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FCC RADIO TEST REPORT

Applicant's company	**Realtek Semiconductor Corp.**
Applicant Address	No. 2,Innovation Road II, Hsinchu Science Park, Hsinchu 300,Taiwan
FCC ID	**TX2-RTL8821AE**
Manufacturer's company	**Realtek Semiconductor Corp.**
Manufacturer Address	No. 2,Innovation Road II, Hsinchu Science Park, Hsinchu 300,Taiwan

Product Name	802.11a/b/g/n/ac RTL8821AE Combo module
Brand Name	REALTEK
Model No.	RTL8821AE
Test Rule Part(s)	47 CFR FCC Part 15 Subpart E § 15.407
Test Freq. Range	5150 ~ 5350MHz / 5470 ~ 5725MHz
Received Date	Apr. 26, 2013
Final Test Date	Oct. 07, 2013
Submission Type	Class II Change
Operating Mode	Client (without radar detection function)

Statement

Test result included is for the IEEE 802.11n and IEEE 802.11a/ac (5150 ~ 5350MHz / 5470 ~ 5725MHz) of the product.

The test result in this report refers exclusively to the presented test model / sample.

Without written approval of SPORTON International Inc., the test report shall not be reproduced except in full.

The measurements and test results shown in this test report were made in accordance with the procedures and found in compliance with the limit given in **ANSI C63.10-2009**, **47 CFR FCC Part 15 Subpart E, KDB 789033 D01 v01r03** and **KDB 662911 D01 v01r02**.

The test equipment used to perform the test is calibrated and traceable to NML/ROC.

TAF
Testing Laboratory
1190

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History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR342603-07AB	Rev. 01	Initial issue of report	Nov. 18, 2013

Certificate No.: CB10211026

1. CERTIFICATE OF COMPLIANCE

Product Name	:	802.11a/b/g/n/ac RTL8821AE Combo module
Brand Name	:	REALTEK
Model No.	:	RTL8821AE
Applicant	:	Realtek Semiconductor Corp.
Test Rule Part(s)	:	47 CFR FCC Part 15 Subpart E § 15.407

Sporton International as requested by the applicant to evaluate the EMC performance of the product sample received on Apr. 26, 2013 would like to declare that the tested sample has been evaluated and found to be in compliance with the tested rule parts. The data recorded as well as the test configuration specified is true and accurate for showing the sample's EMC nature.

Sam Chen

Sam Chen

SPORTON INTERNATIONAL INC.

2. SUMMARY OF THE TEST RESULT

Applied Standard: 47 CFR FCC Part 15 Subpart E				
Part	**Rule Section**	**Description of Test**	**Result**	**Under Limit**
4.1	15.207	AC Power Line Conducted Emissions	Complies	8.44 dB
4.2	15.247(d)	Radiated Emissions	Complies	3.07 dB
4.3	15.203	Antenna Requirements	Complies	-

3. GENERAL INFORMATION

3.1. Product Details

IEEE 802.11n/ac

Items	Description
Product Type	WLAN (1TX, 1RX)
Radio Type	Intentional Transceiver
Power Type	From Host System
Modulation	see the below table for IEEE 802.11n/ac
Data Modulation	For 802.11n: OFDM (BPSK / QPSK / 16QAM / 64QAM) For 802.11ac: OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)
Data Rate (Mbps)	see the below table for IEEE 802.11n/ac
Frequency Range	5150 ~ 5350MHz / 5470 ~ 5725MHz
Channel Number	16 for 20MHz bandwidth ; 7 for 40MHz bandwidth ; 3 for 80MHz bandwidth
Channel Band Width (99%)	802.11ac MCS0/Nss1 (20MHz): 18.24 MHz ; 802.11ac MCS0/Nss1 (40MHz): 36.80 MHz ; 802.11ac MCS0/Nss1 (80MHz): 76.16 MHz
Maximum Conducted Output Power	Band 1: 802.11ac MCS0/Nss1 (20MHz): 16.39 dBm ; 802.11ac MCS0/Nss1 (40MHz): 16.31 dBm ; 802.11ac MCS0/Nss1 (80MHz): 11.41 dBm Band 2: 802.11ac MCS0/Nss1 (20MHz): 16.41 dBm ; 802.11ac MCS0/Nss1 (40MHz): 16.18 dBm ; 802.11ac MCS0/Nss1 (80MHz): 10.01 dBm Band 3: 802.11ac MCS0/Nss1 (20MHz): 16.31 dBm ; 802.11ac MCS0/Nss1 (40MHz): 16.09 dBm ; 802.11ac MCS0/Nss1 (80MHz): 10.42 dBm
Carrier Frequencies	Please refer to section 3.5
Antenna	Please refer to section 3.4

IEEE 802.11a

Items	Description
WLAN (1TX, 1RX)	WLAN (1TX, 1RX)
Intentional Transceiver	Intentional Transceiver
From Host System	From Host System
Modulation	OFDM for IEEE 802.11a
Data Modulation	OFDM (BPSK / QPSK / 16QAM / 64QAM)
Data Rate (Mbps)	OFDM (6/9/12/18/24/36/48/54)
Frequency Range	5150 ~ 5350MHz / 5470 ~ 5725MHz
Channel Number	16
Channel Band Width (99%)	17.12 MHz
Maximum Conducted Output Power	Band 1: 16.32 dBm ; Band 2: 16.42 dBm ; Band 3: 16.48 dBm
Carrier Frequencies	Please refer to section 3.5
Antenna	Please refer to section 3.4

Antenna & Band width

Antenna	Single (TX)		
Band width Mode	20 MHz	40 MHz	80MHz
IEEE 802.11a	V	X	X
IEEE 802.11n	V	V	X
IEEE 802.11ac	V	V	V

IEEE 11n/ac Spec.

