EMC TEST REPORT
No. SH11100532-001

Applicant	:	Shanghai Aero-Sharp Electric Technologies Co.,Ltd 6629 Zhongchun Road Shanghai, 201101 China
Manufacturer	:	Shanghai Aero-Sharp Electric Technologies Co.,Ltd 6629 Zhongchun Road Shanghai, 201101 China
Equipment	:	802.11g Wireless MiniPCI Card
Type/Model	:	COM06

SUMMARY

The equipment complies with the requirements according to the following standard(s):

47CFR Part 15 (2010): Radio Frequency Devices

ANSIC63.4 (2003): American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

RSS-210 Issue 8 (December 2010): Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment

RSS-Gen Issue 3 (December 2010): General Requirements and Information for the Certification of Radiocommunication Equipment

Date of issue: April 13, 2012

Prepared by:

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Reviewed by:

Daniel Zhao (*Reviewer*)

Description of Test Facility

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IC Assigned Code: 2042B-1

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Content

1. General Information

1.1 Applicant Information

Applicant:	Shanghai Aero-Sharp Electric Technologies Co.,Ltd 6629 Zhongchun Road Shanghai, 201101 China
Name of contact:	Fang Lu
Tel:	86-21-64781799
Fax:	86-21-64781799
Manufacturer:	Shanghai Aero-Sharp Electric Technologies Co.,Ltd 6629 Zhongchun Road Shanghai, 201101 China
Sample received date:	Nov 1, 2011
Sample Identification No:	*0111101-10-001*
Date of test:	Nov 1, 2011 ~ Nov 15, 2011

1.2 Identification of the EUT

Equipment:	802.11g Wireless MiniPCI Card
Type/model:	COM06
FCC ID:	Z2TCOM06
IC:	/

1.3 Technical specification

Operation Frequency Band: 2412 - 2462 MHz

Modulation: DBPSK @1Mbps
DQPSK@2Mbp
CCK@5.5/11Mbps
BPSK@6/9 Mbps
QPSK@12/18Mbps
16-QAM@24Mbps
64-QAM@48/54Mpb

Antenna Designation: External, Omni-directional antenna

Gain of Antenna: 2.0dBi max used.

Rating: DC 3.3V powered by debugging board & PC
(PC input: AC 100~240V, 50/60Hz).

Description of EUT: The EUT is the wireless transceiver.
There are two antenna connectors, namely J2 and J3, designed on the EUT. Nevertheless, only the connector J2 was available (connector J3 was disabled by the manufactory) and connected to a professional waterproof antenna.

Channel Description:

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

1.4 Mode of operation during the test / Test peripherals used

While testing transmitter mode of EUT, the internal modulation was employed.
EUT was set up and tested in three axes (X, Y and Z). The three axes were tested one by one while the test receiver worked as “max hold” continuously and the highest reading among the whole test procedure was recorded.
Test peripherals used: Laptop computer (FUJITSU SIMENS, LIFEBOOK)

2. Test Specification

2.1 Instrument list

Equipment	Type	Manu.	Internal no.	Cal. Date	Due date
Test Receiver	ESIB 26	R&S	EC 3045	2011-10-21	2012-10-20
Semi-anechoic chamber	-	Albatross project	EC 3048	2011-5-21	2012-5-20
Bilog Antenna	CBL 6112D	TESEQ	EC 4206	2011-5-16	2013-5-15
Horn antenna	HF 906	R&S	EC 3049	2011-5-13	2013-5-12
Pre-amplifier	Pre-amp 18	R&S	EC 3222	2011-4-12	2012-4-11
Test Receiver	ESCS 30	R&S	EC 2107	2011-10-21	2012-10-20
A.M.N.	ESH2-Z5	R&S	EC 3119	2011-1-10	2012-1-9
A.M.N.	ESH3-Z5	R&S	EC 2109	2011-1-10	2012-1-9
High Pass Filter	WHKX 1.0/15G-10SS	Wainwright	EC4297-1	2011-2-8	2012-2-7
High Pass Filter	WHKX 2.8/18G-12SS	Wainwright	EC4297-2	2011-2-8	2012-2-7
High Pass Filter	WHKX 7.0/1.8G-8SS	Wainwright	EC4297-3	2011-2-8	2012-2-7
Band Reject Filter	WRCGV 2400/2483-2390/2493-35/10SS	Wainwright	EC4297-4	2011-2-8	2012-2-7
Test Receiver	FSV40	R&S	/	2011-10-21	2012-10-20
Preamplifier	AP-025C	Quietek	QT-AP003	2011-11-25	2012-11-24
Preamplifier	AP-180C	Quietek	CHM-0602013	2011-11-25	2012-11-24
Broad-Band Horn Antenna	BBHA9120D	Schwarzbeck	496	2011-11-25	2012-11-24
Broad-Band Horn Antenna	BBHA9170	Schwarzbeck	294	2011-11-25	2012-11-24
Power sensor / Power meter	N1911A/N1921A	Agilent	EC4318	2011-04-11	2012-04-10

