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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-RTL8723BE**
Manufacturer's company	**Realtek Semiconductor Corp.**
Manufacturer Address	No. 2,Innovation Road II, Hsinchu Science Park, Hsinchu 300,Taiwan

Product Name	802.11b/g/n RTL8723BE Combo module
Brand Name	REALTEK
Model Name	RTL8723BE
Test Rule	47 CFR FCC Part 15 Subpart C § 15.247
Test Freq. Range	2400 ~ 2483.5MHz
Received Date	Feb. 08, 2013
Final Test Date	Dec. 10, 2013
Submission Type	Class II Change

Statement

Test result included is only for the Bluetooth LE part 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** and **47 CFR FCC Part 15 Subpart C**.

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

Testing Laboratory
1190

Table of Contents

History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR322105-14AC	Rev. 01	Initial issue of report	Dec. 09, 2013

Certificate No.: CB10211156

1. CERTIFICATE OF COMPLIANCE

Product Name	:	802.11b/g/n RTL8723BE Combo module
Brand Name	:	REALTEK
Model No.	:	RTL8723BE
Applicant	:	Realtek Semiconductor Corp.
Test Rule Part(s)	:	47 CFR FCC Part 15 Subpart C § 15.247

Sporton International as requested by the applicant to evaluate the EMC performance of the product sample received on Feb. 08, 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 C				
Part	**Rule Section**	**Description of Test**	**Result**	**Under Limit**
4.1	15.207	AC Power Line Conducted Emissions	Complies	12.97 dB
4.2	15.247(b)(1)	Maximum Conducted Output Power	Complies	21.91 dB
4.3	15.247(d)	Radiated Emissions	Complies	3.89 dB
4.4	15.247(d)	Band Edge Emissions	Complies	6.81dB
4.5	15.203	Antenna Requirements	Complies	-

3. GENERAL INFORMATION

3.1. Product Details

Items	Description
Power Type	From host sysytem
Modulation	DSSS
Data Rate (Mbps)	GFSK: 1
Frequency Range	2400 ~ 2483.5MHz
Channel Number	40 (37 hopping + 3 advertising channel)
Channel Band Width (99%)	1.06 MHz
Maximum Conducted Output Power	8.09 dBm
Carrier Frequencies	Please refer to section 3.4
Antenna	Please refer to section 3.3

3.2. Accessories

N/A

3.3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	Remark
1	LYNwave	ALA110-222050-300011	PIFA Antenna	I-PEX MHF4	3.5	For NGFF Board
2	LYNwave	ALA110-222050-300010	PIFA Antenna	I-PEX	3.5	For HMC Board
3	JOYMAX	TWF-614XMPXX-500	Dipole Antenna	I-PEX	3	For HMC Board

This project added three configurations of EUT. The more information is listed as below table.

Configuration	Type	Power Type	Antenna Variety	Type of Antenna
1	HMC	USB (WLAN)	Fixed	PIFA with I-PEX connector
		USB (Bluetooth)		Dipole with I-PEX connector
2	NGFF	PCI-E (WLAN)	Fixed	PIFA with I-PEX MHF4 connector
		USB (Bluetooth)		
3	NGFF	SDIO (WLAN)	Fixed	PIFA with I-PEX MHF4 connector
		UART (Bluetooth)		

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

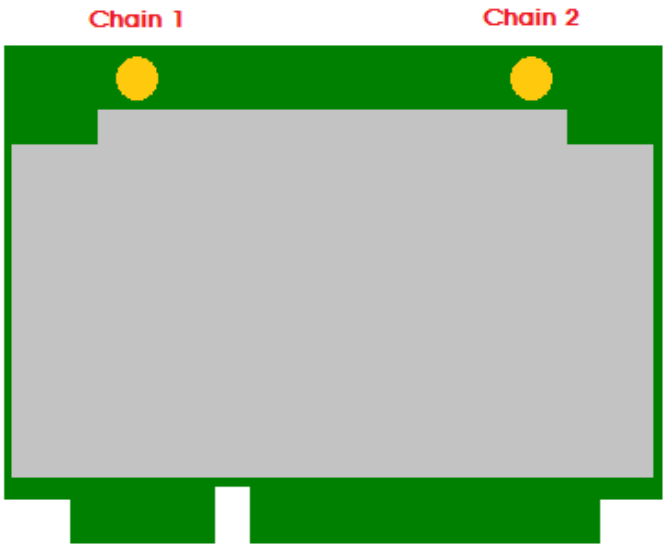
For fixed type: (Chain 1 is designated for WLAN function, Chain 2 is designated for Bluetooth function.)

For WLAN 802.11b/g/n (1TX, 1RX) mode:

Chain 1 can be used as transmitting/receiving antenna.

For Bluetooth mode:

Chain 2 can be used as transmitting/receiving antenna.



3.4. Table for Carrier Frequencies

Frequency Band	Channel No.	Frequency	Channel No.	Frequency
2400~2483.5MHz	0	2402 MHz	20	2442 MHz
	1	2404 MHz	:	:
	2	2406 MHz	37	2476 MHz
	:	:	38	2478 MHz
	18	2438 MHz	39	2480 MHz
	19	2440 MHz	-	-

3.5. Table for Class II Change

This product is an extension of original report under Sporton project number: FR322105AC
Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
For HMC Fixed type: In addition to PCI-E interface for WLAN power type, also utilize USB interface. New power type of WLAN & BT both utilize USB interface.	1. Conducted Emissions 2. Radiated Emissions (Below 1GHz)
For NGFF Fixed type: Changing antenna connector location.	1. Conducted Emissions 2. Maximum Conducted Output Power 3. Radiated Emissions 4. Emissions Measurement 5. Co-location

There is no change in existing RF relevant portion.

3.6. 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 Line Conducted Emissions	Normal Link	-	-	-
Maximum Conducted Output Power Power Spectral Density	GFSK	1 Mbps	0/20/39	1
Radiated Emissions 9kHz~1GHz	Normal Link	-	-	-
Radiated Emissions 1GHz~10th Harmonic	GFSK	1 Mbps	0/20/39	1
Band Edge Emissions	GFSK	1 Mbps	0/20/39	1

The following test modes were performed for all tests:

For Conducted Emission test:

Mode 1. HMC+ USB(WLAN)/USB(Bluetooth) for Power Type + Fixed+ PIFA with I-PEX connector

Mode 2. HMC+ USB(WLAN)/USB(Bluetooth) for Power Type + Fixed+ Dipole with I-PEX connector

Mode 3. NGFF+ PCI-E(WLAN)/USB(Bluetooth) for Power Type + Fixed + PIFA with I-PEX MHF4 connector

Mode 4. NGFF+ SDIO(WLAN)/UART(Bluetooth) for Power Type + Fixed + PIFA with I-PEX MHF4 connector

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

For Radiated Emission test below 1GHz:

Mode 1. HMC+ USB(WLAN)/USB(Bluetooth) for Power Type + Fixed+ PIFA with I-PEX connector

Mode 2. HMC+ USB(WLAN)/USB(Bluetooth) for Power Type + Fixed+ Dipole with I-PEX connector

Mode 3. NGFF+ PCI-E(WLAN)/USB(Bluetooth) for Power Type + Fixed + PIFA with I-PEX MHF4 connector

Mode 4. NGFF+ SDIO(WLAN)/UART(Bluetooth) for Power Type + Fixed + PIFA with I-PEX MHF4 connector

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

For Radiated Emission test above1GHz:

Mode 1. NGFF+ PCI-E(WLAN)/USB(Bluetooth) for Power Type + Fixed + PIFA with I-PEX MHF4 connector

Mode 2. NGFF+ SDIO(WLAN)/UART(Bluetooth) for Power Type + Fixed + PIFA with I-PEX MHF4 connector

Mode 2 generated the worst test result, so it was recorded in this report.