Protocol	Number of Transmit Chains (NTX)	Data Rate / MCS
802.11n (HT20)	1	MCS 0-7
802.11n (HT40)	1	MCS 0-7
802.11ac (VHT20)	1	MCS 0-8/Nss1
802.11ac (VHT40)	1	MCS 0-9/Nss1
802.11ac (VHT80)	1	MCS 0-9/Nss1
Note 1: IEEE Std. 802.11n modulation consists of HT20 and HT40 (HT: High Throughput). Then EUT support HT20 and HT40. Note 2: IEEE Std. 802.11ac modulation consists of VHT20, VHT40, VHT80 and VHT160 (VHT: Very High Throughput). Then EUT support VHT20, VHT40 and VHT80. Note 3: Modulation modes consist of below configuration: 11a: IEEE 802.11a, HT20/HT40: IEEE 802.11n, VHT20/VHT40/VHT80: IEEE 802.11ac		

3.2. Accessories

N/A

3.3. Table for Class II Change

This product is an extension of original report under Sporton project number: 342603AB
Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
For HMC type: 1.It changed PCB Layout of Power Supply. 2.It added RC filter and 2.4GHz RX LNA. There is no change in existing RF relevant portion.	1. Conducted Emissions 2. Radiated Emissions (Below 1GHz)
For NGFF type: 1.It changed PCB Layout of Power Supply. 2.It added RC filter. There is no change in existing RF relevant portion.	

3.4. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	
					2.4GHz	5GHz
1	LYNwave	ALA110-222050-300011	PIFA Antenna	I-PEX MHF4	3.5	5.0
2	LYNwave	ALA110-222050-300010	PIFA Antenna	I-PEX	3.5	5.0
3	JOYMAX	TWF-614XMPXX-500	Dipole Antenna	I-PEX	3.0	5.0
4	Realtek	PANT-001	SLOT Antenna	I-PEX	3.33	4.52
5	Realtek	PANT-002	SLOT Antenna	I-PEX MHF4	3.33	4.52

There are six configurations of EUT. The more information is listed as below table.

Configuration	Type	Module	Power Type	Antenna Variety	Type of Antenna
1	HMC	RC	PCI-E	Diversity	PIFA with I-PEX connector
					Dipole with I-PEX connector
					SLOT with I-PEX connector
2	HMC	RC	PCI-E	Fixed	PIFA with I-PEX connector
					Dipole with I-PEX connector
					SLOT with I-PEX connector
3	NGFF	RC	PCI-E	Diversity	PIFA with I-PEX MHF4 connector
					SLOT with I-PEX MHF4 connector
4	NGFF	RC	PCI-E	Fixed	PIFA with I-PEX MHF4 connector
					SLOT with I-PEX MHF4 connector
5	NGFF	RC	SDIO	Diversity	PIFA with I-PEX MHF4 connector
					SLOT with I-PEX MHF4 connector
6	NGFF	RC	SDIO	Fixed	PIFA with I-PEX MHF4 connector
					SLOT with I-PEX MHF4 connector
7	HMC	RC+LNA	PCI-E	Diversity	PIFA with I-PEX connector
					Dipole with I-PEX connector
					SLOT with I-PEX connector
8	HMC	RC+LNA	PCI-E	Fixed	PIFA with I-PEX connector
					Dipole with I-PEX connector
					SLOT with I-PEX connector

Note: The more detail information of diversity type and fixed type is listed as below.

For diversity type: (Both of those two antenna connectors can be used.)

<For 2.4GHz Band:>

The EUT supports the antenna with TX/RX diversity function for 2.4GHz WLAN and Bluetooth, but only one of them will be used at the same time.

Base on WLAN's operation mode to select the other antenna to work.

(Ex. Assume Main port was selected to conduct transmitting function in 2.4GHz WLAN, so AUX port was selected in Bluetooth Mode. Vice versa.)

<For 5GHz Band:>

The EUT supports the antenna with TX/RX diversity function for 5GHz WLAN and Bluetooth, and both them can transmit and receive signal simultaneously.

For WLAN function (1TX, 1RX):

Both of Chain 1 and Chain 2 can be used as transmitting/receiving functions, but only one antenna can be used as transmitting/receiving functions at the same time.

Chain 1 generated the worst case than Chain 2, so it is tested and recorded in the report.

For Bluetooth function (1TX, 1RX):

Both of Chain 1 and Chain 2 can be used as transmitting/receiving functions, but only one antenna can be used as transmitting/receiving functions at the same time.

Chain 1 generated the worst case than Chain 2, so it is tested and recorded in the report.

For fixed type: (Chain 1 is designated for 2.4 GHz WLAN function, Chain 2 is designated for 5GHz WLAN and Bluetooth functions.)

For 2.4GHz WLAN function (1TX, 1RX):

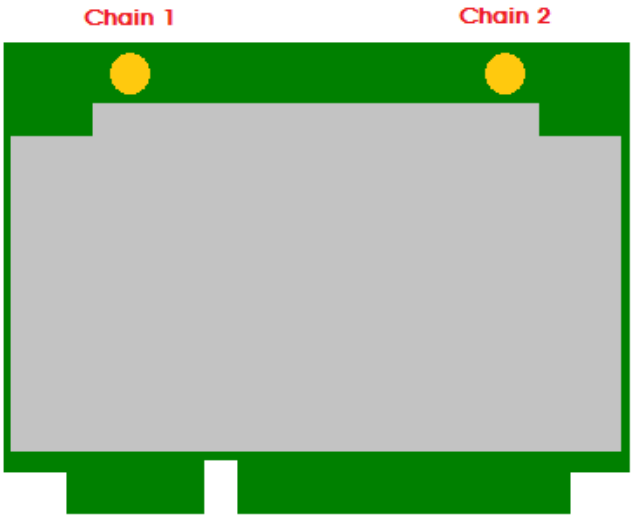
Only Chain 1 can be used as transmitting/receiving functions.

For 5GHz WLAN function (1TX, 1RX):

Only Chain 2 can be used as transmitting/receiving functions.

For Bluetooth function (1TX, 1RX):

Only Chain 2 can be used as transmitting/receiving functions.



3.5. Table for Carrier Frequencies

The EUT has three bandwidth system.

For 20MHz bandwidth systems, use Channel 36, 40, 44, 48, 52, 56, 60, 64, 100, 104, 108, 112, 116, 132, 136, 140.

For 40MHz bandwidth systems, use Channel 38, 46, 54, 62, 102, 110, 134.

For 80MHz bandwidth systems, use Channel 42, 58, 106.