2.2 Test Standard

47CFR Part 15 (2010)
ANSIC63.4 (2003)
RSS-210 Issue 8 (December 2010)
RSS-Gen Issue 3 (December 2010)

2.3 Test Summary

This report applies to tested sample only. This report shall not be reproduced in part without written approval of Intertek Testing Service Shanghai Limited.

TEST ITEM	FCC REFERANCE	IC REFERANCE	RESULT
Minimum 6dB Bandwidth	15.247(a)(2)	RSS-210 Issue 8 Annex 8	Pass
Maximum peak output power	15.247(b)	RSS-210 Issue 8 Annex 8	Pass
Power spectrum density	15.247(e)	RSS-210 Issue 8 Annex 8	Pass
Radiated emission	15.205 & 15.209	RSS-210 Issue 8 Clause 2	Pass
Emission outside the frequency band	15.247(d)	RSS-210 Issue 8 Annex 8	Pass
Power line conducted emission	15.207	RSS-Gen Issue 3 Clause 7.2.4	Pass
Channel number of hopping system	15.247(a)(1)(iii)	RSS-210 Issue 8 Annex 8	NA
Average time of occupancy in any channel	15.247(a)(1)(iii)	RSS-210 Issue 8 Annex 8	NA
Occupied bandwidth	-	RSS-Gen Issue 3 Clause 4.6.1	Tested
Spurious emission for receiver	15B	RSS-310 Issue 3 Clause 3.1	NA

2.4 Data rate VS power

Mode	Data Rate	CH	Level (dBm)
802.11g	MCS0	M	21.51
	MCS1	M	21.09
	MCS2	M	21.37
	MCS3	M	21.48
	MCS4	M	21.62
	MCS5	M	21.56
	MCS6	M	21.69
	MCS7	M	**21.78**
802.11b	MCS0	M	15.26
	MCS1	M	15.37
	MCS2	M	15.39
	MCS3	M	15.33
	MCS4	M	15.51
	MCS5	M	15.60
	MCS6	M	**15.62**

Based on the test data above, in this report, the highest speed is applied for all tests in every mode.

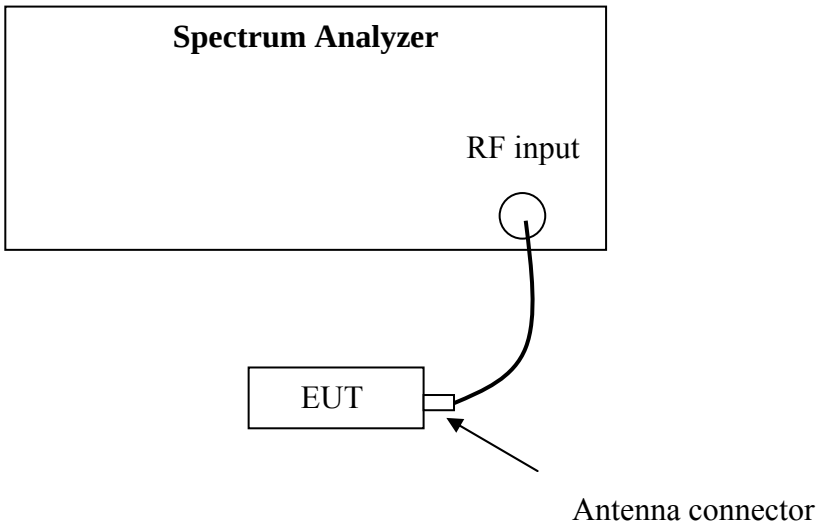
3. Minimum 6dB Bandwidth

Test result: PASS

3.1 Limit

For systems using digital modulation techniques that may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz bands, the minimum 6 dB bandwidth shall be at least 500 kHz.