For Co-location Test:

Mode 1. WLAN + Bluetooth

For Co-location Test:

The EUT could be applied with 2.4GHz WLAN and Bluetooth function; Co-location (please refer to Appendix B) tests are added for simultaneously transmit between 2.4GHz WLAN and Bluetooth function.

3.7. Table for Testing Locations

Test Site No.	Site Category	Location	FCC Reg. No.	IC File No.
03CH01-CB	SAC	Hsin Chu	262045	IC 4086D
CO01-CB	Conduction	Hsin Chu	262045	IC 4086D
TH01-CB	OVEN Room	Hsin Chu	-	-

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

Please refer section 6 for Test Site Address.

3.8. Table for Supporting Units

For Test Site No : CO01-CB

Support Unit	Brand	Model	FCC ID
Wireless AP	Planex	GW-AP54SGX	N/A
NB	DELL	E6430	DoC
NB	DELL	E6220	DoC
Mouse	Logitech	M-U0026	DoC
Earphone	SHYARO CHI	MIC-04	N/A
The test fixture	Realtek	PCIE Adapter	N/A

For Test Site No : 03CH01-CB (Below 1GHz)

Support Unit	Brand	Model	FCC ID
NB	DELL	E6430	DoC
Mouse	Logitech	M-U0026	DoC
Earphone	E-BOOKI	E-EPC040	N/A
Wireless AP	Planex	GW-AP54SGX	N/A
NB	DELL	D420	E2KWM3945ABG
The test fixture	Realtek	PCIE Adapter	N/A

For Test Site No : 03CH01-CB (Above 1GHz)

Support Unit	Brand	Model	FCC ID
NB	DELL	D420	E2KWM3945ABG
The test fixture	Realtek	PCIE Adapter	N/A

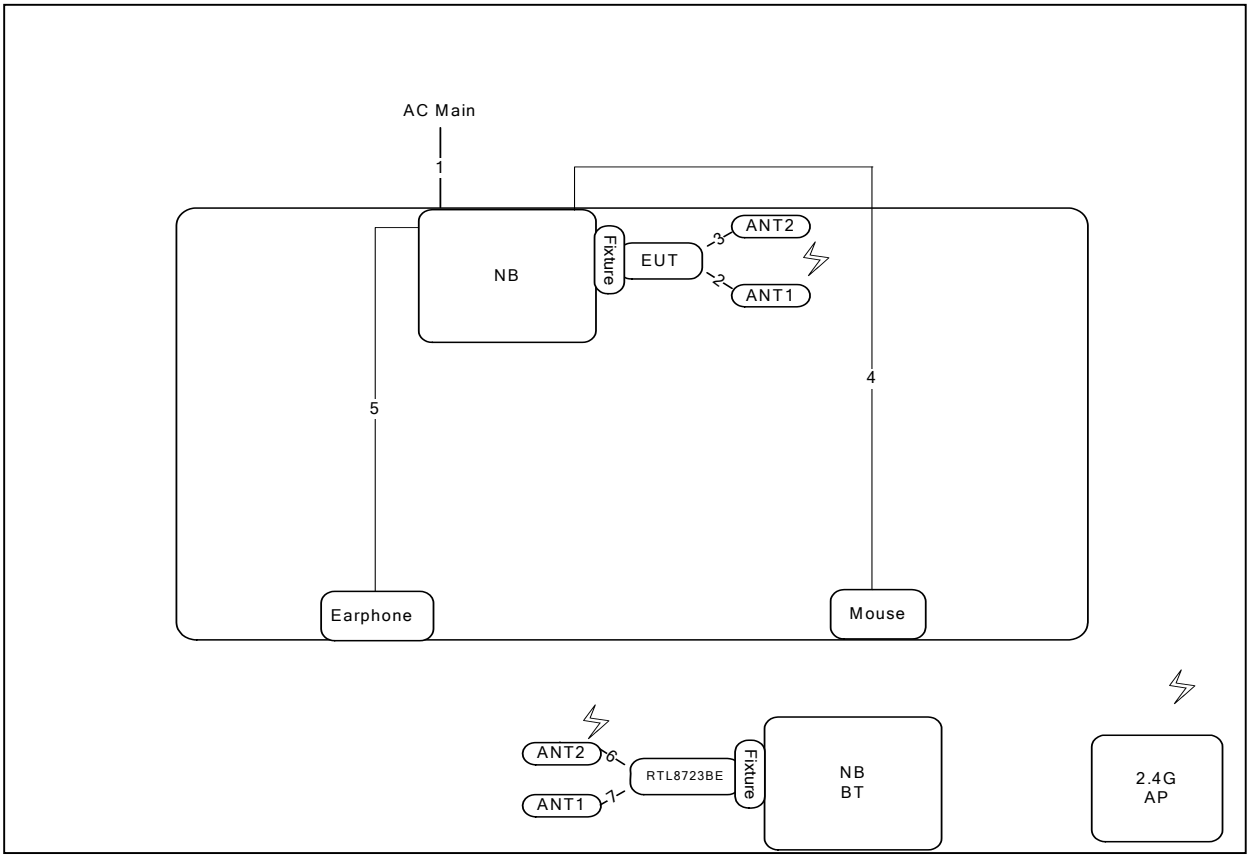
For Test Site No : TH01-CB

Support Unit	Brand	Model	FCC ID
Notebook	DELL	M1330	E2KWM3945ABG
The test fixture	Realtek	PCIE Adapter	N/A

