
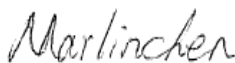




FCC Part15B Test Report

Applicant : Compex Systems Pte Ltd
Product : WIRELESS-BGN 23DBM 2X2 NETWORK MINI PCIE
ADAPTER
Model No. : WLE200N2-23, MMS2N26E, MPS2N26E, MMJ2N26E,
MML2N26E, MPE72N2-23, WPE72N2-23, MMS72N2-23,
MPS72N2-23, MMJ72N2-23
Brand Name : COMPEX
FCC ID : TK4WLE200N2-23
Standards : FCC CFR Title 47 Part 15 Subpart B: 2012 Class B
Test Date : May 26, 2013 ~ Jun 09, 2013

Reviewed By : 
(Engineer: Sunny Sun)
Approved By : 
(Manager: Marlin Chen)

The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standards through the calibration of the equipment and evaluated measurement uncertainty herein.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date
1305RSU00202	Rev. 01	Initial report	2013-06-09
1305RSU00202	Rev. 02	Updated the manufacturer address	2013-06-17
1305RSU00202	Rev. 03	Updated the model no for EUT	2013-06-19

Test Summary

FCC Part Section(s)	Test Description	Test Result (Pass/Fail)	Reference
15.207	Conducted Emission	Pass	Section 3
15.205 15.209	Radiated Emission	Pass	Section 4

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1. General Information

1.1. Applicant

Compex Systems Pte Ltd
135 Joo Seng Road #08-01 Singapore 368363.

1.2. Manufacturer

Compex Systems Pte Ltd
135 Joo Seng Road #08-01 Singapore 368363.

1.3. Feature of Product

Product Name	WIRELESS-BGN 23DBM 2X2 NETWORK MINI PCIE ADAPTER
Model No.	WLE200N2-23, MMS2N26E, MPS2N26E, MMJ2N26E, MML2N26E, MPE72N2-23, WPE72N2-23, MMS72N2-23, MPS72N2-23, MMJ72N2-23
Brand Name	COMPEX
EUT Voltage	DC 3.3V
Frequency Range	802.11b/g/n(20MHz): 2412~2462MHz 802.11n(40MHz): 2422~2452MHz
Channel Number	802.11b/g/n(20MHz): 11 802.11n(40MHz): 7
Type of Modulation	802.11b: DSSS 802.11g/n: OFDM
Data Rate	802.11g: 6/9/12/18/24/36/48/54 Mbps 802.11b: 1/2/5.5/11 Mbps 802.11n: up to 300 Mbps
Channel Control	Auto
Antenna Delivery	2*Tx + 2*Rx
Antenna Type	Reference to Antenna List
Peak Antenna Gain	Reference to Antenna List

Note:1: There are different plastic casings for selling between the Model No has showed in the report, and as the same with other configuration.
2: WLE200N2-23 for RF test.

For 2.4GHz Band

802.11b/g/n(20MHz) Working Frequency of Each Channel:					
Channel	Frequency	Channel	Frequency	Channel	Frequency
01	2412 MHz	02	2417 MHz	03	2422 MHz
04	2427 MHz	05	2432 MHz	06	2437 MHz
07	2442 MHz	08	2447 MHz	09	2452 MHz
10	2457 MHz	11	2462 MHz	N/A	N/A
802.11n(40MHz) Working Frequency of Each Channel:					
Channel	Frequency	Channel	Frequency	Channel	Frequency
03	2422 MHz	04	2427 MHz	05	2432 MHz
06	2437 MHz	07	2442 MHz	08	2447 MHz
09	2452 MHz	N/A	N/A	N/A	N/A

802.11b/g/n Antenna List

Antenna	Manufacturer	Peak Gain
Dipole Antenna #1	SmartAnt Telecom Co., Ltd.	4.5dBi for 2.4GHz
Dipole Antenna #2	Kunshan Wavelink Electronic Co., Ltd.	2dBi for 2.4GHz
Panel Antenna #1	Compex Systems Pte Ltd	14dBi for 2.4GHz
Panel Antenna #2	Compex Systems Pte Ltd	6.5dBi for 2.4GHz
Panel Antenna #3	Compex Systems Pte Ltd	11dBi for 2.4GHz