Frequency Band	Channel No.	Frequency	Channel No.	Frequency
5150~5250 MHz Band 1	36	5180 MHz	44	5220 MHz
	38	5190 MHz	46	5230 MHz
	40	5200 MHz	48	5240 MHz
	42	5210 MHz	-	-
5250~5350 MHz Band 2	52	5260 MHz	60	5300 MHz
	54	5270 MHz	62	5310 MHz
	56	5280 MHz	64	5320 MHz
	58	5290 MHz	-	-
5470~5725 MHz Band 3	100	5500 MHz	112	5560 MHz
	102	5510MHz	116	5580 MHz
	104	5520 MHz	132	5660 MHz
	106	5530 MHz	134	5670 MHz
	108	5540 MHz	136	5680 MHz
	110	5550 MHz	140	5700 MHz

3.6. Table for Product Information

Items	Description	
Communication Mode	☒ IP Based (Load Based)	☐ Frame Based
TPC Function	☒ With TPC	☐ Without TPC
Weather Band (5600~5650MHz)	☐ With 5600~5650MHz	☒ Without 5600~5650MHz
Beamforming Function	☐ With beamforming	☒ Without beamforming

3.7. Table for Test Modes

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	Mode	Data Rate	Channel	Chain
AC Power Conducted Emission	Normal Link	-	-	-
Radiated Emission Below 1GHz	Normal Link	-	-	-

The following test modes were performed for all tests:

< For Conducted Emission test >:

For RC+LNA module:
The mode "Diversity + PIFA antenna" has been evaluated to be the worst case for Radiated emission below 1GHz test.
For RC module / HMC type:
The mode "Fixed + PIFA antenna" has been evaluated to be the worst case for Radiated emission below 1GHz test.
For RC module / NGFF type:
The mode "Diversity + SLOT antenna" has been evaluated to be the worst case for Radiated emission below 1GHz test.
Consequently, measurement for Conducted emission test will follow this same test mode.

Test Mode	Description
1	HMC + PCI-E + Diversity + PIFA (I-PEX connector) / RC+LNA module
2	HMC + PCI-E + Fixed + PIFA (I-PEX connector) / RC module
3	NGFF + PCI-E + Diversity + SLOT (I-PEX MHF4 connector) / RC module
4	NGFF + SDIO + Diversity + SLOT (I-PEX MHF4 connector) / RC module

Mode 1 generated the worst test result, so it was recorded in this report.

< For Radiated Emission below 1GHz test >:

Test Mode	Description
1	HMC + PCI-E + Diversity + PIFA (I-PEX connector) / RC+LNA module
2	HMC + PCI-E + Fixed + PIFA (I-PEX connector) / RC+LNA module
Mode 1 is found as the worse case between Mode 1 and Mode 2, thus the measurement (Diversity type) for Mode 3 ~ Mode 4 will follow this same test mode.	
3	HMC + PCI-E + Diversity + SLOT (I-PEX connector) / RC+LNA module
4	HMC + PCI-E + Diversity + Dipole (I-PEX connector) / RC+LNA module
5	HMC + PCI-E + Diversity + PIFA (I-PEX connector) / RC module
6	HMC + PCI-E + Fixed + PIFA (I-PEX connector) / RC module
Mode 6 is found as the worse case between Mode 5 and Mode 6, thus the measurement (Fixed type) for Mode 7 ~ Mode 8 will follow this same test mode.	
7	HMC + PCI-E + Fixed + SOLT (I-PEX connector) / RC module
8	HMC + PCI-E + Fixed + Dipole (I-PEX connector) / RC module
9	NGFF+ PCI-E + Diversity + PIFA (I-PEX MHF4 connector) / RC module
10	NGFF + PCI-E + Fixed + PIFA (I-PEX MHF4 connector) / RC module
Mode 9 is found as the worse case between Mode 9 and Mode 10, thus the measurement (Diversity type) for Mode 11 will follow this same test mode.	
11	NGFF + SDIO + Diversity + SLOT (I-PEX MHF4 connector) / RC module
Mode 11 generated the worst test result, so it was recorded in this report.	

3.8. Table for Testing Locations

Test Site No.	Site Category	Location	FCC Reg. No.	IC File No.	VCCI Reg. No
03CH01-CB	SAC	Hsin Chu	262045	IC 4086D	-
CO01-CB	Conduction	Hsin Chu	262045	IC 4086D	-

Open Area Test Site (OATS); Semi Anechoic Chamber (SAC).

Please refer section 6 for Test Site Address.

3.9. Table for Supporting Units

Test Site: CO01-CB

Support Unit	Brand	Model	FCC ID
Wireless AP	Planex	GW-AP54SGX	N/A
Notebook	DELL	E6430	QDS-BRCM1049LE
Notebook	DELL	E6220	QDS-BRCM1049LE
Mouse	Logitech	M-U0026	DoC
Earphone	SHYARO CHI	MIC-04	N/A
Test Fixture (For HMC type)	REALTEK	PCIE Adapter	N/A
Test Fixture (For NGFF type)	REALTEK	PCIE & SDIO Adapter	N/A