3.9. Test Configurations

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

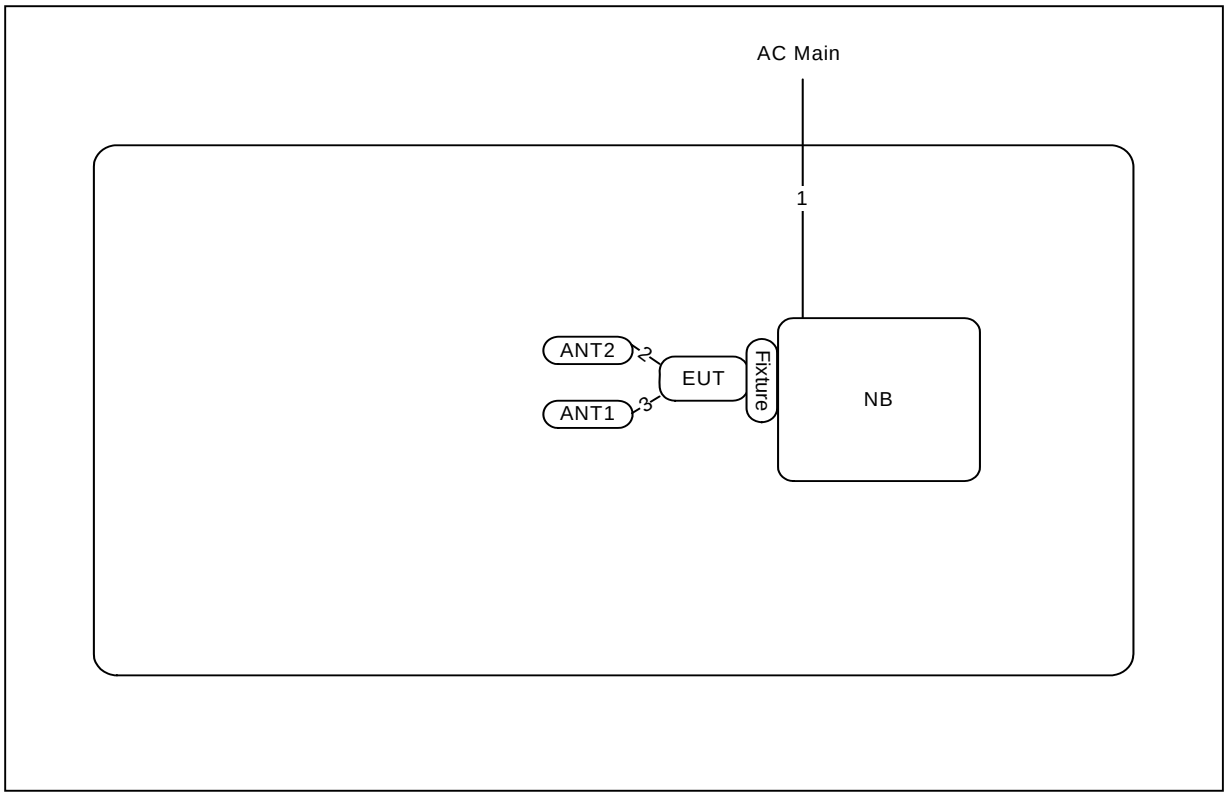
Test Mode : Mode 1



Item	Connection	Shield	Length
1	Power cable	No	2.6m
2	PIFA ANT cable	Yes	0.3m
3	PIFA ANT cable	Yes	0.3m
4	USB cable	Yes	1.8m
5	Audio cable	No	1.1m
6	PIFA ANT cable	Yes	0.3m
7	PIFA ANT cable	Yes	0.3m

Test Configuration: above 1GHz

Test Mode : Mode 2



Item	Connection	Shield	Length
1	Power cable	No	2.6m
2	PIFA ANT cable	Yes	0.3m
3	PIFA ANT cable	Yes	0.3m

4. TEST RESULT

4.1. AC Power Line Conducted Emissions Measurement

4.1.1. Limit

For a Low-power Radio-frequency Device which is designed to be connected 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

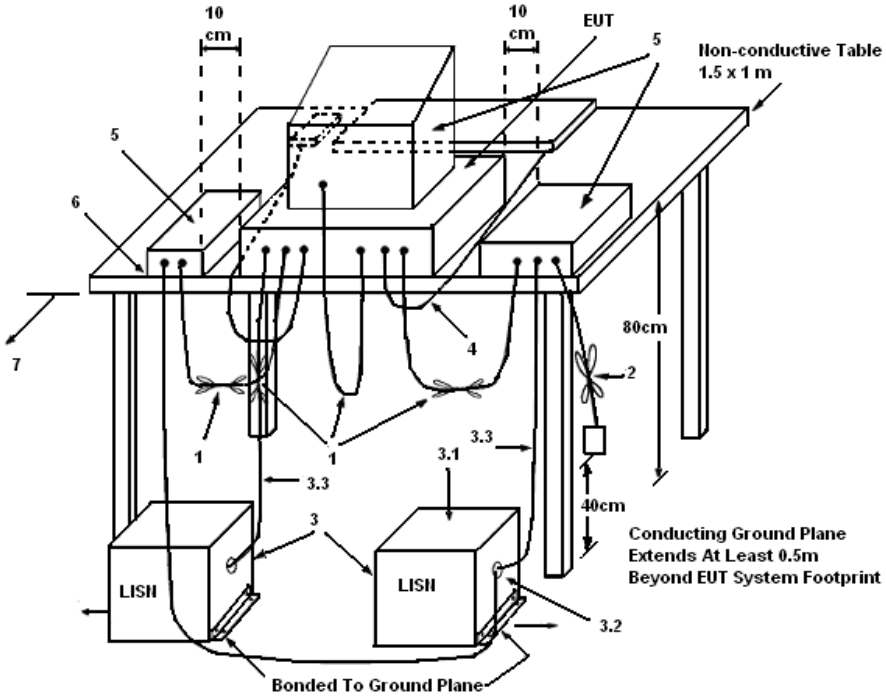
Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

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

4.1.3. Test Procedures

1. 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.
2. Connect EUT or host of EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connected to the other LISNs. The LISN should provide 50uH/50ohms coupling impedance.
4. The frequency range from 150 kHz to 30 MHz was searched.
5. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. 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

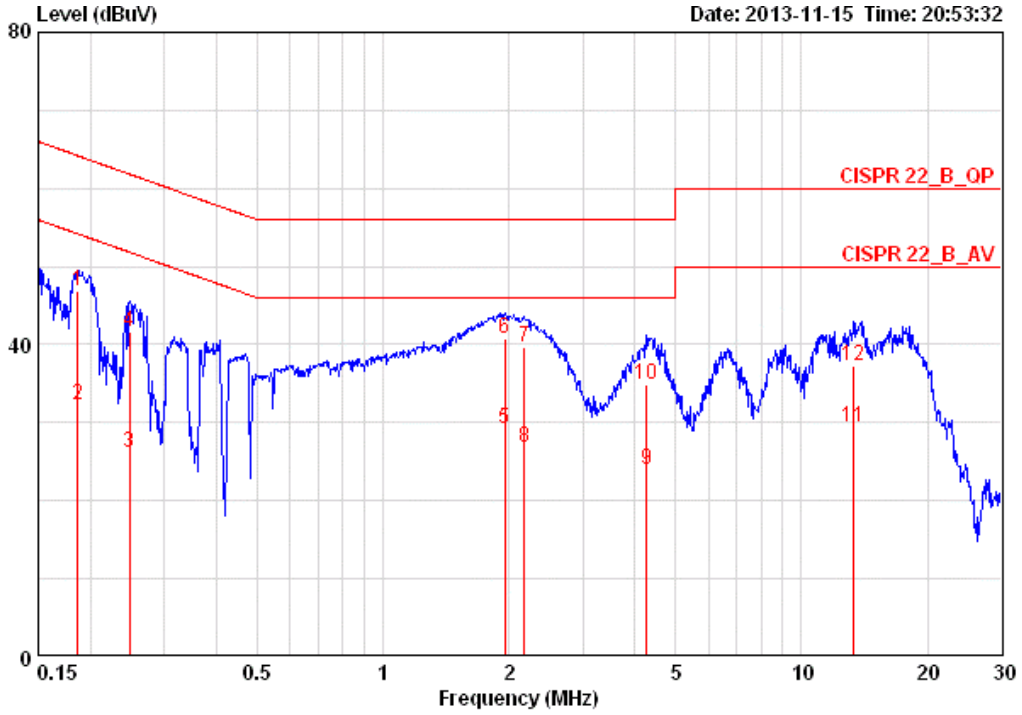
There is no deviation with the original standard.

4.1.6. EUT Operation during Test

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

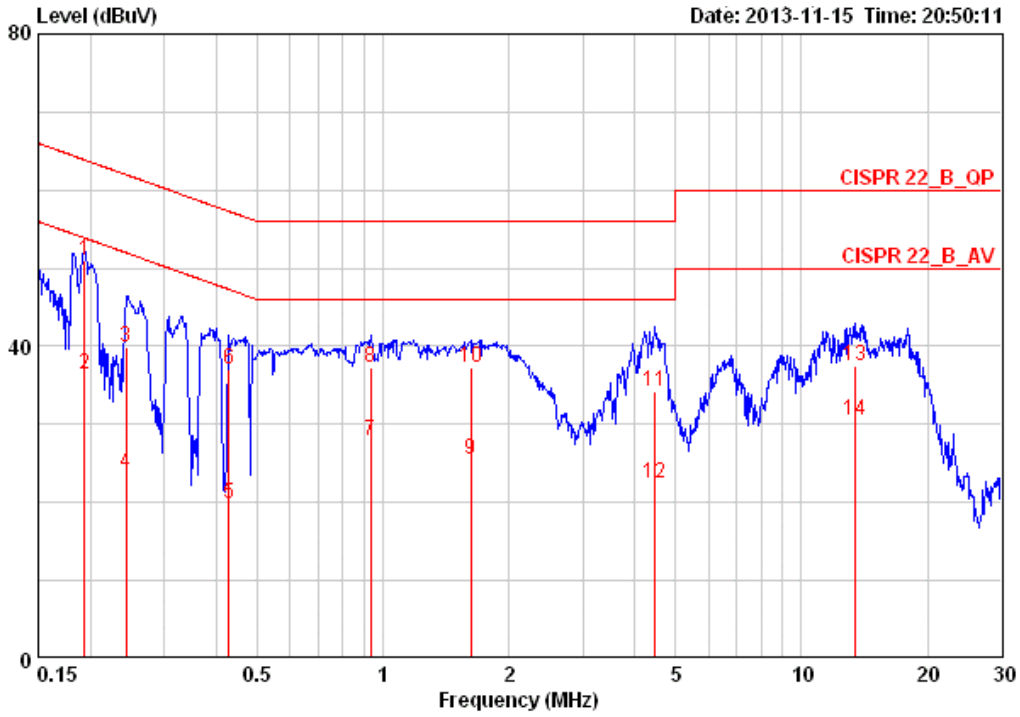
4.1.7. Results of AC Power Line Conducted Emissions Measurement