3.2 Test Configuration



3.3 Test Procedure and test setup

The minimum 6dB bandwidth per FCC §15.247(a)(2) is measured using the Spectrum Analyzer with the resolutions bandwidth set at 100kHz, the video bandwidth set at 300kHz, and the SPAN>>RBW. The test was performed at 3 channels (lowest, middle and highest channel).
The EUT was tested according to DTS test procedure of KDB558074 (March 23, 2005) for compliance to FCC 47CFR 15.247 requirements.

3.4 Test Protocol

Temperature : 25°C

Relative Humidity : 55 %

CH	Bandwidth of 802.11b (MHz)	Bandwidth of 802.11g (MHz)	Limit (MHz)
L	9.48	16.50	⩾0.5
M	9.45	16.49	⩾0.5
H	9.48	16.45	⩾0.5

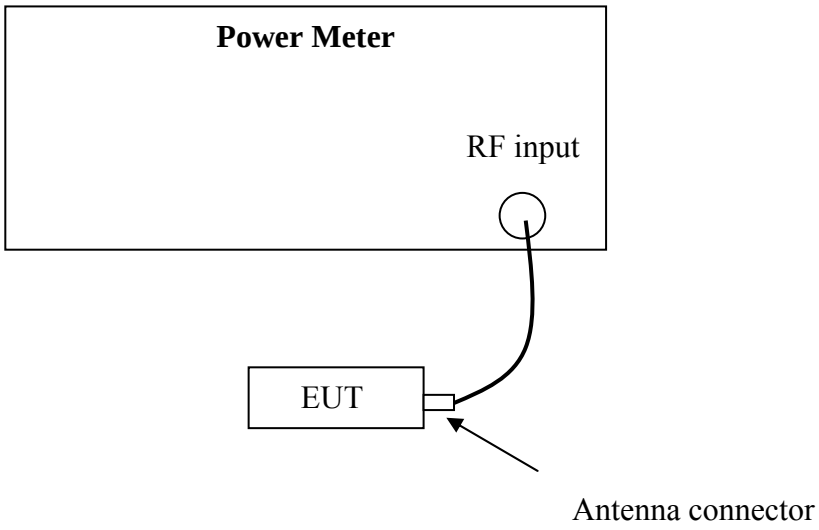
4. Maximum peak output power

Test result: Pass

4.1 Test limit

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt
For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts
If the transmitting antenna of directional gain greater than 6dBi is used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.
For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

4.2 Test Configuration



4.3 Test procedure and test setup

The power output per FCC § 15.247(b) is measured using a broadband power meter.
The EUT was tested according to DTS test procedure of KDB558074 (March 23, 2005) for compliance to FCC 47CFR 15.247 requirements (Power Output Option 1).

4.4 Test protocol

Temperature : 25 °C

Relative Humidity : 55 %

CH	Cable loss (dB)	Power of 802.11b (dBm)	Power of 802.11g (dBm)	Limit (dBm)
L	0.50	16.14	21.75	≤30
M	0.50	15.62	21.78	≤30
H	0.50	16.59	21.88	≤30

The maximum e.i.r.p of 2.4GHz transmitter = 21.88dBm + 2.0dBi = 23.88dBm = 244.34mW (lower than the e.i.r.p limit of 4W showed in RSS-210.).

