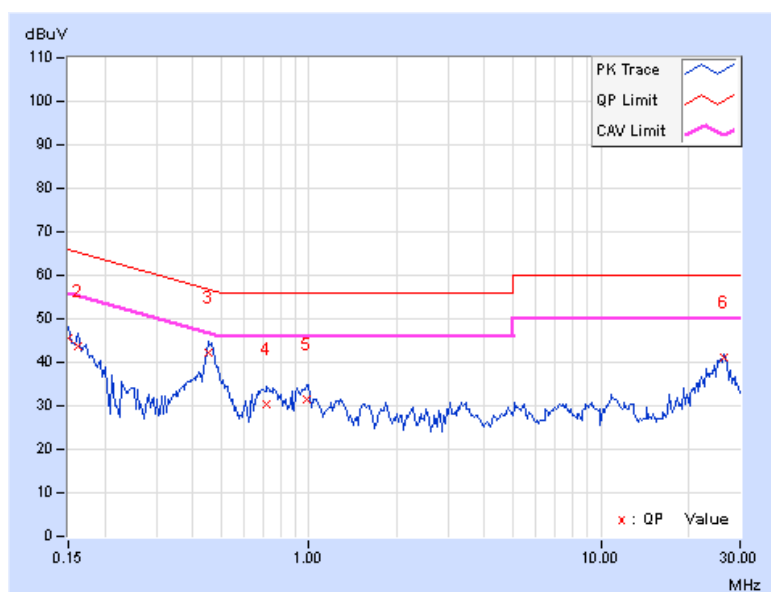
802.11b + 802.11n (HT20) + Zigbee

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	CH 1 + CH 40 + CH 26		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.12	35.45	20.72	45.57	30.84	66.00	56.00	-20.43	-25.16
2	0.16172	10.13	33.64	18.87	43.77	29.00	65.38	55.38	-21.61	-26.38
3	0.45469	10.19	31.88	26.29	42.07	36.48	56.79	46.79	-14.72	-10.31
4	0.72031	10.21	20.18	15.95	30.39	26.16	56.00	46.00	-25.61	-19.84
5	0.98203	10.22	21.13	17.03	31.35	27.25	56.00	46.00	-24.65	-18.75
6	26.46875	10.48	30.58	29.74	41.06	40.22	60.00	50.00	-18.94	-9.78

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

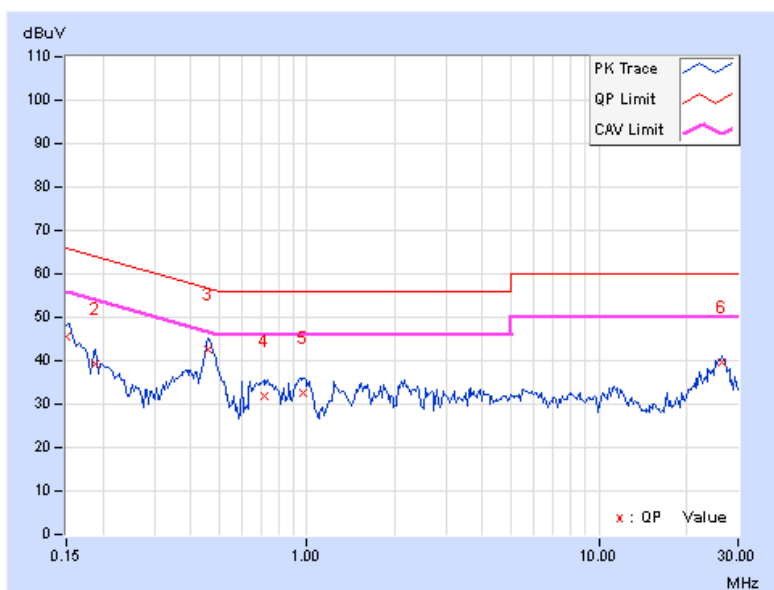


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	CH 1 + CH 40 + CH 26		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.13	35.27	21.73	45.40	31.86	66.00	56.00	-20.60	-24.14
2	0.18906	10.15	28.95	16.60	39.10	26.75	64.08	54.08	-24.98	-27.33
3	0.45859	10.19	32.47	27.38	42.66	37.57	56.72	46.72	-14.06	-9.15
4	0.71250	10.20	21.59	17.29	31.79	27.49	56.00	46.00	-24.21	-18.51
5	0.97422	10.21	22.29	18.33	32.50	28.54	56.00	46.00	-23.50	-17.46
6	26.46875	10.62	29.14	28.31	39.76	38.93	60.00	50.00	-20.24	-11.07

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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The address and road map of all our labs can be found in our web site also.

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