Temperature	25°C	Humidity	61%
Test Engineer	Ryo Fan	Phase	Line
Configuration	Normal Link / Mode 1		



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	0.18640	46.79	-17.40	64.20	46.45	0.15	0.19	LINE	QP
2	0.18640	32.27	-21.92	54.20	31.93	0.15	0.19	LINE	AVERAGE
3	0.24814	26.12	-25.70	51.82	25.77	0.15	0.20	LINE	AVERAGE
4	0.24814	41.56	-20.26	61.82	41.21	0.15	0.20	LINE	QP
5	1.959	29.18	-16.82	46.00	28.76	0.19	0.23	LINE	AVERAGE
6 @	1.959	40.86	-15.14	56.00	40.44	0.19	0.23	LINE	QP
7	2.178	39.73	-16.27	56.00	39.30	0.20	0.23	LINE	QP
8	2.178	26.88	-19.12	46.00	26.45	0.20	0.23	LINE	AVERAGE
9	4.269	23.95	-22.05	46.00	23.36	0.28	0.31	LINE	AVERAGE
10	4.269	34.92	-21.08	56.00	34.33	0.28	0.31	LINE	QP
11	13.337	29.54	-20.46	50.00	28.69	0.45	0.40	LINE	AVERAGE
12	13.337	37.35	-22.65	60.00	36.50	0.45	0.40	LINE	QP

Temperature	25°C	Humidity	61%
Test Engineer	Ryo Fan	Phase	Neutral
Configuration	Normal Link / Mode 1		



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1 @	0.19344	50.92	-12.97	63.89	50.65	0.07	0.20	NEUTRAL	QP
2	0.19344	36.46	-17.43	53.89	36.19	0.07	0.20	NEUTRAL	AVERAGE
3	0.24293	39.90	-22.10	62.00	39.63	0.07	0.20	NEUTRAL	QP
4	0.24293	23.67	-28.33	52.00	23.40	0.07	0.20	NEUTRAL	AVERAGE
5	0.42825	19.90	-27.39	47.29	19.63	0.07	0.20	NEUTRAL	AVERAGE
6	0.42825	37.15	-20.14	57.29	36.88	0.07	0.20	NEUTRAL	QP
7	0.93314	27.84	-18.16	46.00	27.58	0.08	0.18	NEUTRAL	AVERAGE
8	0.93314	37.34	-18.66	56.00	37.08	0.08	0.18	NEUTRAL	QP
9	1.619	25.40	-20.60	46.00	25.08	0.10	0.22	NEUTRAL	AVERAGE
10	1.619	37.22	-18.78	56.00	36.90	0.10	0.22	NEUTRAL	QP
11	4.478	34.17	-21.83	56.00	33.72	0.14	0.31	NEUTRAL	QP
12	4.478	22.49	-23.51	46.00	22.04	0.14	0.31	NEUTRAL	AVERAGE
13	13.479	37.54	-22.46	60.00	36.81	0.33	0.40	NEUTRAL	QP
14	13.479	30.59	-19.41	50.00	29.86	0.33	0.40	NEUTRAL	AVERAGE

Note:

Level = Read Level + LISN Factor + Cable Loss.

4.2. Maximum Conducted Output Power Measurement

4.2.1. Limit

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, the limit for peak output power is 1Watt (30dBm). For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts (21dBm). The limited has to be reduced by the amount in dB that the gain of the antenna exceed 6dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

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 the power meter.

Power Meter Parameter	Setting
Bandwidth	50MHz bandwidth is greater than the EUT emission bandwidth
Detector	Average

4.2.3. Test Procedures

This procedure provides an alternative for determining the RMS output power using a broadband RF average power meter with a thermocouple detector.

4.2.4. Test Setup Layout

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. Test Result of Maximum Conducted Output Power

Temperature	25°C	Humidity	56%
Test Engineer	Denis Su	Configurations	GFSK
Test Date	Mar. 21, 2013		

Channel	Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
0	2402 MHz	8.06	30.00	Complies
20	2442 MHz	8.09	30.00	Complies
39	2480 MHz	7.86	30.00	Complies

4.3. Radiated Emissions Measurement

4.3.1. Limit

20dBc in any 100 kHz bandwidth outside the operating frequency band. 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

4.3.2. 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	10th carrier harmonic
RBW / VBW (Emission in restricted band)	1MHz / 3MHz for Peak, 1MHz / 10Hz for Average
RBW / VBW (Emission in non-restricted band)	100kHz / 300kHz for peak

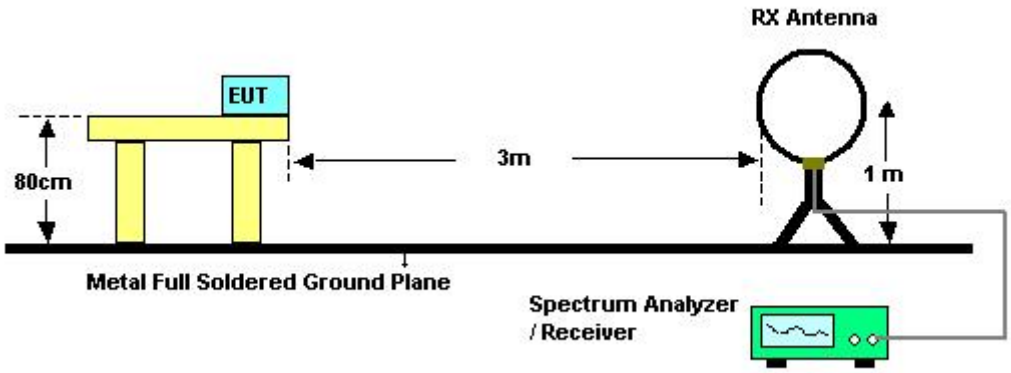
Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RBW 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RBW 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RBW 120kHz for QP

4.3.3. Test Procedures

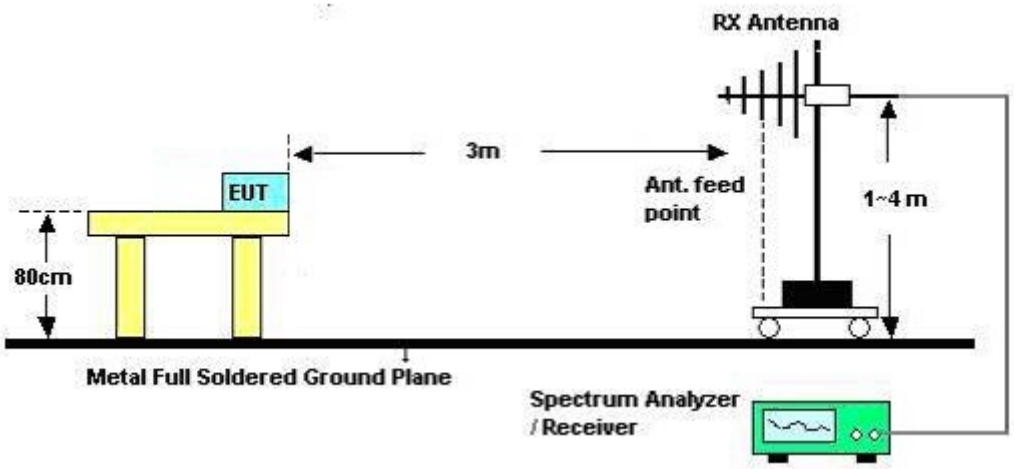
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. 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.
4. 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.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and 3MHz RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer.
7. 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.
8. 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.
9. 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.
10. 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.