1.4. Testing Facility

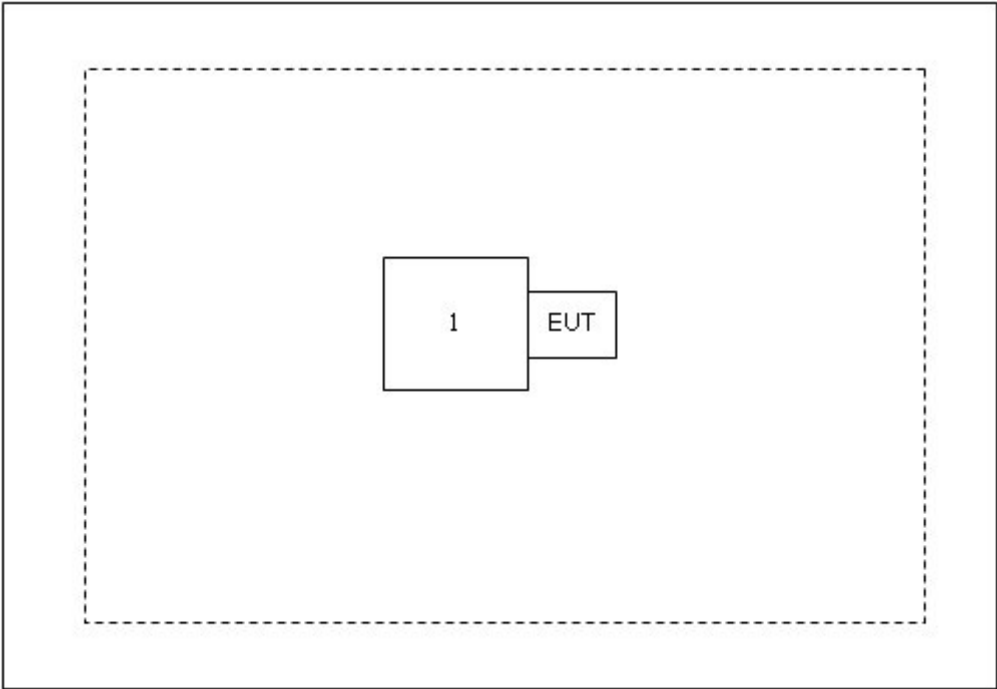
Test Site	QuieTek Technology (Suzhou) Co., Ltd.
Test Site Location	No.99 Hongye Rd., Suzhou Industrial Park Loufeng Hi-Tech Development Zone., Suzhou, China

2. Test Configuration of Equipment Under Test

2.1. Test Mode

Test Mode
Mode 1: Receive by 802.11n(20MHz)
Mode 2: Receive by 802.11n(40MHz)

2.2. Configuration of Tested System

Connection Diagram		
		
Signal Cable Type		Signal cable Description
	N/A	N/A

2.3. Test System Details

The types for all equipments, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product		Manufacturer	Model No.	Serial No.	Power Cord
1	Notebook	Asus	N80V	8BN0AS226971468	Non-Shielded, 1.8m

2.4. Test Software

Turn on the power of all equipment, then run the RF test software “ART2” provided by applicant, and set the test mode and channel, then press OK to start continue receive.

3. Conducted Emission

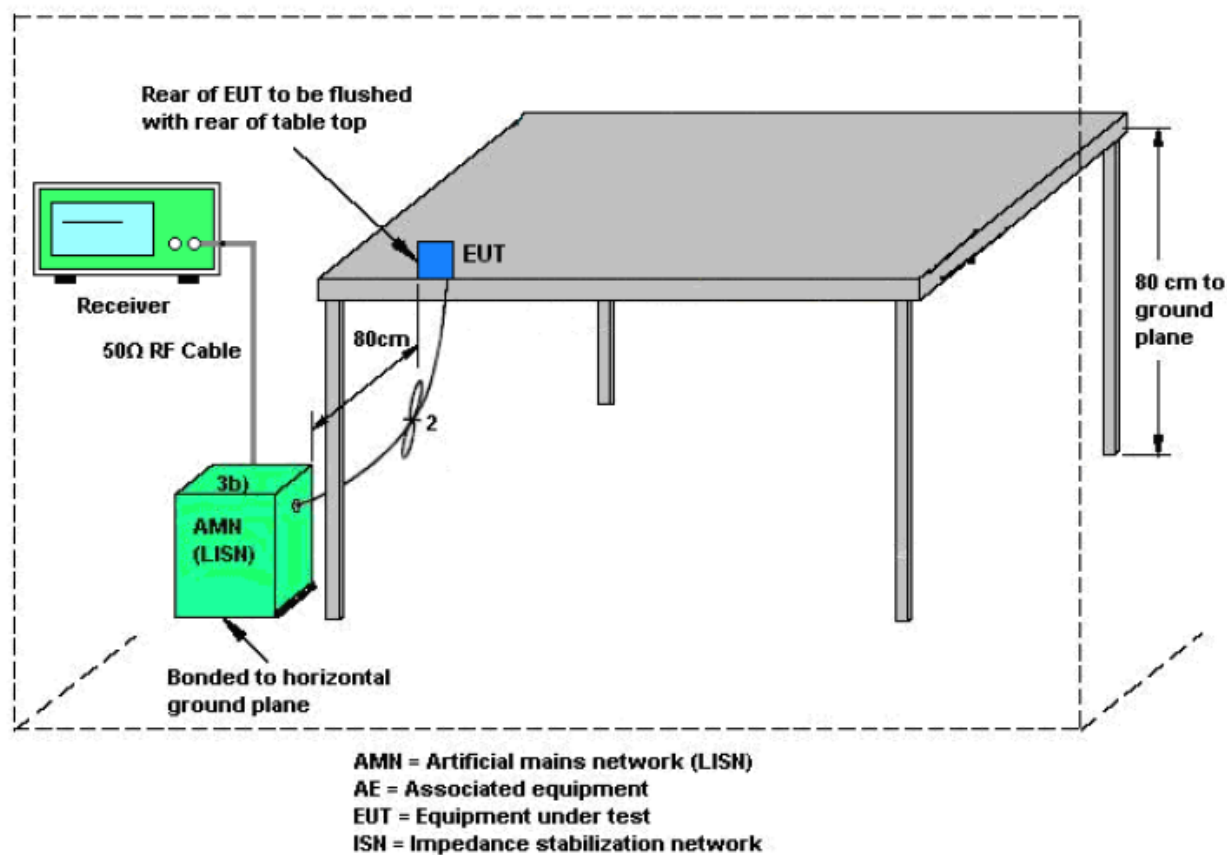
3.1. Limit of Conducted Emission

FCC Part 15 Subpart B Paragraph 15.107 Limits		
Frequency (MHz)	QP (dBuV)	AV (dBuV)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