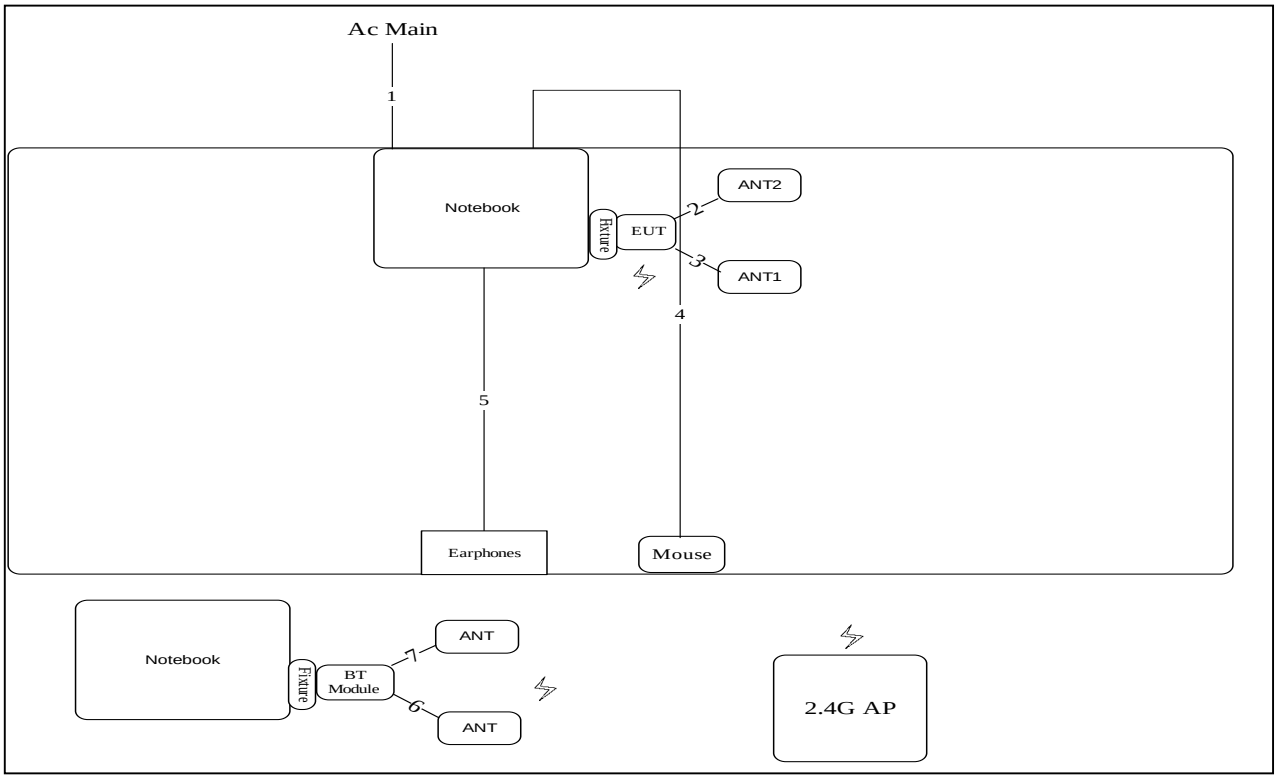
Test Site: 03CH01-CB (Below 1GHz)

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E6430	QDS-BRCM1049LE
Notebook	DELL	D420	E2KWM3945ABG
Mouse	Logitech	M-U0026	DoC
Earphone	E-BOOKI	E-EPC040	N/A
Wireless AP	Planex	GW-AP54SGX	N/A
Test Fixture (For HMC type)	REALTEK	PCIE Adapter	N/A
Test Fixture (For NGFF type)	REALTEK	PCIE & SDIO Adapter	N/A

3.10. Test Configurations

3.10.1. AC Power Line Conduction Emissions and Radiation Emissions (Below 1GHz) Test Configuration

Conduction Emissions Test Mode: Mode 1, Radiation Emissions (Below 1GHz): Mode 11



Item	Connection	Shield	Length
1	Power cable	No	2.6m
2	ANT cable	Yes	0.18m
3	ANT cable	Yes	0.18m
4	USB cable	Yes	1.8m
5	Audio cable	No	1.1m
6	ANT cable	Yes	0.18m
7	ANT cable	Yes	0.18m

4. TEST RESULT

4.1. AC Power Line Conducted Emissions Measurement

4.1.1. Limit

For this product that is designed to connect to the AC power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed below limits table.

Frequency (MHz)	QP Limit (dBuV)	AV Limit (dBuV)
0.15~0.5	66~56	56~46
0.5~5	56	46
5~30	60	50

4.1.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 KHz

4.1.3. Test Procedures

Configure the EUT according to ANSI C63.10. The EUT or host of EUT has to be placed 0.4 meter far from the conducting wall of the shielding room and at least 80 centimeters from any other grounded conducting surface.

Connect EUT or host of EUT to the power mains through a line impedance stabilization network (LISN).

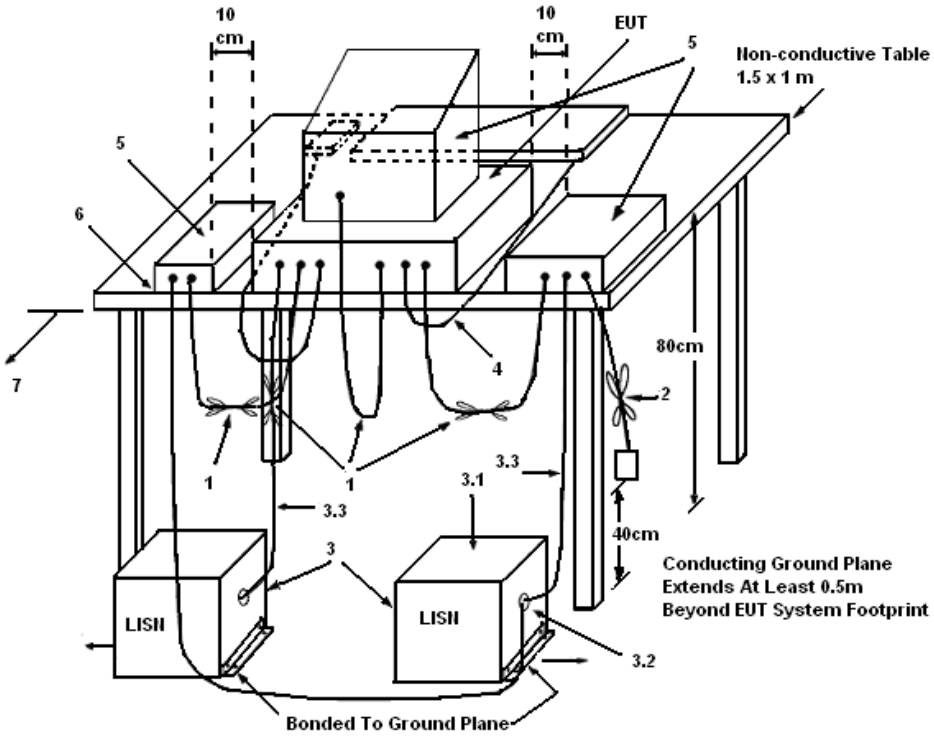
All the support units are connected to the other LISNs. The LISN should provide 50uH/50ohms coupling impedance.

The frequency range from 150 KHz to 30 MHz was searched.

Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

The measurement has to be done between each power line and ground at the power terminal.

4.1.4. Test Setup Layout



LEGEND:

(1) Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

(2) I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

(3) EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50 Ω. LISN can be placed on top of, or immediately beneath, reference ground plane.

(3.1) All other equipment powered from additional LISN(s).

(3.2) Multiple outlet strip can be used for multiple power cords of non-EUT equipment.

(3.3) LISN at least 80 cm from nearest part of EUT chassis.

(4) Cables of hand-operated devices, such as keyboards, mice, etc., shall be placed as for normal use.