4.3.4. Test Setup Layout

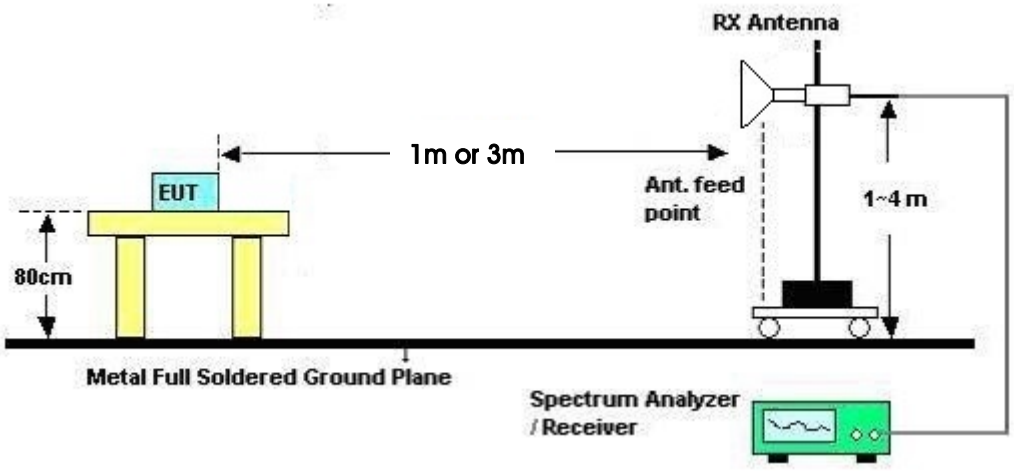
For Radiated Emissions: 9kHz ~30MHz



For radiated emissions below 1GHz



For radiated emissions above 1GHz



4.3.5. Test Deviation

There is no deviation with the original standard.

4.3.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

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

Temperature	20°C	Humidity	60%
Test Engineer	Benson Peng	Configurations	Normal Link
Test Date	Nov. 22, 2013		

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

Note:

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

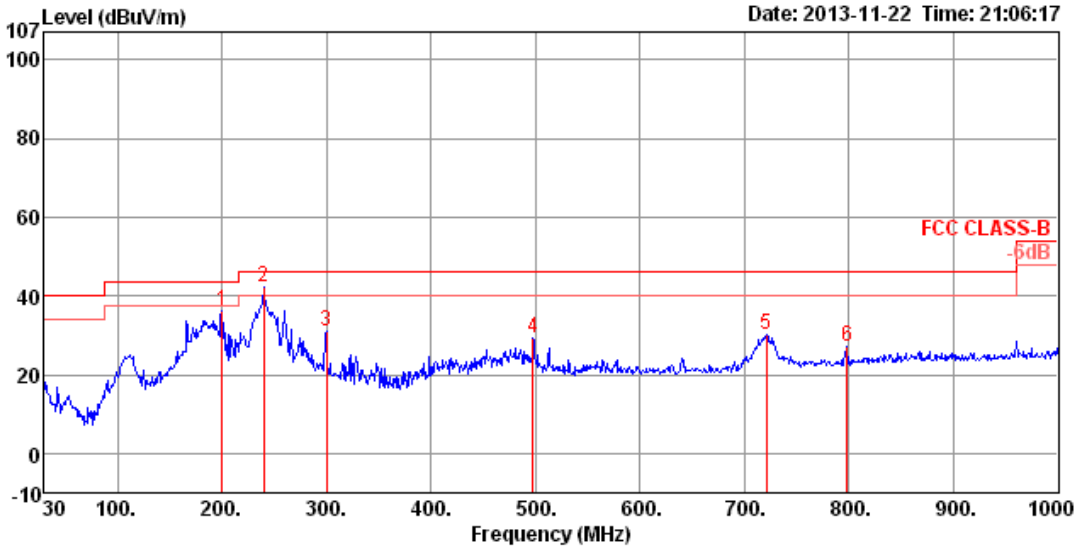
Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

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

4.3.8. Results of Radiated Emissions (30MHz~1GHz)

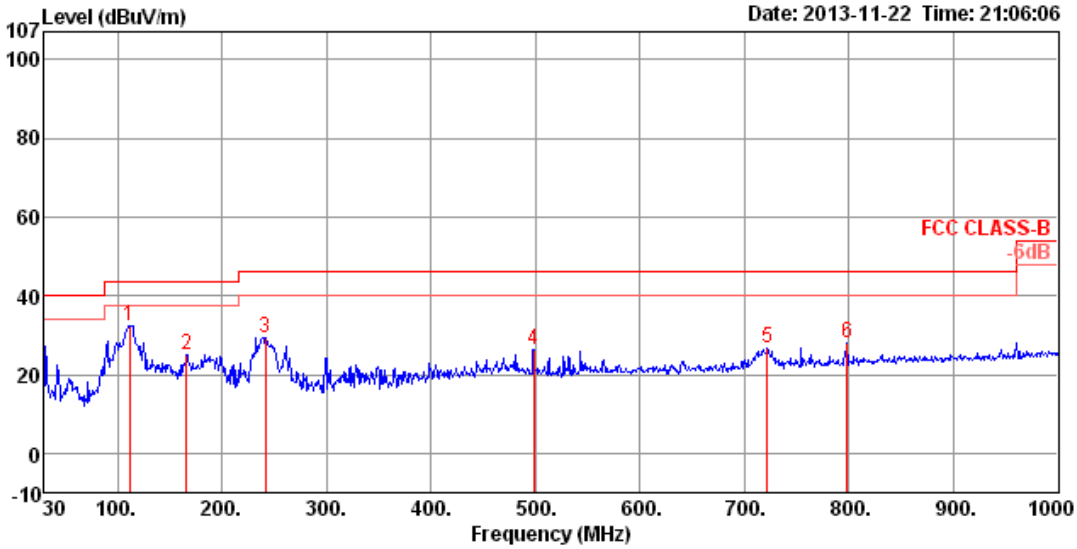
Temperature	20°C	Humidity	60%
Test Engineer	Benson Peng	Configurations	Normal Link / Mode 1

Horizontal



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	199.75	36.17	43.50	-7.33	57.23	1.70	8.75	31.51	150	173	HORIZONTAL	Peak
2	239.52	42.11	46.00	-3.89	60.88	1.86	10.81	31.44	150	165	HORIZONTAL	Peak
3	299.66	30.85	46.00	-15.15	47.12	2.13	13.02	31.42	100	19	HORIZONTAL	Peak
4	497.54	29.34	46.00	-16.66	41.04	2.81	16.88	31.39	200	115	HORIZONTAL	Peak
5	720.64	30.30	46.00	-15.70	38.79	3.45	19.30	31.24	125	97	HORIZONTAL	Peak
6	798.24	26.94	46.00	-19.06	34.79	3.67	19.76	31.28	100	142	HORIZONTAL	Peak

Vertical



	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	111.48	32.52	43.50	-10.98	51.39	1.26	11.41	31.54	100	305	VERTICAL	Peak
2	165.80	25.14	43.50	-18.36	45.74	1.56	9.38	31.54	300	99	VERTICAL	Peak
3	241.46	29.36	46.00	-16.64	47.94	1.87	11.00	31.45	200	79	VERTICAL	Peak
4	498.51	26.21	46.00	-19.79	37.90	2.81	16.90	31.40	150	105	VERTICAL	Peak
5	721.61	26.61	46.00	-19.39	35.08	3.45	19.33	31.25	150	86	VERTICAL	Peak
6	798.24	27.80	46.00	-18.20	35.65	3.67	19.76	31.28	150	176	VERTICAL	Peak

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB 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.