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

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

3.2. Test Setup



3.3. Test Procedure

The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface. The EUT and simulators are connected to the main power through a line impedance stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)

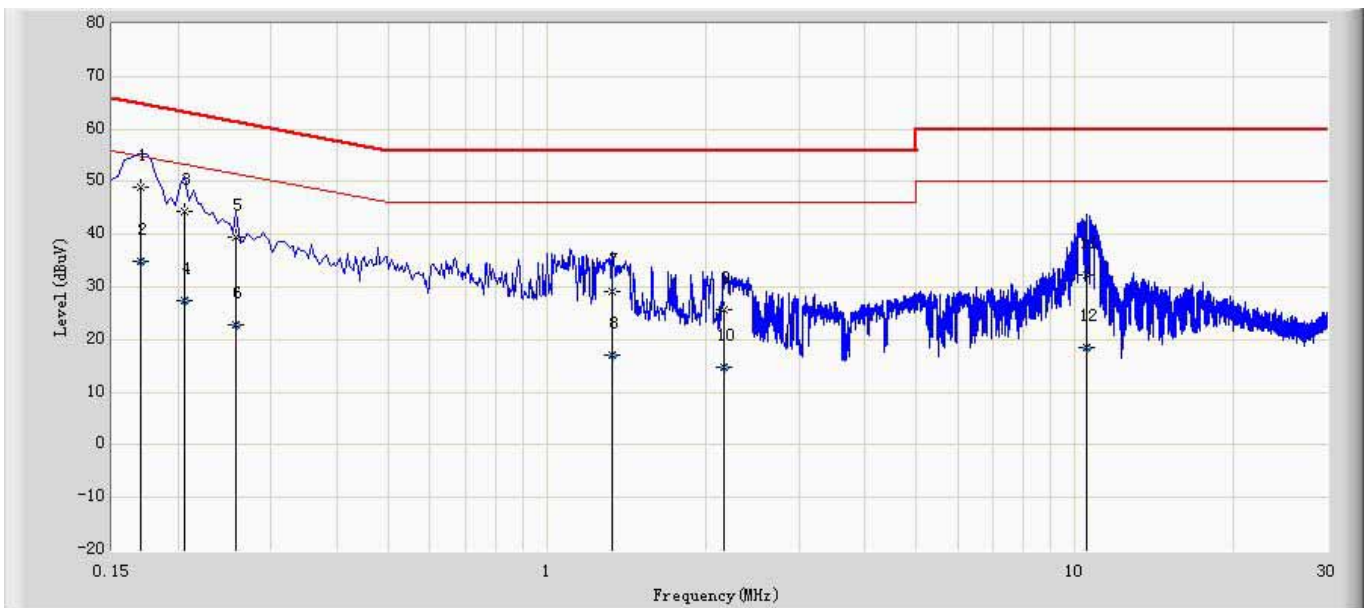
Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.

The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.

Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

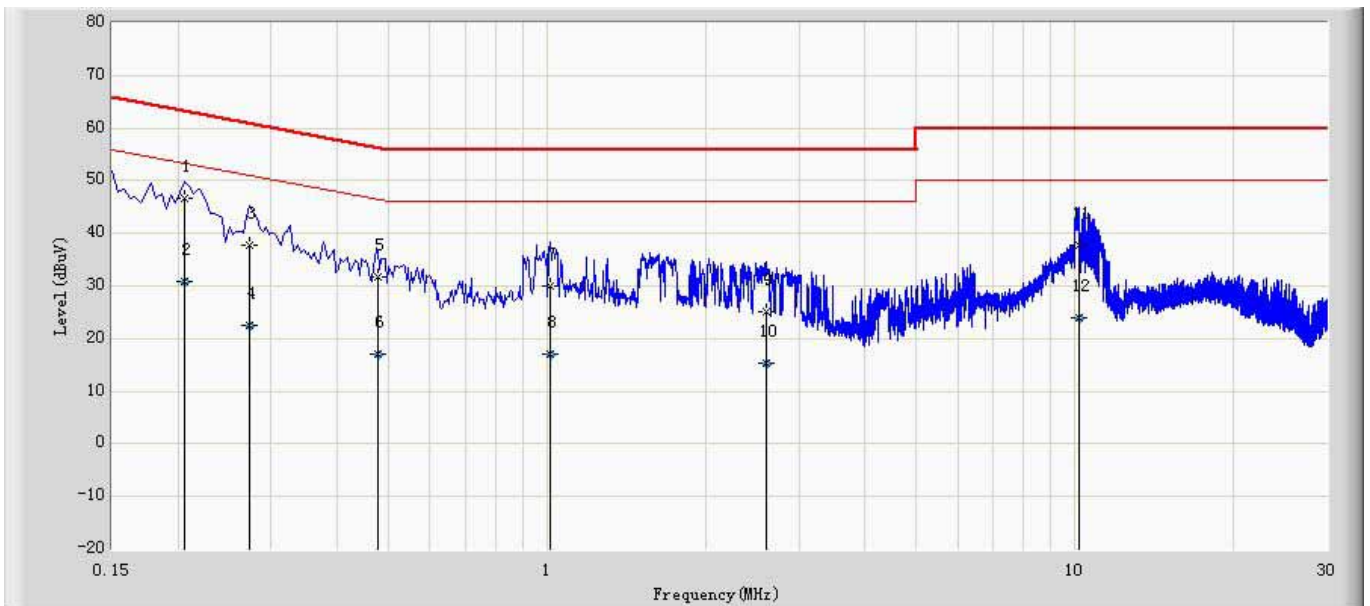
3.4. Test Result

Site: TR1	Time: 2013/05/28 - 17:53
Limit: FCC_Part15.107_CE_AC Power_ClassB	Margin: 0
Probe: ENV216_101044(0.009-30MHz)	Polarity: Line
EUT: WIRELESS-BGN 23DBM 2X2 NETWORK MINI PCIE ADAPTER	Power: AC 120V/60Hz
Note: Mode 1	



No	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Factor (dB)	Type
1	*	0.170	48.908	39.057	-16.052	64.960	9.851	QP
2		0.170	34.793	24.942	-20.168	54.960	9.851	AV
3		0.206	44.485	34.624	-18.880	63.365	9.861	QP
4		0.206	27.307	17.446	-26.058	53.365	9.861	AV
5		0.258	39.513	29.645	-21.983	61.496	9.868	QP
6		0.258	22.788	12.920	-28.707	51.496	9.868	AV
7		1.330	29.245	19.448	-26.755	56.000	9.797	QP
8		1.330	17.182	7.385	-28.818	46.000	9.797	AV
9		2.158	25.803	16.012	-30.197	56.000	9.791	QP
10		2.158	14.717	4.926	-31.283	46.000	9.791	AV
11		10.534	32.287	22.272	-27.713	60.000	10.015	QP
12		10.534	18.507	8.492	-31.493	50.000	10.015	AV

Site: TR1	Time: 2013/05/28 - 17:58
Limit: FCC_Part15.107_CE_AC Power_ClassB	Margin: 0
Probe: ENV216_101044(0.009-30MHz)	Polarity: Neutral
EUT: WIRELESS-BGN 23DBM 2X2 NETWORK MINI PCIE ADAPTER	Power: AC 120V/60Hz
Note: Mode 1	



No	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Factor (dB)	Type
1	*	0.206	46.688	36.771	-16.677	63.365	9.917	QP
2		0.206	30.816	20.900	-22.549	53.365	9.917	AV
3		0.274	37.702	27.766	-23.293	60.996	9.937	QP
4		0.274	22.516	12.579	-28.480	50.996	9.937	AV
5		0.478	31.638	21.589	-24.736	56.374	10.049	QP
6		0.478	16.934	6.885	-29.440	46.374	10.049	AV
7		1.014	30.041	20.004	-25.959	56.000	10.038	QP
8		1.014	17.184	7.146	-28.816	46.000	10.038	AV
9		2.594	25.154	15.175	-30.846	56.000	9.978	QP
10		2.594	15.481	5.503	-30.519	46.000	9.978	AV
11		10.170	37.698	27.319	-22.302	60.000	10.379	QP
12		10.170	23.943	13.564	-26.057	50.000	10.379	AV

4. Radiated Emission

4.1. Limit

FCC Part 15 Subpart B Paragraph 15.109		
Frequency (MHz)	Distance (m)	Level (dBuV/m)
30 - 88	3	40
88 - 216	3	43.5
216 - 960	3	46
Above 960	3	54

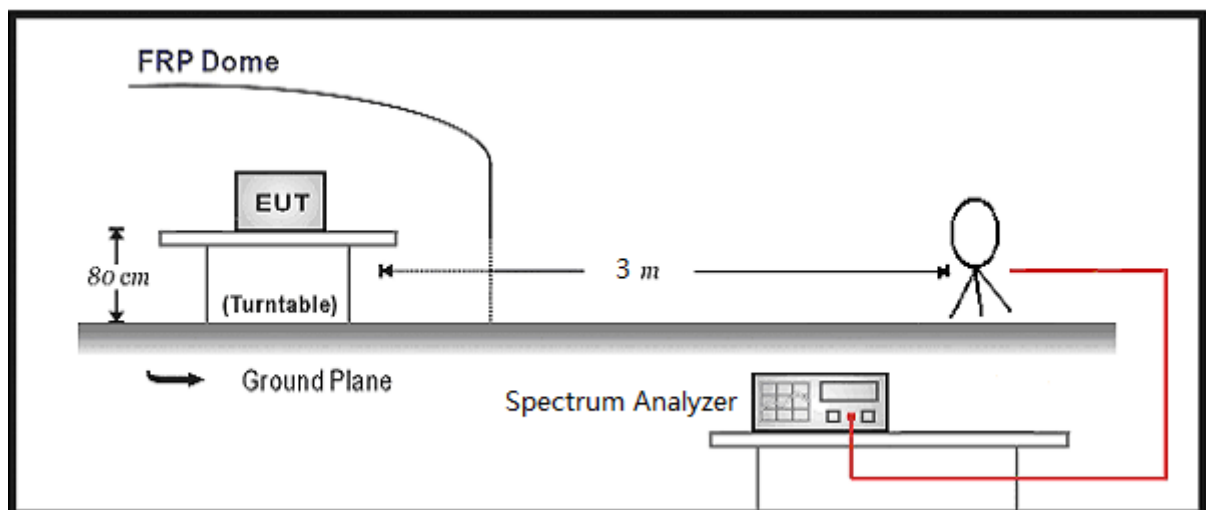
Note 1: The lower limit shall apply at the transition frequency.