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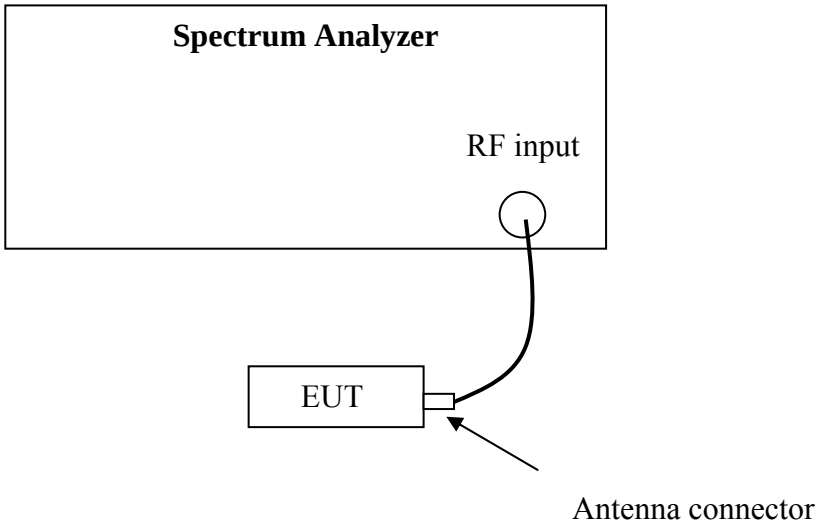
5. Power spectrum density

Test result: **Pass**

5.1 Test limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

5.2 Test Configuration



5.3 Test procedure and test setup

The power output per FCC §15.247(e) was measured using the Spectrum Analyzer with the resolutions bandwidth set at 3kHz, the video bandwidth set at 10kHz. The test was performed at 3 channels (lowest, middle and highest channel).
The EUT was tested according to DTS test procedure of KDB558074 (March 23, 2005) for compliance to FCC 47CFR 15.247 requirements.

5.4 Test Protocol

Temperature : 25 °C
Relative Humidity : 55 %

CH	**Power Density of 802.11b** (dBm/3kHz)	**Power Density of 802.11g** (dBm/3kHz)	**Limit** (dBm/3kHz)
L	-13.15	-16.26	≤8
M	-15.61	-16.15	≤8
H	-16.39	-16.09	≤8

6. Radiated emission

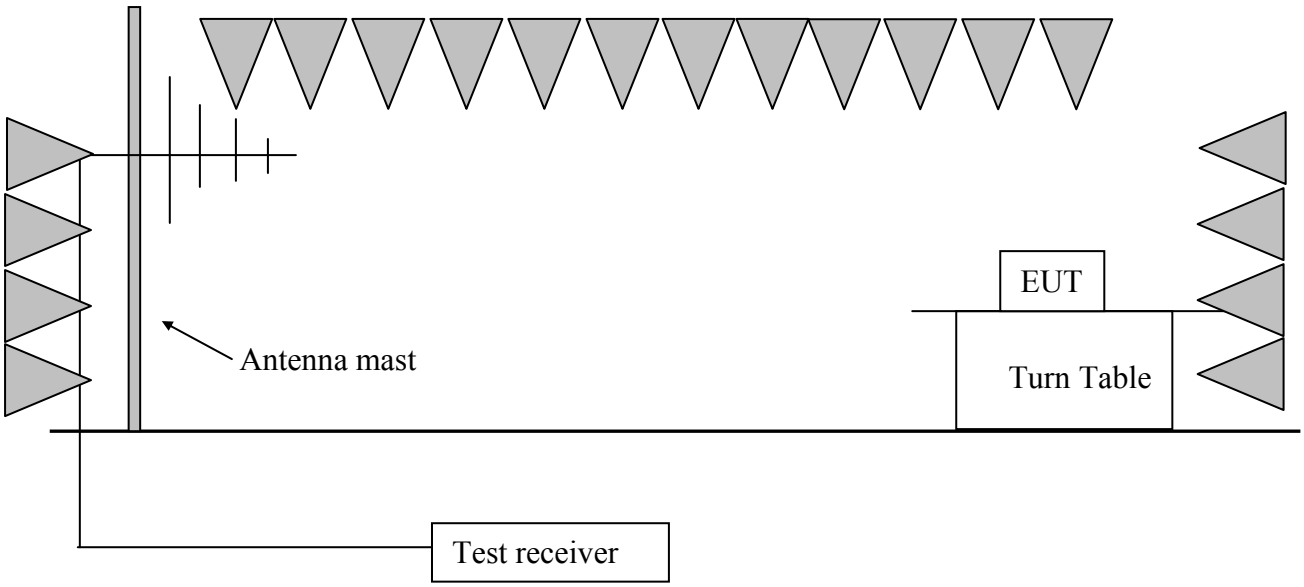
Test result: PASS

6.1 Test limit

The radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) showed as below:

Frequency (MHz)	Field Strength (dBuV/m)	Measurement Distance (m)
30 - 88	40.0	3
88 - 216	43.5	3
216 - 960	46.0	3
Above 960	54.0	3

6.2 Test Configuration



6.3 Test procedure and test setup

The measurement was applied in a semi-anechoic chamber. While testing for spurious emission higher than 1GHz, if applied, the pre-amplifier would be equipped just at the output terminal of the antenna.
The EUT and simulators were placed on a 0.8m high wooden turntable above the horizontal metal ground plane. The turn table rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on an antenna mast. The antenna moved up and down between from 1meter to 4 meters to find out the maximum emission level.
The EUT was tested according to DTS test procedure of KDB558074 (March 23, 2005) for compliance to FCC 47CFR 15.247 requirements.

The radiated emission was measured using the Spectrum Analyzer with the resolutions bandwidth set as:

RBW = 100kHz, VBW = 300kHz (30MHz~1GHz)
RBW = 1MHz, VBW = 3MHz (>1GHz for PK);
RBW = 1MHz, VBW = 10Hz (>1GHz for AV);

6.4 Test protocol

The test is performed under the 80.211g mode which has higher conducted output power:

CH	Antenna	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
L	V	2412.79	30.70	111.60	Fundamental	/	PK
	H	105.81	14.30	43.20	Non-restrict	/	QP
	H	615.11	21.20	42.60	Non-restrict	/	QP
	V	156.75	13.50	31.80	43.50	11.70	PK
	H	282.71	14.30	41.10	46.00	4.90	PK
	H	377.96	17.60	33.90	46.00	12.10	PK
	H	1324.65	-12.10	39.70	54.00	14.30	PK
	V	2390.00	-8.00	51.80	54.00	2.20	PK
	V	4547.09	-2.50	40.30	54.00	13.70	PK
M	V	2438.15	30.70	110.20	Fundamental	/	PK
	H	105.81	14.30	43.20	Non-restrict	/	QP
	H	615.11	21.20	42.60	Non-restrict	/	QP
	V	156.75	13.50	31.80	43.50	11.70	PK
	H	282.71	14.30	41.10	46.00	4.90	PK
	H	377.96	17.60	33.90	46.00	12.10	PK
	H	1323.57	-12.10	40.30	54.00	13.70	PK
	V	4548.16	-2.50	41.60	54.00	12.40	PK
H	V	2463.48	30.70	111.60	Fundamental	/	PK
	H	105.81	14.30	43.20	Non-restrict	/	QP
	H	615.11	21.20	42.60	Non-restrict	/	QP
	V	156.75	13.50	31.80	43.50	11.70	PK
	H	282.71	14.30	41.10	46.00	4.90	PK
	H	377.96	17.60	33.90	46.00	12.10	PK
	H	1324.43	-12.10	39.50	54.00	14.50	PK
	V	2483.50	-8.00	46.60	54.00	7.40	PK
	V	4545.93	-2.50	39.50	54.00	14.50	PK

Remark: 1. For fundamental test, no amplifier is employed.
2. Correct Factor = Antenna Factor + Cable Loss (-Amplifier, is employed)
3. Corrected Reading = Original Receiver Reading + Correct Factor
4. Margin = limit – Corrected Reading
5. If the PK reading is lower than AV limit, the AV test can be elided.
6. The emission test is conducted from 30MHz to 25GHz.

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10dBuV.
Then Correct Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m; Corrected Reading = 10dBuV + 0.20dB/m = 10.20dBuV/m
Assuming limit = 54dBuV/m, Corrected Reading = 10.20dBuV/m, then Margin = 54 -10.20 = 43.80dBuV/m