4.3.9. Results for Radiated Emissions (1GHz~10th Harmonic)

Temperature	20°C	Humidity	60%
Test Engineer	YC Chen	Configurations	Channel 0 / Mode 2
Test Date	Sep. 03, 2013		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4803.53	32.73	54.00	-21.27	29.62	5.66	32.74	35.29	100	219	HORIZONTAL	Average
2	4803.56	43.61	74.00	-30.39	40.50	5.66	32.74	35.29	100	219	HORIZONTAL	Peak

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4803.06	32.65	54.00	-21.35	29.54	5.66	32.74	35.29	100	172	VERTICAL	Average
2	4803.09	44.21	74.00	-29.79	41.10	5.66	32.74	35.29	100	172	VERTICAL	Peak

Temperature	20℃	Humidity	60%
Test Engineer	YC Chen	Configurations	Channel 20 / Mode 2
Test Date	Sep. 03, 2013		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4881.05	43.57	74.00	-30.43	40.33	5.76	32.80	35.32	100	231	HORIZONTAL	Peak
2	4881.24	32.61	54.00	-21.39	29.36	5.76	32.81	35.32	100	231	HORIZONTAL	Average
3	7324.39	38.12	54.00	-15.88	29.28	7.06	37.13	35.35	100	350	HORIZONTAL	Average
4	7326.69	49.94	74.00	-24.06	41.10	7.06	37.13	35.35	100	350	HORIZONTAL	Peak

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4879.87	32.83	54.00	-21.17	29.60	5.75	32.80	35.32	100	256	VERTICAL	Average
2	4879.91	44.94	74.00	-29.06	41.71	5.75	32.80	35.32	100	256	VERTICAL	Peak
3	7323.53	49.90	74.00	-24.10	41.06	7.06	37.13	35.35	100	288	VERTICAL	Peak
4	7323.61	38.07	54.00	-15.93	29.23	7.06	37.13	35.35	100	288	VERTICAL	Average

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.

Temperature	20℃	Humidity	60%
Test Engineer	YC Chen	Configurations	Channel 39 / Mode 2
Test Date	Sep. 03, 2013		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4959.91	33.31	54.00	-20.69	29.94	5.85	32.87	35.35	100	227	HORIZONTAL	Average
2	4960.07	43.96	74.00	-30.04	40.59	5.85	32.87	35.35	100	227	HORIZONTAL	Peak
3	7439.32	50.02	74.00	-23.98	41.03	7.11	37.17	35.29	100	278	HORIZONTAL	Peak
4	7439.48	37.52	54.00	-16.48	28.53	7.11	37.17	35.29	100	278	HORIZONTAL	Average

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4961.03	32.82	54.00	-21.18	29.45	5.85	32.87	35.35	100	91	VERTICAL	Average
2	4961.33	45.60	74.00	-28.40	42.23	5.85	32.87	35.35	100	91	VERTICAL	Peak
3	7439.39	37.61	54.00	-16.39	28.62	7.11	37.17	35.29	100	153	VERTICAL	Average
4	7439.53	48.54	74.00	-25.46	39.55	7.11	37.17	35.29	100	23	VERTICAL	Peak

4.4. Emissions Measurement

4.4.1. Limit

20dBc in any 100 kHz bandwidth outside the operating frequency band. 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

4.4.2. Measuring Instruments and Setting

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

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	100 MHz
RBW / VBW (Emission in restricted band)	1MHz / 3MHz for Peak, 1MHz / 10Hz for Average
RBW / VBW (Emission in non-restricted band)	100 kHz /100 kHz for Peak

4.4.3. Test Procedures

For Radiated band edges Measurement:

1. The test procedure is the same as section 4.3.3, only the frequency range investigated is limited to 100MHz around band edges.

For Radiated Out of Band Emission Measurement:

1. The radiated emission test is performed on each TX port of operating mode without summing or adding 10log (N) since the limit is relative emission limit.
   Only worst data of each operating mode is presented.

4.4.4. Test Setup Layout

For Radiated band edges Measurement:

This test setup layout is the same as that shown in section 4.3.4.

For Radiated Out of Band Emission Measurement:

This test setup layout is the same as that shown in section 4.3.4.

4.4.5. Test Deviation

There is no deviation with the original standard.

4.4.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.4.7. Test Result of Band Edge and Fundamental Emissions

Temperature	20°C	Humidity	60%
Test Engineer	YC Chen	Configurations	Channel 0, 20, 39 / Mode 2
Test Date	Sep. 03, 2013		

Channel 0

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	2374.10	41.97	54.00	-12.03	10.40	3.67	27.90	0.00	134	97	HORIZONTAL	Average
2	2389.20	62.37	74.00	-11.63	30.79	3.68	27.90	0.00	134	97	HORIZONTAL	Peak
3	2401.80	107.22			75.63	3.69	27.90	0.00	134	97	HORIZONTAL	Peak
4	2402.00	102.32			70.73	3.69	27.90	0.00	134	97	HORIZONTAL	Average

Item 3, 4 are the fundamental frequency at 2402 MHz.

Channel 20

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	2359.80	56.60	74.00	-17.40	25.04	3.66	27.90	0.00	134	114	HORIZONTAL	Peak
2	2360.00	47.19	54.00	-6.81	15.63	3.66	27.90	0.00	134	114	HORIZONTAL	Average
3	2439.80	104.77			73.16	3.71	27.90	0.00	134	114	HORIZONTAL	Peak
4	2439.97	99.89			68.28	3.71	27.90	0.00	134	114	HORIZONTAL	Average
5	2492.50	41.16	54.00	-12.84	9.52	3.74	27.90	0.00	134	114	HORIZONTAL	Average
6	2496.90	56.98	74.00	-17.02	25.34	3.74	27.90	0.00	134	114	HORIZONTAL	Peak

Item 3, 4 are the fundamental frequency at 2442 MHz.

Channel 39

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	2479.80	99.51			67.88	3.73	27.90	0.00	132	103	HORIZONTAL	Average
2	2480.00	104.66			73.03	3.73	27.90	0.00	132	103	HORIZONTAL	Peak
3	2483.50	42.22	54.00	-11.78	10.59	3.73	27.90	0.00	132	103	HORIZONTAL	Average
4	2483.50	58.67	74.00	-15.33	27.04	3.73	27.90	0.00	132	103	HORIZONTAL	Peak

Item 1, 2 are the fundamental frequency at 2480 MHz.