(5) Non-EUT components of EUT system being tested.

(6) Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop.

(7) Rear of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground plane.

4.1.5. Test Deviation

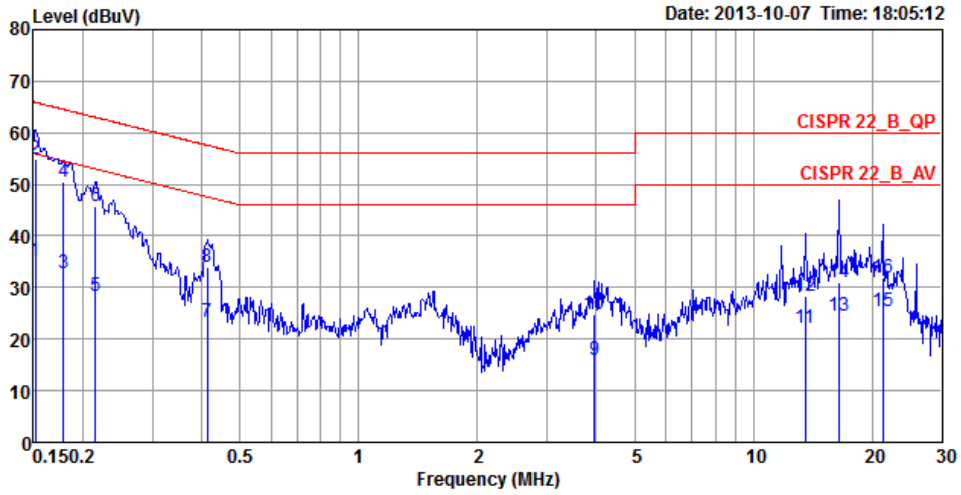
There is no deviation with the original standard.

4.1.6. EUT Operation during Test

The EUT was placed on the test table and programmed in normal function.

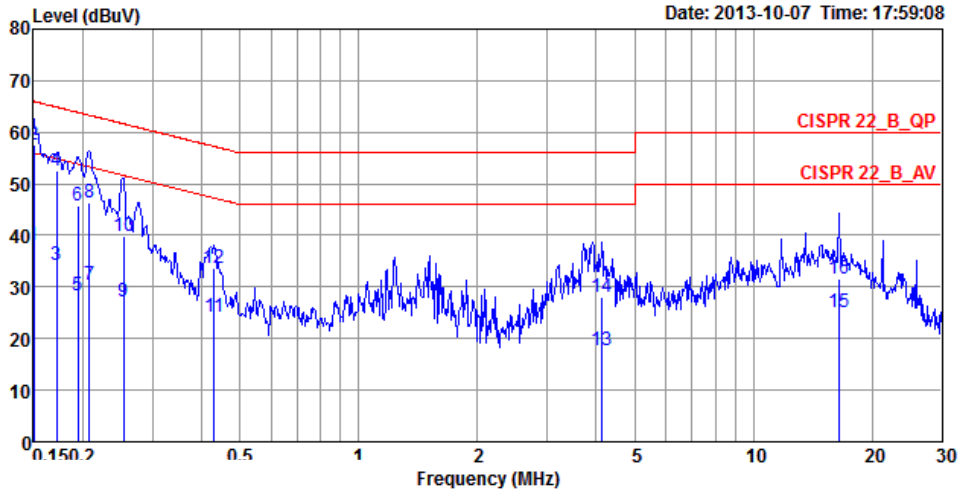
4.1.7. Results of AC Power Line Conducted Emissions Measurement

Temperature	25°C	Humidity	60%
Test Engineer	Ryo Fan	Phase	Line
Configuration	Normal Link	Test Mode	Mode 1



		Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark	Pol/Phase
		MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	a	0.1516	35.11	-20.80	55.91	34.84	0.22	0.05	Average	LINE
2	q	0.1516	55.01	-10.90	65.91	54.74	0.22	0.05	QP	LINE
3		0.1787	32.85	-21.70	54.55	32.57	0.21	0.07	Average	LINE
4		0.1787	50.44	-14.11	64.55	50.16	0.21	0.07	QP	LINE
5		0.2151	28.39	-24.62	53.01	28.11	0.21	0.07	Average	LINE
6		0.2151	45.87	-17.14	63.01	45.59	0.21	0.07	QP	LINE
7		0.4127	23.29	-24.30	47.59	23.02	0.22	0.05	Average	LINE
8		0.4127	33.82	-23.77	57.59	33.55	0.22	0.05	QP	LINE
9		3.9639	15.81	-30.19	46.00	15.39	0.29	0.13	Average	LINE
10		3.9639	24.76	-31.24	56.00	24.34	0.29	0.13	QP	LINE
11		13.5509	22.04	-27.96	50.00	21.35	0.56	0.13	Average	LINE
12		13.5509	28.36	-31.64	60.00	27.67	0.56	0.13	QP	LINE
13		16.4856	24.45	-25.55	50.00	23.68	0.65	0.12	Average	LINE
14		16.4856	30.92	-29.08	60.00	30.15	0.65	0.12	QP	LINE
15		21.2596	25.45	-24.55	50.00	24.51	0.77	0.17	Average	LINE
16		21.2596	31.96	-28.04	60.00	31.02	0.77	0.17	QP	LINE

Temperature	25°C	Humidity	60%
Test Engineer	Ryo Fan	Phase	Neutral
Configuration	Normal Link	Test Mode	Mode 1



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1 a	0.1500	38.12	-17.88	56.00	37.98	0.09	0.05	Average	NEUTRAL
2 q	0.1500	57.56	-8.44	66.00	57.42	0.09	0.05	QP	NEUTRAL
3	0.1712	34.14	-20.76	54.90	34.01	0.08	0.05	Average	NEUTRAL
4	0.1712	52.64	-12.26	64.90	52.51	0.08	0.05	QP	NEUTRAL
5	0.1945	28.44	-25.40	53.84	28.30	0.07	0.07	Average	NEUTRAL
6	0.1945	45.65	-18.19	63.84	45.51	0.07	0.07	QP	NEUTRAL
7	0.2072	30.41	-22.91	53.32	30.27	0.07	0.07	Average	NEUTRAL
8	0.2072	46.27	-17.05	63.32	46.13	0.07	0.07	QP	NEUTRAL
9	0.2535	27.24	-24.40	51.64	27.11	0.07	0.06	Average	NEUTRAL
10	0.2535	39.74	-21.90	61.64	39.61	0.07	0.06	QP	NEUTRAL
11	0.4305	24.09	-23.15	47.24	23.96	0.08	0.05	Average	NEUTRAL
12	0.4305	33.67	-23.57	57.24	33.54	0.08	0.05	QP	NEUTRAL
13	4.1356	17.84	-28.16	46.00	17.55	0.16	0.13	Average	NEUTRAL
14	4.1356	27.96	-28.04	56.00	27.67	0.16	0.13	QP	NEUTRAL
15	16.4856	25.13	-24.87	50.00	24.58	0.43	0.12	Average	NEUTRAL
16	16.4856	31.71	-28.29	60.00	31.16	0.43	0.12	QP	NEUTRAL