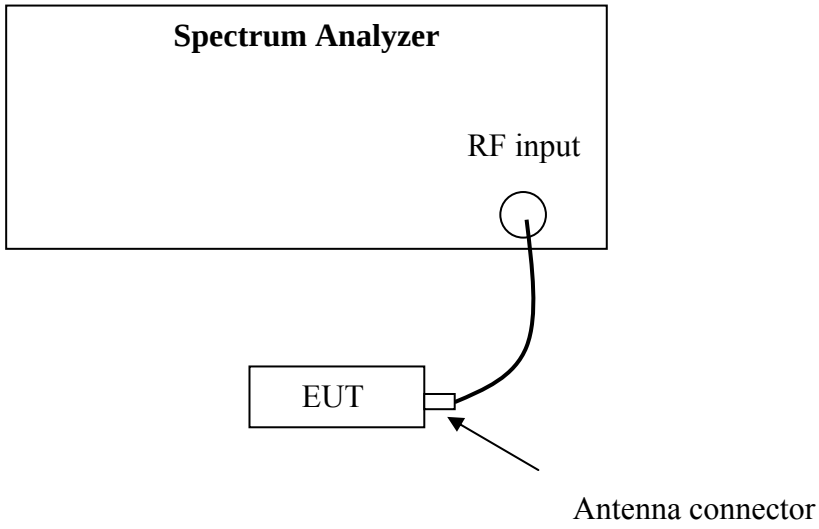
7. Emission outside the frequency Band

Test result: **PASS**

7.1 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

7.2 Test Configuration



7.3 Test procedure and test setup

The Emission outside the frequency Band per FCC §15.247(d) is measured using the Spectrum Analyzer with the resolutions bandwidth set at 100kHz, the video bandwidth set at 300kHz, and the SPAN>>RBW.
The EUT was tested according to DTS test procedure of KDB558074 (March 23, 2005) for compliance to FCC 47CFR 15.247 requirements.

7.4 Test protocol

Mode	CH	Max reading among band (dBm)	Min Attenuation outside band (dB)	Limit (dB)
802.11b	L	-2.00	37.18	≥20
	M	-1.69	42.59	
	H	-2.15	40.90	
802.11g	L	-3.03	33.91	
	M	-3.45	41.45	
	H	-3.18	39.22	

Note: Please refer to the “test data” for band edge emission.

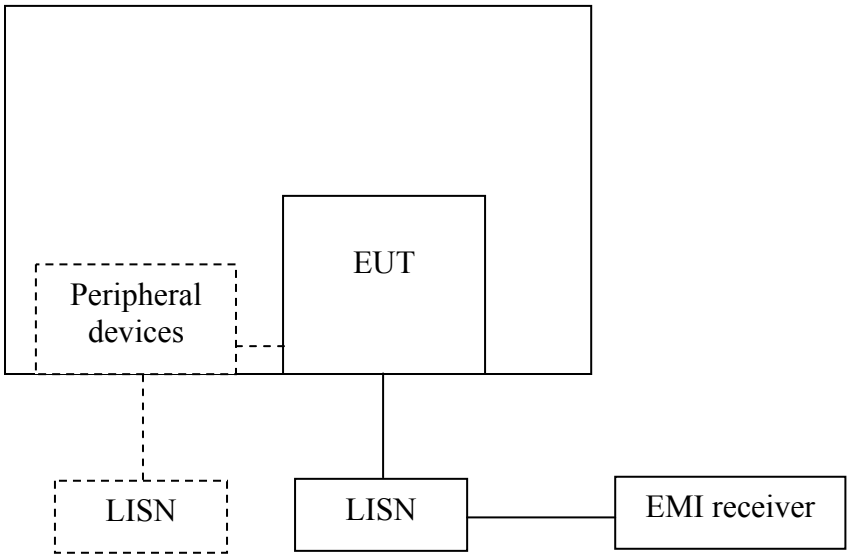
8. Power line conducted emission

Test result: **Pass**

8.1 Limit

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	QP	AV
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.		

8.2 Test configuration



☒ For table top equipment, wooden support is 0.8m height table

☐ For floor standing equipment, wooden support is 0.1m height rack.

8.3 Test procedure and test set up

The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a 50Ω/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50Ω/50uH coupling impedance with 50Ω termination.
Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4 on conducted measurement.
The bandwidth of the test receiver is set at 9 kHz.