Note 2: Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

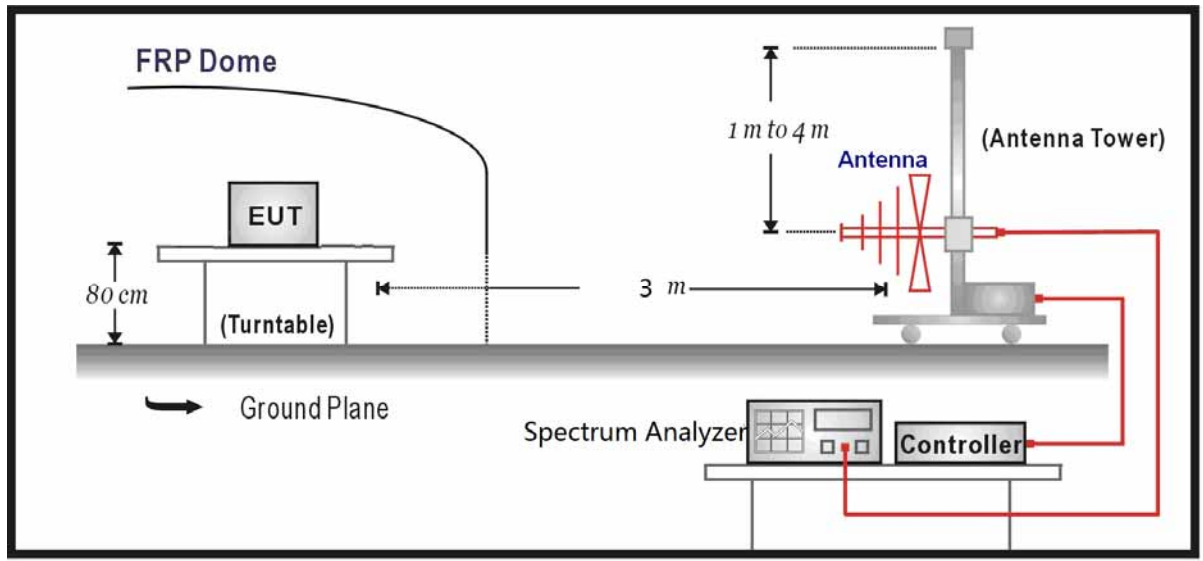
Note 3: E field strength (dBuV/m) = 20 log E field strength (uV/m)

4.2. Test Setup

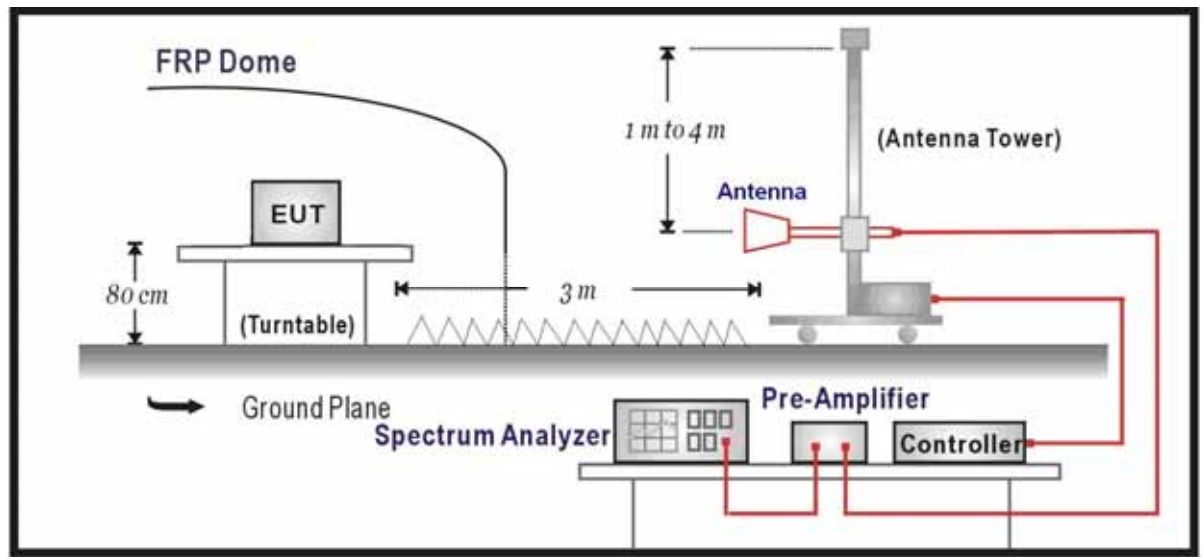
Below 30MHz Test Setup:



Below 1GHz Test Setup:



Above 1GHz Test Setup:



4.3. Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 10 meters. The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated on radiated measurement.