Note:

Level = Read Level + LISN Factor + Cable Loss

4.2. Radiated Emissions Measurement

4.2.1. Limit

For transmitters operating in the 5.15-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed a -27dBm peak limit or average 54dBuV/m and peak 74dBuV/m limits. For transmitters operating in the 5.470-5.725 GHz band: all emissions outside of the 5.470-5.725 GHz band shall not exceed a -27dBm peak limit or average 54dBuV/m and peak 74dBuV/m limits. In addition, In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (micorvolts/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

4.2.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	40 GHz
RBW / VBW (Emission in restricted band)	1MHz / 3MHz for Peak, 1 MHz / 10Hz for Average
RBW / VBW (Emission in non-restricted band)	1MHz / 3MHz for peak

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RBW 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RBW 120kHz for QP

4.2.3. Test Procedures

1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.

Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.

The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.

For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.

Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.

For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer.

When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.

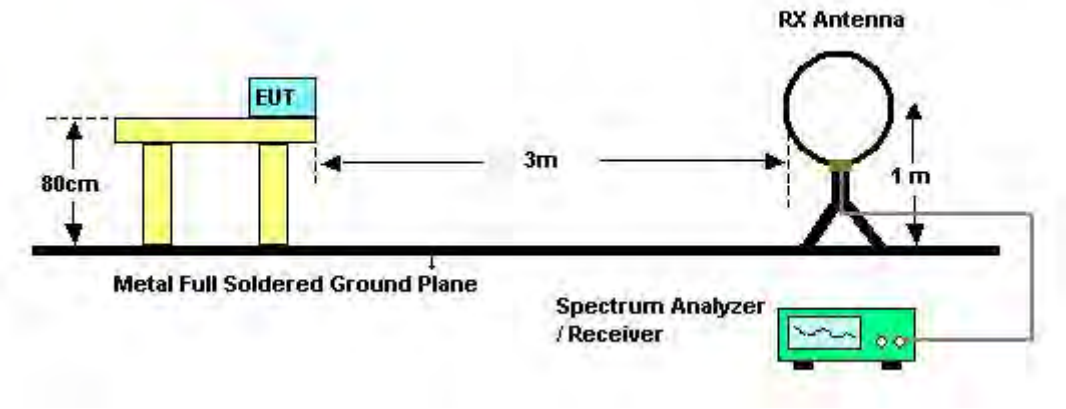
If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.

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

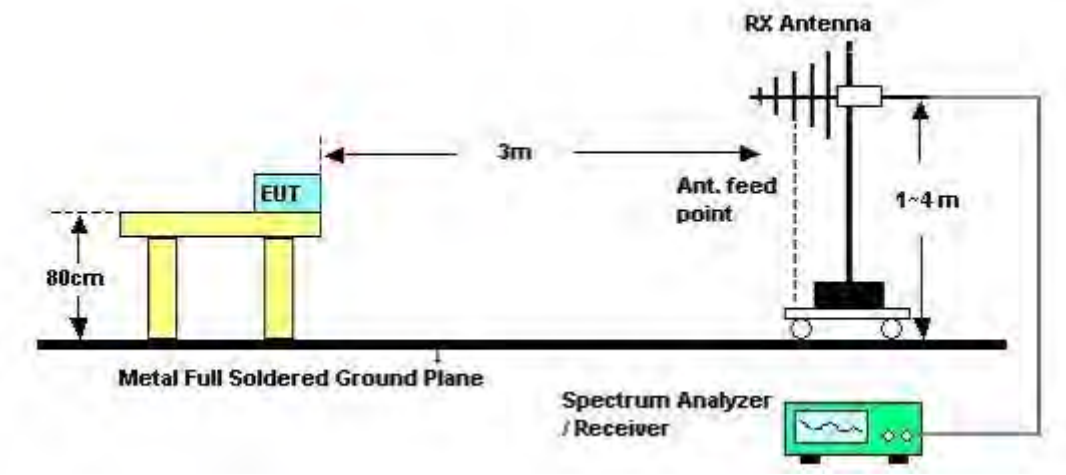
In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High – Low scan is not required in this case.

4.2.4. Test Setup Layout

For Radiated Emissions: 9kHz ~30MHz



For radiated emissions below 1GHz



4.2.5. Test Deviation

There is no deviation with the original standard.

4.2.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.2.7. Results of Radiated Emissions (9kHz~30MHz)

Temperature	23℃	Humidity	64%
Test Engineer	YC Chen	Configurations	Normal Link
Test Date	Sep. 14, 2013		

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Limit Line (dBuV)	Remark
-	-	-	-	See Note

Note:

The amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

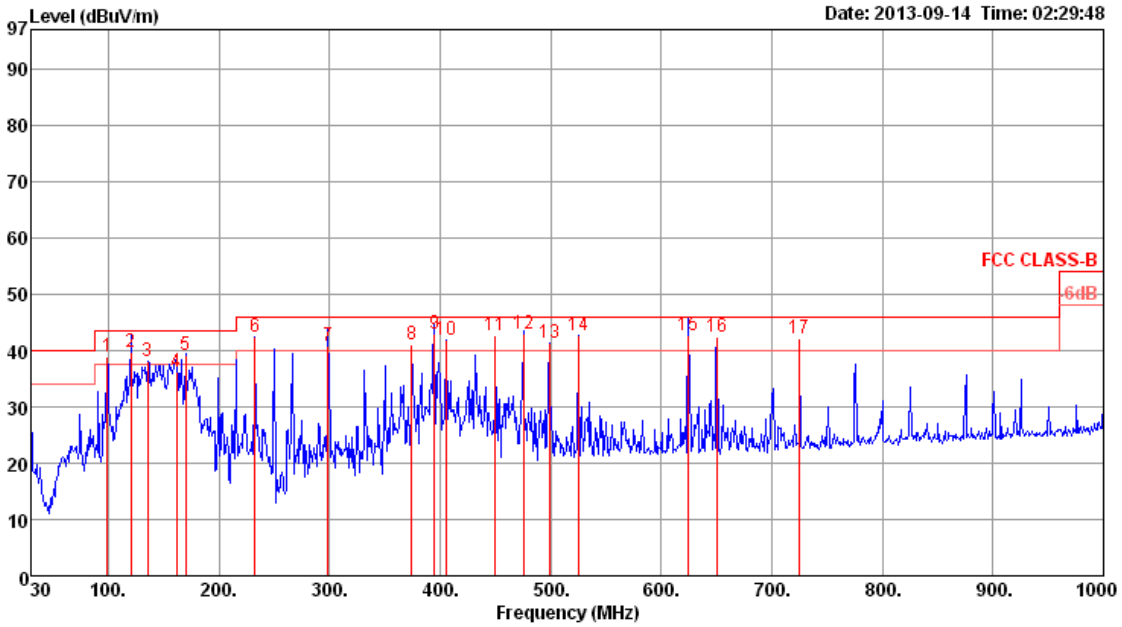
Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

4.2.8. Results of Radiated Emissions (Below 1GHz)

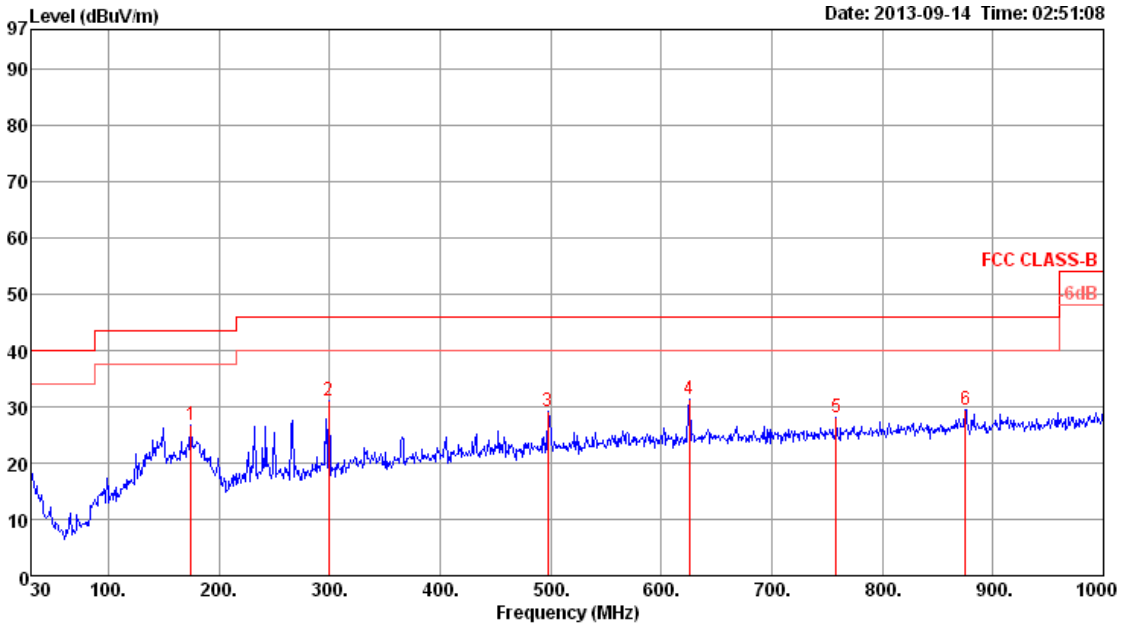
Temperature	23℃	Humidity	64%
Test Engineer	YC Chen	Configurations	Normal Link
Test Mode	Mode 11		

Horizontal



	Freq		Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	/m	/m	dB		dB	dB/m	dB		cm	deg	
1	98.87	39.04	43.50	-4.46	54.69	1.17	10.79	27.61	QP	100	201	HORIZONTAL
2	120.21	39.75	43.50	-3.75	53.42	1.30	12.53	27.50	QP	100	175	HORIZONTAL
3	135.73	38.08	43.50	-5.42	51.79	1.40	12.31	27.42	Peak	400	0	HORIZONTAL
4	161.92	36.08	43.50	-7.42	49.77	1.42	12.18	27.29	QP	100	257	HORIZONTAL
5	169.68	39.09	43.50	-4.41	52.10	1.48	12.76	27.25	QP	100	346	HORIZONTAL
6	232.73	42.29	46.00	-3.71	56.10	1.74	11.48	27.03	Peak	400	0	HORIZONTAL
7	298.69	40.88	46.00	-5.12	52.40	2.03	13.35	26.90	QP	117	119	HORIZONTAL
8	374.35	40.95	46.00	-5.05	50.79	2.20	15.38	27.42	QP	100	289	HORIZONTAL
9	394.72	42.88	46.00	-3.12	52.23	2.28	15.93	27.56	QP	100	109	HORIZONTAL
10	405.39	41.95	46.00	-4.05	51.11	2.32	16.15	27.63	Peak	400	0	HORIZONTAL
11	450.01	42.59	46.00	-3.41	51.13	2.47	16.84	27.85	QP	100	146	HORIZONTAL
12	475.23	42.93	46.00	-3.07	51.09	2.57	17.24	27.97	Peak	400	0	HORIZONTAL
13	498.51	41.26	46.00	-4.74	49.09	2.66	17.60	28.09	Peak	400	0	HORIZONTAL
14	524.70	42.81	46.00	-3.19	50.28	2.72	17.91	28.10	Peak	400	0	HORIZONTAL
15	624.61	42.79	46.00	-3.21	49.12	2.90	18.85	28.08	Peak	400	0	HORIZONTAL
16	650.80	42.49	46.00	-3.51	48.62	2.99	18.93	28.05	Peak	400	0	HORIZONTAL
17	725.49	42.18	46.00	-3.82	47.67	3.15	19.26	27.90	QP	125	69	HORIZONTAL