8.4 Test protocol

Temperature : 25 °C
Relative Humidity : 55 %

Frequency	Correct Factor (dB)	Corrected Reading (dBuV)		Limit (dBuV)		Margin (dB)	
		QP	AV	QP	AV	QP	AV
0.16 (N)	3.00	40.15	23.10	65.60	55.60	25.45	32.50
0.17 (L)	3.00	49.22	39.27	64.86	54.86	15.64	15.59
0.23 (N)	3.00	44.26	36.26	62.48	52.48	18.22	16.22
0.27 (N)	3.00	33.98	20.66	61.07	51.07	27.09	30.41
3.82 (N)	3.00	35.10	18.54	56.00	46.00	20.90	27.46
4.05 (L)	3.00	33.95	19.07	56.00	46.00	22.05	26.93
Remark: 1. Correction Factor (dB) = LISN Factor (dB) + Cable Loss (dB). 2. Margin (dB) = Limit - Corrected Reading.							

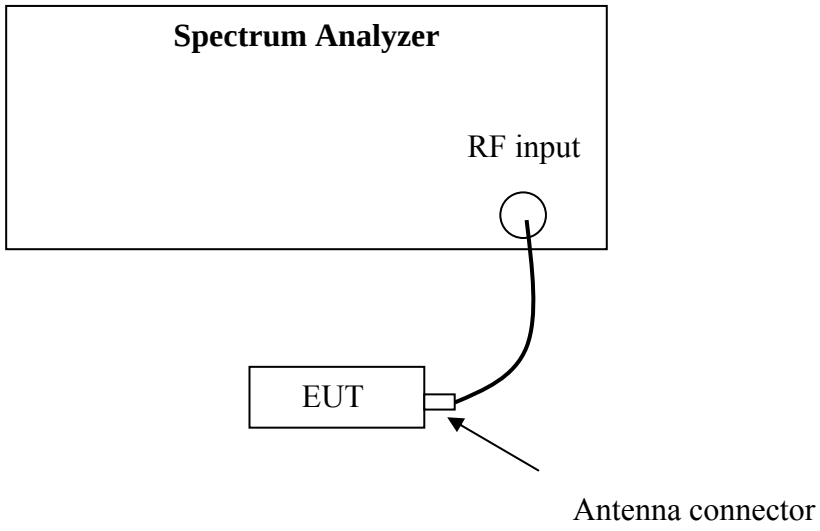
9. Channel Number of hopping system

Test result: **NA**

9.1 Limit

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

9.2 Test Configuration



9.3 Test procedure and test setup

The channel number per FCC §15.247(a)(1)(iii) is measured using the Spectrum Analyzer with the resolutions bandwidth set at 100kHz, the video bandwidth set at 300kHz, and the SPAN>>RBW.
The RF passband of the EUT was divided into 3 appropriate bands to test.

9.4 Test protocol

Channel Number	Limit
-	≥15

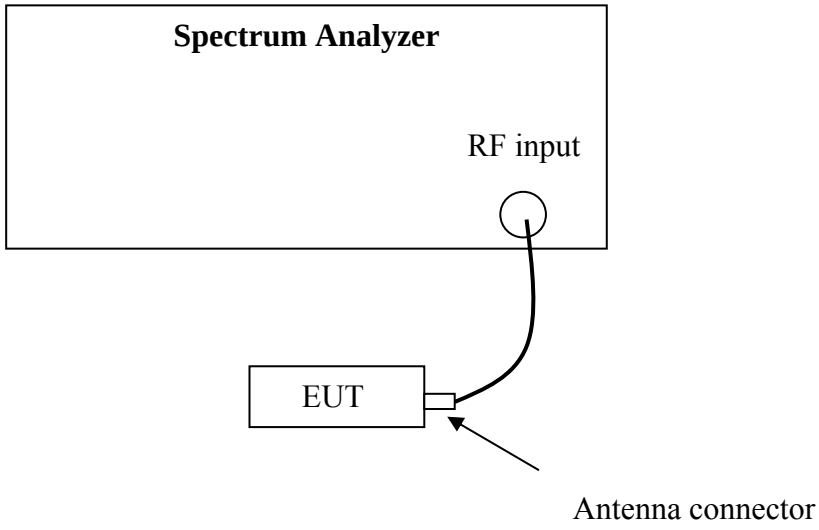
10. Average time of occupancy in any channel

Test result: **NA**

10.1 Limit

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

10.2 Test Configuration



10.3 Test procedure and test setup

Average time of occupancy in any channel per FCC § 15.247(a)(1)(iii)
is measured using the Spectrum Analyzer with the resolutions bandwidth set at 100kHz, the video bandwidth set at 300kHz, and the SPAN set to be 0Hz to test in time domain. The test is performed at the middle channel.