For an unintentional radiator, including a digital device, the spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a radiated emission limit is specified, up to the frequency shown in the following table:

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705 - 108	1000
108 - 500	2000
500 - 1000	5000
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower

On any frequency or frequencies below or equal to 1000 MHz, the radiated limits shown are based on measuring equipment employing a quasi-peak detector function and above 1000 MHz, the radiated limits shown are based measuring equipment employing an average detector function.

When average radiated emission measurement are included emission measurement Above 1000 MHz, there also is a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.

For class A, the measurement distance between the EUT and antenna is 10 meters for under 1GHz and above 1GHz.

For class B, the measurement distance between the EUT and antenna is 3 meters for under 1GHz and 3 meters for above 1GHz.

The bandwidth below 1GHz setting on the field strength meter (R&S Test Receiver ESCI) is 120 kHz and above 1GHz is 1MHz.

Note: When measurement above 1GHz, the horn antenna will bend down a little (as horn antenna have the narrow beamwidth) in order to find the maximum emission of EUT.

4.4. Test Result

All of the test result shown indicates the worst case, and spectrum analyzer parameters setting as shown below:

Peak detector: RBW = 1MHz, VBW = 3MHz, sweep time = 200ms;

Average detector: RBW = 1MHz, VBW = 10Hz, sweep time = auto.

Measure Level = Reading Level + Cable Loss + Antenna Factor - Preamplifier Gain

Test by Dipole Antenna #1

Mode 1: Receive by 802.11n(20MHz)

CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	H	3023.0	51.3	-10.8	40.5	54(note3)	-13.5	PK
	V	3125.0	50.9	-10.9	40.0	54(note3)	-14.0	PK
	H	4824.0	47.8	-34.5	13.3	54(note3)	-40.7	PK
	V	4825.0	49.0	-33.4	15.6	54(note3)	-38.4	PK
6	H	3125.0	52.4	-10.6	41.8	54(note3)	-12.2	PK
	V	3116.5	50.9	-10.9	40.0	54(note3)	-14.0	PK
	H	4874.0	48.3	-34.0	14.3	54(note3)	-39.7	PK
	V	4874.0	48.7	-33.6	15.1	54(note3)	-38.9	PK
11	H	3116.5	51.3	-10.6	40.7	54(note3)	-13.3	PK
	V	3159.0	51.2	-10.8	40.4	54(note3)	-13.6	PK
	H	4924.0	48.1	-34.3	13.8	54(note3)	-40.2	PK
	V	4924.0	49.6	-32.7	16.9	54(note3)	-37.1	PK

Note: 1. Measure Level = Reading Level + Factor.

2. The test trace is same as the ambient noise (the test frequency range: 9kHz~30MHz, 18GHz~25GHz), therefore no data appear in the report.

3. This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

Mode 2: Receive by 802.11n(40MHz)

CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	H	3023.0	51.3	-10.8	40.5	54(note3)	-13.5	PK
	V	3125.0	50.9	-10.9	40.0	54(note3)	-14.0	PK
	H	4824.0	47.8	-34.5	13.3	54(note3)	-40.7	PK
	V	4825.0	49.0	-33.4	15.6	54(note3)	-38.4	PK
6	H	3125.0	52.4	-10.6	41.8	54(note3)	-12.2	PK
	V	3116.5	50.9	-10.9	40.0	54(note3)	-14.0	PK
	H	4874.0	48.3	-34.0	14.3	54(note3)	-39.7	PK
	V	4874.0	48.7	-33.6	15.1	54(note3)	-38.9	PK
11	H	3116.5	51.3	-10.6	40.7	54(note3)	-13.3	PK
	V	3159.0	51.2	-10.8	40.4	54(note3)	-13.6	PK
	H	4924.0	48.1	-34.3	13.8	54(note3)	-40.2	PK
	V	4924.0	49.6	-32.7	16.9	54(note3)	-37.1	PK

Note: 1. Measure Level = Reading Level + Factor.

2. The test trace is same as the ambient noise (the test frequency range: 9kHz~30MHz, 18GHz~25GHz), therefore no data appear in the report.