Note:

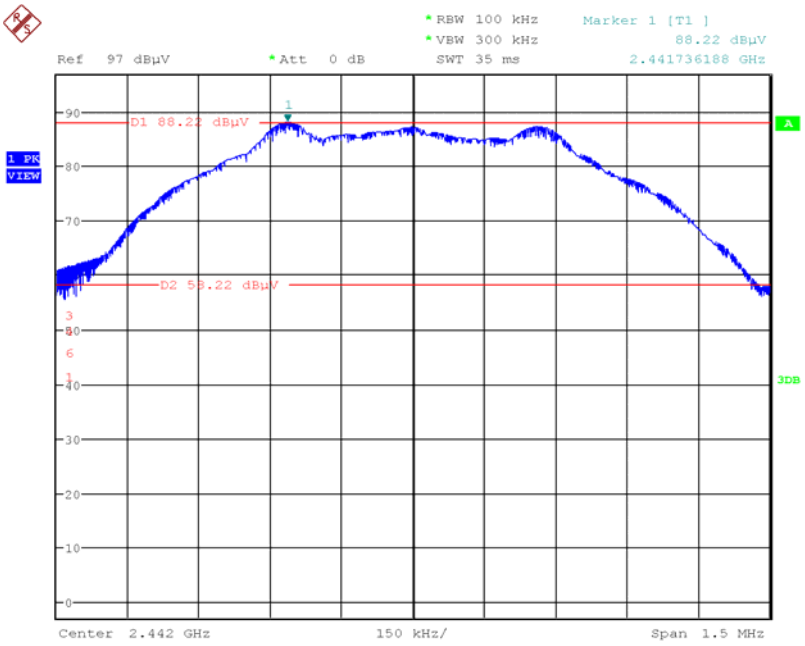
Emission level (dBuV/m) = 20 log Emission level (uV/m).

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

For Emission not in Restricted Band

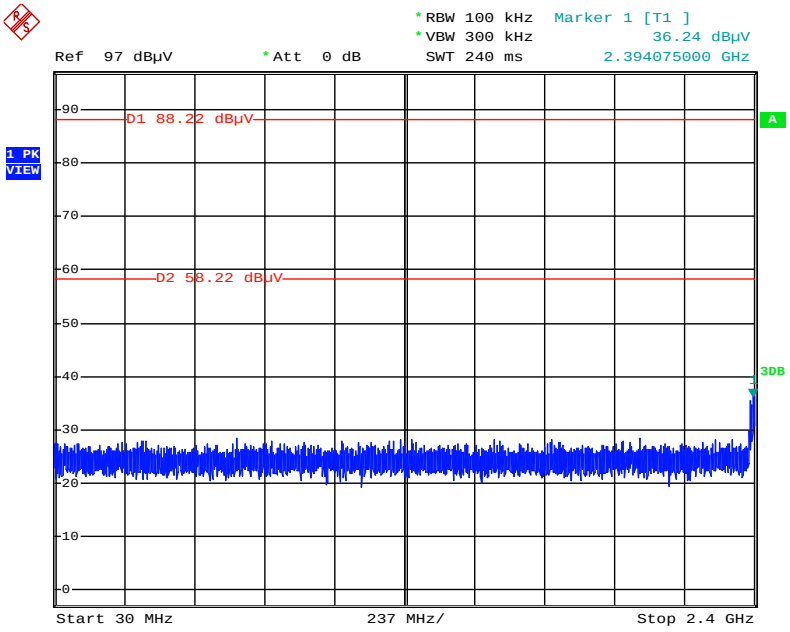
For Mode 2

Plot on Configuration / Reference Level



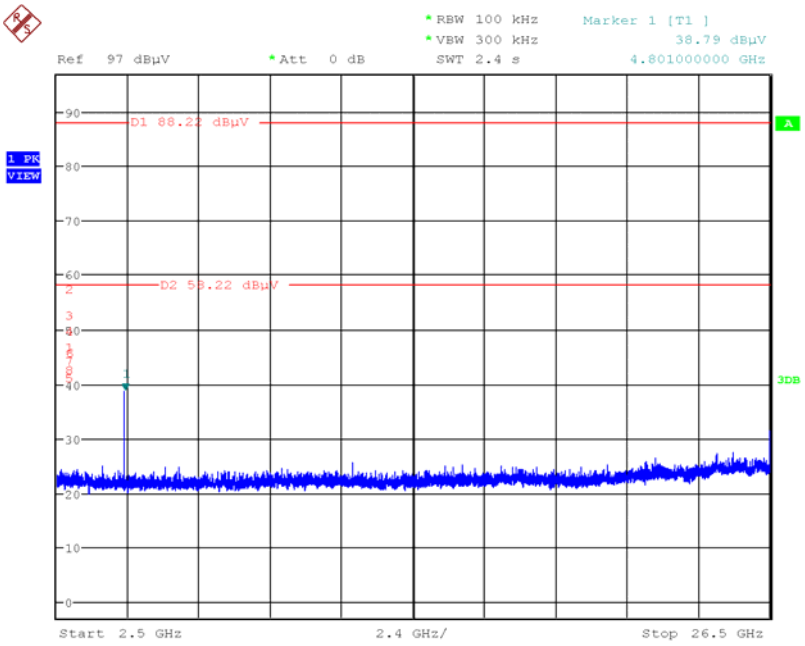
Date: 7.SEP.2013 01:09:13

Plot on Configuration For Bluetooth 4.0 / Channel 0 / 30MHz~2400MHz (down 30dBc)



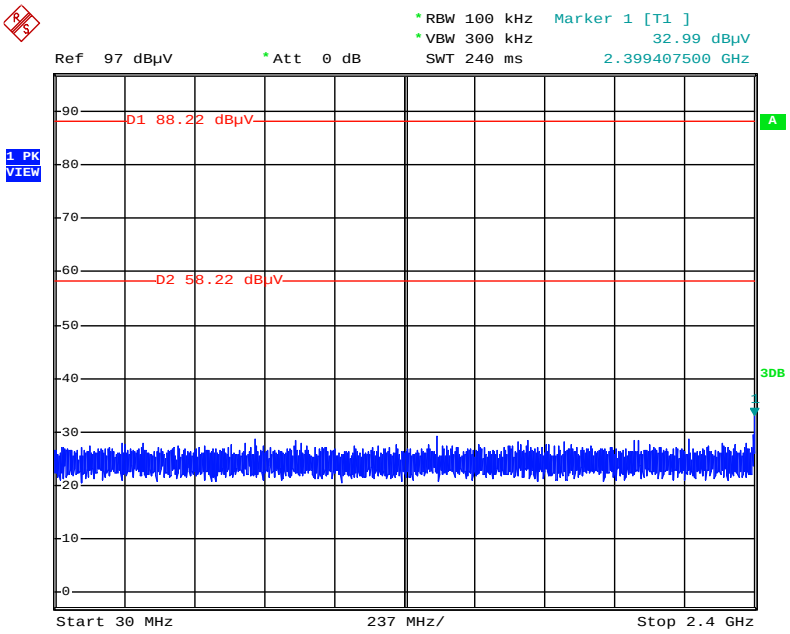
Date: 10.DEC.2013 02:32:24

Plot on Configuration For Bluetooth 4.0 / Channel 0 / 2500MHz~26500MHz (down 30dBc)