Vertical



	Freq	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	/m	/m	dB	dB	dB/m	dB		cm	deg	
1	174.53	26.66	43.50	-16.84	39.25	1.52	13.12	27.23 Peak	400	0	VERTICAL
2	299.66	31.19	46.00	-14.81	42.70	2.03	13.36	26.90 Peak	400	0	VERTICAL
3	497.54	29.07	46.00	-16.93	36.92	2.66	17.58	28.09 Peak	400	0	VERTICAL
4	625.58	31.31	46.00	-14.69	37.63	2.90	18.85	28.07 Peak	400	0	VERTICAL
5	758.47	28.06	46.00	-17.94	33.14	3.20	19.49	27.77 Peak	400	0	VERTICAL
6	874.87	29.57	46.00	-16.43	33.22	3.46	20.34	27.45 Peak	400	0	VERTICAL

Note:

The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

4.3. Antenna Requirements

4.3.1. Limit

Except for special regulations, the Low-power Radio-frequency Devices must not be equipped with any jacket for installing an antenna with extension cable. 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

4.3.2. Antenna Connector Construction

Please refer to section 3.4 in this test report; antenna connector complied with the requirements.

5. LIST OF MEASURING EQUIPMENTS

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
EMI Test Receiver	R&S	ESCS 30	100355	9kHz ~ 2.75GHz	Apr. 12, 2013	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150kHz ~ 100MHz	Nov. 26, 2012	Conduction (CO01-CB)
V- LISN	Schwarzbeck	NSLK 8127	8127478	9kHz ~ 30MHz	Jul. 17, 2013	Conduction (CO01-CB)
Impulsbegrenzer Pulse Limiter	Rohde&Schwarz	ESH3-Z2	100430	9kHz~30MHz	Feb. 21, 2013	Conduction (CO01-CB)
COND Cable	Woken	Cable	01	0.15MHz~30MHz	Dec. 04, 2012	Conduction (CO01-CB)
Software	Audix	E3	5.410e	-	-	Conduction (CO01-CB)
BILOG ANTENNA	Schaffner	CBL6112D	22021	20MHz ~ 2GHz	Apr. 16, 2013	Radiation (03CH01-CB)
Loop Antenna	Teseq	HLA 6120	24155	9 kHz - 30 MHz	Nov. 05, 2012*	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz~18GHz	Nov. 27, 2012	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10991	0.1MHz ~ 1.3GHz	Nov. 27, 2012	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSP40	100056	9kHz~40GHz	Nov. 16, 2012	Radiation (03CH01-CB)
EMI Test Receiver	R&S	ESCS 30	100355	9kHz ~ 2.75GHz	Apr. 15, 2013	Radiation (03CH01-CB)
Turn Table	INN CO	CO 2000	N/A	0 ~ 360 degree	N.C.R	Radiation (03CH01-CB)
Antenna Mast	INN CO	CO2000	N/A	1 m - 4 m	N.C.R	Radiation (03CH01-CB)
RF Cable-low	Woken	Low Cable-1	N/A	30 MHz - 1 GHz	Nov. 18, 2012	Radiation (03CH01-CB)

Note: Calibration Interval of instruments listed above is one year.

* Calibration Interval of instruments listed above is two years.

N.C.R. means Non-Calibration required.

6. TEST LOCATION

SHIJR	ADD	:	6Fl., No. 106, Sec. 1, Shintai 5th Rd., Shijr City, Taipei, Taiwan 221, R.O.C.
	TEL	:	886-2-2696-2468
	FAX	:	886-2-2696-2255
HWA YA	ADD	:	No. 52, Hwa Ya 1st Rd., Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.
	TEL	:	886-3-327-3456
	FAX	:	886-3-318-0055
LINKOU	ADD	:	No. 30-2, Dingfu Tsuen, Linkou Shiang, Taipei, Taiwan 244, R.O.C
	TEL	:	886-2-2601-1640
	FAX	:	886-2-2601-1695
DUNGHU	ADD	:	No. 3, Lane 238, Kangle St., Neihu Chiu, Taipei, Taiwan 114, R.O.C.
	TEL	:	886-2-2631-4739
	FAX	:	886-2-2631-9740
JUNGHE	ADD	:	7Fl., No. 758, Jungjeng Rd., Junghe City, Taipei, Taiwan 235, R.O.C.
	TEL	:	886-2-8227-2020
	FAX	:	886-2-8227-2626
NEIHU	ADD	:	4Fl., No. 339, Hsin Hu 2nd Rd., Taipei 114, Taiwan, R.O.C.
	TEL	:	886-2-2794-8886
	FAX	:	886-2-2794-9777
JHUBEI	ADD	:	No.8, Lane 724, Bo-ai St., Jhubei City, HsinChu County 302, Taiwan, R.O.C.
	TEL	:	886-3-656-9065
	FAX	:	886-3-656-9085

7. MEASUREMENT UNCERTAINTY

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

Contribution	Uncertainty of x_i			$u(x_i)$
	Value	Unit	Probability Distribution k	
Receiver reading	0.026	dB	normal(k=2)	0.013
Cable loss	0.002	dB	normal(k=2)	0.001
AMN/LISN specification	1.200	dB	normal(k=2)	0.600
Mismatch Receiver VSWR 1= AMN/LISN VSWR 2=	-0.080	dB	U-shaped	0.060
combined standard uncertainty Ue(y)	1.2			
Measuring uncertainty for a level of confidence of 95% U=2Ue(y)	2.4			

Uncertainty of Radiated Emission Measurement (30MHz ~ 1,000MHz)

Contribution	Uncertainty of x_i			$u(x_i)$
	Value	Unit	Probability Distribution k	
Receiver reading	0.1727	dB	normal(k=1)	0.1727
Cable loss	0.1736	dB	normal(k=2)	0.0868
Antenna gain	0.1687	dB	normal(k=2)	0.0843
Site imperfection	0.4898	dB	Triangular	0.2
Pre-amplifier gain	0.3661	dB	normal(k=2)	0.183
Transmitter antenna	1.7	dB	rectangular	0.9815
Signal generator	0.5	dB	rectangular	0.2887
Mismatch	0.08	dB	u-shape	0.244
Spectrum analyzer	0.5	dB	rectangular	0.2887
combined standard uncertainty Ue(y)	1.1434			
Measuring uncertainty for a level of confidence of 95% U=2Ue(y)	2.2869			

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