3. This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

Test by Panel Antenna #1

Mode 1: Receive by 802.11n(20MHz)

CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	H	3023.0	51.3	-10.8	40.5	54(note3)	-13.5	PK
	V	3125.0	50.9	-10.9	40.0	54(note3)	-14.0	PK
	H	4824.0	47.8	-34.5	13.3	54(note3)	-40.7	PK
	V	4825.0	49.0	-33.4	15.6	54(note3)	-38.4	PK
6	H	3125.0	52.4	-10.6	41.8	54(note3)	-12.2	PK
	V	3116.5	50.9	-10.9	40.0	54(note3)	-14.0	PK
	H	4874.0	48.3	-34.0	14.3	54(note3)	-39.7	PK
	V	4874.0	48.7	-33.6	15.1	54(note3)	-38.9	PK
11	H	3116.5	51.3	-10.6	40.7	54(note3)	-13.3	PK
	V	3159.0	51.2	-10.8	40.4	54(note3)	-13.6	PK
	H	4924.0	48.1	-34.3	13.8	54(note3)	-40.2	PK
	V	4924.0	49.6	-32.7	16.9	54(note3)	-37.1	PK

Note: 1. Measure Level = Reading Level + Factor.

2. The test trace is same as the ambient noise (the test frequency range: 9kHz~30MHz, 18GHz~25GHz), therefore no data appear in the report.

3. This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

Mode 2: Receive by 802.11n(40MHz)

CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	H	3023.0	51.3	-10.8	40.5	54(note3)	-13.5	PK
	V	3125.0	50.9	-10.9	40.0	54(note3)	-14.0	PK
	H	4824.0	47.8	-34.5	13.3	54(note3)	-40.7	PK
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11	H	3116.5	51.3	-10.6	40.7	54(note3)	-13.3	PK
	V	3159.0	51.2	-10.8	40.4	54(note3)	-13.6	PK
	H	4924.0	48.1	-34.3	13.8	54(note3)	-40.2	PK
	V	4924.0	49.6	-32.7	16.9	54(note3)	-37.1	PK

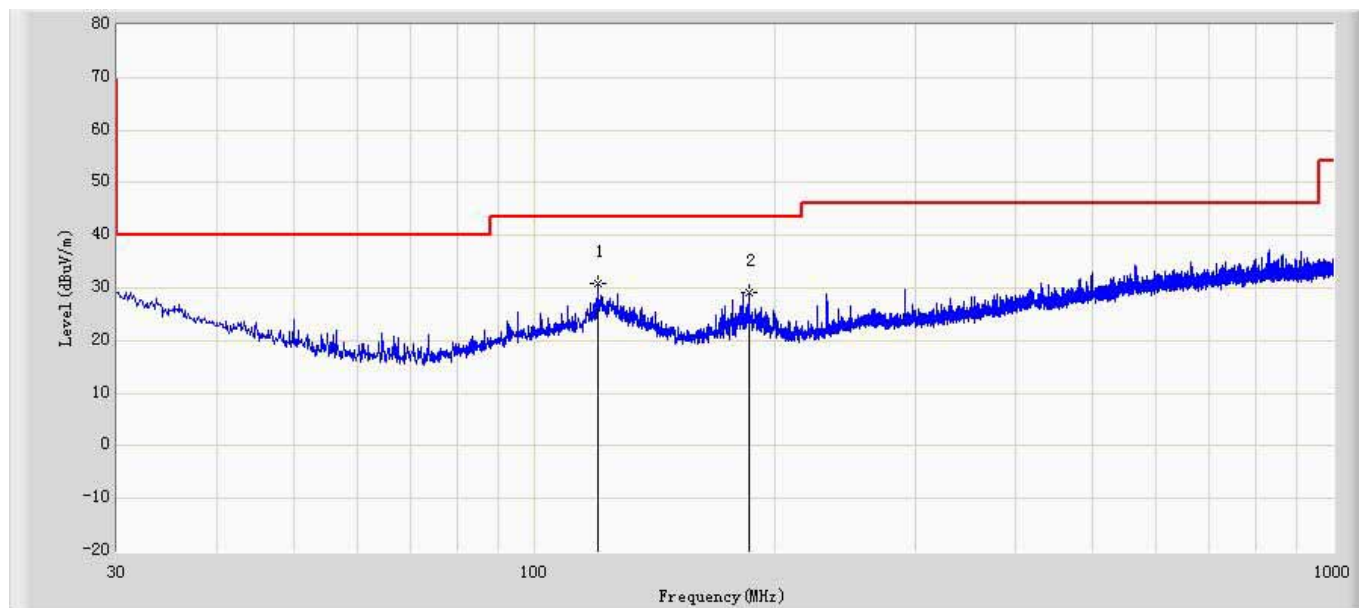
Note: 1. Measure Level = Reading Level + Factor.

2. The test trace is same as the ambient noise (the test frequency range: 9kHz~30MHz, 18GHz~25GHz), therefore no data appear in the report.