10.4 Test protocol

Packet	Observed period (s) **P**	Time of occupancy for single hopping (ms) **O**	Hops among the interval of 3.6 s **I**	Average time of occupancy (s) **T**	Limit (s)
Packet Type 4	-	-	-	-	≤0.4
Packet Type 11	-	-	-	-	≤0.4
Packet Type 15	-	-	-	-	≤0.4

Remark: 1. There are 79 channels in all. So the observed period P = 0.4 * 79 = 31.6 s.
2. Average time of occupancy **T = O *I * P / 3.6**

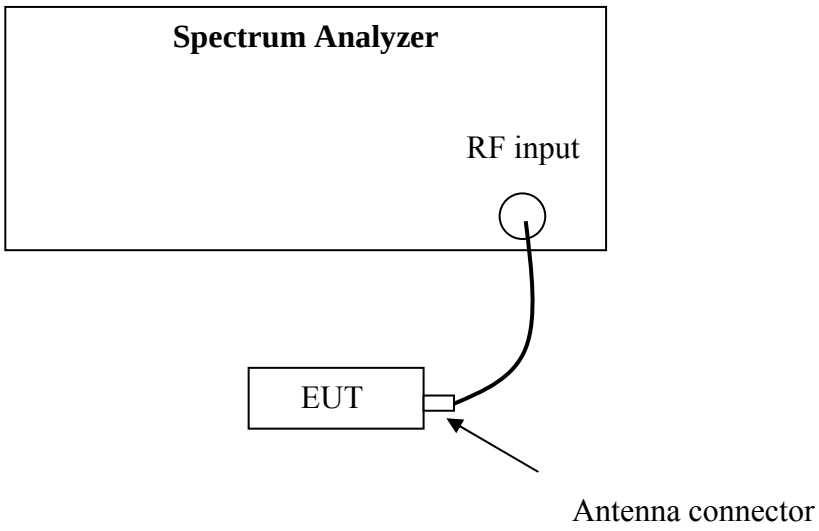
11. Occupied Bandwidth

Test Status: Tested

11.1 Test limit

None

11.2 Test Configuration



11.3 Test procedure and test setup

The occupied bandwidth per RSS-Gen Issue 3 Clause 4.6.1 was measured using the Spectrum Analyzer.

11.4 Test protocol

Temperature : 25 °C
Relative Humidity : 55 %

Mode	Channel	Occupied Bandwidth (MHz)	Max. Value (MHz)
802.11b	L	13.62	16.84
	M	13.62	
	H	13.61	
802.11g	L	16.84	
	M	16.80	
	H	16.79	

Remark: "Max. Value" is the maximum test result of all the measured occupied bandwidth.

12. Spurious emission for receiver

Test result: NA

12.1 Test limit

The spurious emission shall test through 3 times tuneable or local oscillator frequency whichever is the higher, without exceeding 40 GHz.
1) If a conducted measurement is made, no spurious output signals appearing at the antenna terminals shall exceed 2nW per any 4 kHz spurious frequency in the band 30-1000 MHz, or 5nW above 1 GHz.
2) If a radiated measurement is made, all spurious emissions shall comply with the limits of Table below:

Frequency (MHz)	Field Strength (dBuV/m)	Measurement Distance (m)
30 - 88	40.0	3
88 - 216	43.5	3
216 - 960	46.0	3
Above 960	54.0	3

12.2 Test Configuration

Please refer to clause 6.2

12.3 Test procedure and test setup

Please refer to clause 6.3.

12.4 Test protocol

Polarization	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-

Remark: 1. Correct Factor = Antenna Factor + Cable Loss (-Amplifier, is employed)
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = limit – Corrected Reading

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
Original Receiver Reading = 10dBuV.
Then Correct Factor = 30.20 + 2.00 = 32.20dB/m; Corrected Reading = 10dBuV + 32.20dB/m = 42.20dBuV/m
Assuming limit = 54dBuV/m, Corrected Reading = 42.20dBuV/m, then Margin = 54 -42.20 = 11.80dBuV/m