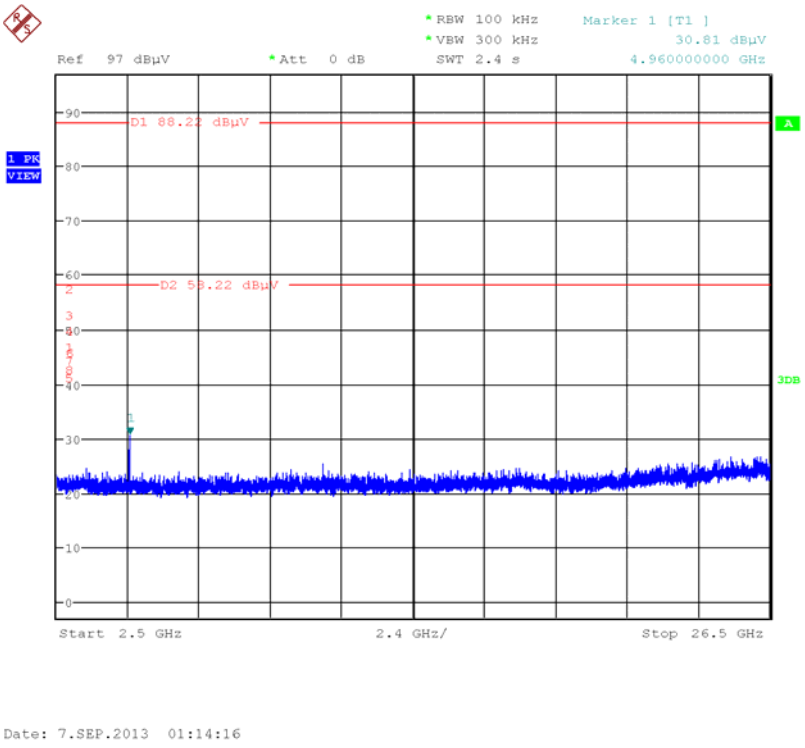
Date: 7.SEP.2013 01:13:07

Plot on Configuration For Bluetooth 4.0 / Channel 39 / 30MHz~2400MHz (down 30dBc)



Date: 10.DEC.2013 02:36:48

Plot on Configuration For Bluetooth 4.0 / Channel 39 / 2500MHz~26500MHz (down 30dBc)



4.5. Antenna Requirements

4.5.1. 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.

4.5.2. Antenna Connector Construction

Please refer to section 3.3 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	9 kHz ~ 2.75 GHz	Apr. 12, 2013	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150 kHz ~ 100 MHz	Nov. 26, 2012	Conduction (CO01-CB)
V- LISN	Schwarzbeck	NSLK 8127	8127478	9 kHz ~ 30 MHz	Nov. 11, 2013	Conduction (CO01-CB)
COND Cable	Woken	Cable	01	150 kHz ~ 30 MHz	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)
Horn Antenna	EMCO	3115	00075790	750MHz~18GHz	Nov. 01, 2013	Radiation (03CH01-CB)
Horn Antenna	SCHWARZBEAK	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Nov. 23, 2012	Radiation (03CH01-CB)
Horn Antenna	SCHWARZBEAK	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jan. 14, 2013	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10991	0.1MHz ~ 1.3GHz	Nov. 27, 2012	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10991	0.1MHz ~ 1.3GHz	Nov. 12, 2013	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Nov. 23, 2012	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Nov. 23, 2013	Radiation (03CH01-CB)
Pre-Amplifier	WM	TF-130N-R1	923365	26.5GHz ~ 40GHz	Oct. 24, 2012	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSP40	100304	9kHz ~ 40GHz	Nov. 27, 2012	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSP40	100304	9kHz ~ 40GHz	Dec. 20, 2013	Radiation (03CH01-CB)
EMI Test Receiver	Agilent	N9038A	MY52260123	9kHz ~ 8GHz	Nov. 26, 2012	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)
RF Cable-low	Woken	Low Cable-1	N/A	30 MHz - 1 GHz	Nov. 17, 2013	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-1	N/A	1 GHz – 26.5 GHz	Nov. 18, 2012	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-1	N/A	1 GHz – 26.5 GHz	Nov. 17, 2013	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-2	N/A	1 GHz – 26.5 GHz	Nov. 18, 2012	Radiation (03CH01-CB)

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
RF Cable-high	Woken	High Cable-2	N/A	1 GHz – 26.5 GHz	Nov. 17, 2013	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-3	N/A	1 GHz - 40 GHz	Nov. 18, 2012	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-3	N/A	1 GHz - 40 GHz	Nov. 17, 2013	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-4	N/A	1 GHz - 40 GHz	Nov. 18, 2012	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-4	N/A	1 GHz - 40 GHz	Nov. 17, 2013	Radiation (03CH01-CB)
Signal analyzer	R&S	FSV40	100979	9KHz~40GHz	Oct. 08, 2012	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-7	-	1 GHz – 26.5 GHz	Nov. 19, 2012	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-8	-	1 GHz – 26.5 GHz	Nov. 19, 2012	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-9	-	1 GHz – 26.5 GHz	Nov. 19, 2012	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-10	-	1 GHz – 26.5 GHz	Nov. 19, 2012	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-11	-	1 GHz – 26.5 GHz	Nov. 19, 2012	Conducted (TH01-CB)
Power Sensor	Anritsu	MA2411B	0917223	300MHz~40GHz	Nov. 28, 2012	Conducted (TH01-CB)
Power Meter	Anritsu	ML2495A	1035008	300MHz~40GHz	Nov. 27, 2012	Conducted (TH01-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 Uc(y)				1.2
Measuring uncertainty for a level of confidence of 95% U=2Uc(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	±0.173	dB	K=1	0.086
Cable loss	±0.174	dB	K=2	0.087
Antenna gain	±0.169	dB	K=2	0.084
Site imperfection	±0.433	dB	Triangular	0.214
Pre-amplifier gain	±0.366	dB	K=2	0.183
Transmitter antenna	±1.200	dB	Rectangular	0.600
Signal generator	±0.461	dB	Rectangular	0.231
Mismatch	±0.080	dB	U-shape	0.040
Spectrum analyzer	±0.500	dB	Rectangular	0.250
Combined standard uncertainty Uc(y)				1.778
Measuring uncertainty for a level of confidence of 95% U=2Uc(y)				3.555

Uncertainty of Radiated Emission Measurement (1GHz ~ 18GHz)

Contribution	Uncertainty of x_i			$u(x_i)$
	Value	Unit	Probability Distribution k	
Receiver reading	±0.191	dB	K=1	0.095
Cable loss	±0.169	dB	K=2	0.084
Antenna gain	±0.191	dB	K=2	0.096
Site imperfection	±0.582	dB	Triangular	0.291
Pre-amplifier gain	±0.304	dB	K=2	0.152
Transmitter antenna	±1.200	dB	Rectangular	0.600
Signal generator	±0.461	dB	Rectangular	0.231
Mismatch	±0.080	dB	U-shape	0.040
Spectrum analyzer	±0.500	dB	Rectangular	0.250
Combined standard uncertainty Uc(y)				1.839
Measuring uncertainty for a level of confidence of 95% U=2Uc(y)				3.678

Uncertainty of Radiated Emission Measurement (18GHz ~ 40GHz)

Contribution	Uncertainty of x_i			$u(x_i)$
	Value	Unit	Probability Distribution k	
Receiver reading	±0.186	dB	K=1	0.093
Cable loss	±0.167	dB	K=2	0.083
Antenna gain	±0.190	dB	K=2	0.095
Site imperfection	±0.488	dB	Triangular	0.244
Pre-amplifier gain	±0.269	dB	K=2	0.134
Transmitter antenna	±1.200	dB	Rectangular	0.600
Signal generator	±0.461	dB	Rectangular	0.231
Mismatch	±0.080	dB	U-shape	0.040
Spectrum analyzer	±0.500	dB	Rectangular	0.250
Combined standard uncertainty Uc(y)				1.771
Measuring uncertainty for a level of confidence of 95% U=2Uc(y)				3.541

Uncertainty of Conducted Emission Measurement

Contribution	Uncertainty of x_i			$u(x_i)$
	Value	Unit	Probability Distribution k	
Cable loss	±0.038	dB	K=2	0.019
Attenuator	±0.047	dB	K=2	0.024
Power Meter specification	±0.300	dB	Triangular	0.150
Power Sensor specification	±0.300	dB	Rectangular	0.150
Signal generator	±0.461	dB	Rectangular	0.231
Mismatch	±0.080	dB	U-shape	0.040
Spectrum analyzer	±0.500	dB	Rectangular	0.250
Combined standard uncertainty Uc(y)				0.863
Measuring uncertainty for a level of confidence of 95% U=2Uc(y)				1.726