3. This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

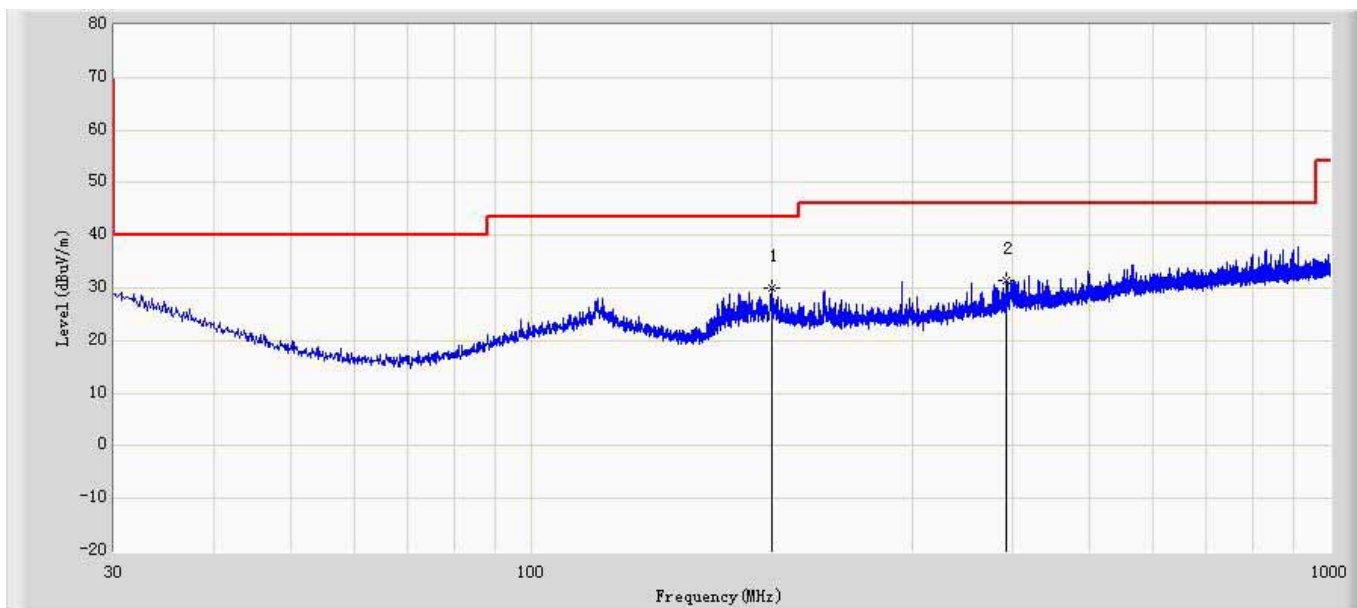
The worst case of Radiated Emission below 1GHz:

Site: AC2	Time: 2013/05/26 - 11:57
Limit: FCC_Part15.109_RE(3m)_ClassB	Margin: 0
Probe: CBL6112D_27611(30-1000MHz)	Polarity: Horizontal
EUT: WIRELESS-BGN 23DBM 2X2 NETWORK MINI PCIE ADAPTER	Power: AC 120V/60Hz
Note: Mode 1: Receive at channel 2412MHz by 802.11n(20MHz)	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	120.089	30.862	12.259	-12.638	43.500	18.604	QP
2		185.321	29.001	13.559	-14.499	43.500	15.442	QP

Site: AC2	Time: 2013/05/26 - 10:41
Limit: FCC_Part15.109_RE(3m)_ClassB	Margin: 0
Probe: CBL6112D_27611(30-1000MHz)	Polarity: Vertical
EUT: WIRELESS-BGN 23DBM 2X2 NETWORK MINI PCIE ADAPTER	Power: AC 120V/60Hz
Note: Mode 1: Receive at channel 2412MHz by 802.11n(20MHz)	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	199.871	29.895	13.787	-13.605	43.500	16.109	QP
2		393.265	31.490	8.151	-14.510	46.000	23.340	QP

5. Measurement Uncertainty

Conducted Emission
The maximum measurement uncertainty is defined as: 9kHz~30MHz: $\pm 2.02\text{dB}$
Radiated disturbance
The maximum measurement uncertainty is defined as: Below 1GHz: $\pm 3.8\text{dB}$ Above 1GHz: $\pm 3.9\text{dB}$

6. List of Measuring Instrument

Conducted Emission / TR-1

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
EMI Test Receiver	R&S	ESCI	100726	2014.01.07
Two-Line V-Network	R&S	ENV216	100043	2014.03.30
Two-Line V-Network	R&S	ENV216	100044	2013.09.17
50ohm Coaxial Switch	Anritsu	MP59B	6200464462	2014.03.01
50ohm Termination	SHX	TF2	07081401	2013.09.17
Temperature/Humidity Meter	zhicheng	ZC1-2	TR1-TH	2014.01.10

Radiated Emission / AC-2

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
EMI Test Receiver	R&S	ESCI	100573	2014.03.30
Loop Antenna	R&S	HFH2-Z2	833799/003	2013.11.22
Bilog Antenna	Teseq GmbH	CBL6112D	27611	2013.10.15
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC2-C	2014.03.01
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC2-TH	2014.01.09

Radiated Emission / AC-5

Instrument	Manufacturer	Type No.	Serial No.	Cal. Date
Spectrum Analyzer	Agilent	N9020A	MY49100159	2014.03.30
Preamplifier	Miteq	NSP1800-25	1364185	2014.05.04
Preamplifier	QuieTek	AP-040G	CHM-0906001	2014.05.04
Bilog Antenna	Teseq GmbH	CBL6112D	27612	2013.10.15
DRG Horn	ETS-Lindgren	3117	00123988	2014.01.21
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2013.11.24
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2014.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2014.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2014.03.01
EMI Receiver	Agilent	N9038A	MY51210196	2013.06.11
Temperature/Humidity Meter	Zhichen	ZC1-2	AC5-TH	2014.01.11