



SPORTON International Inc.

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FCC RADIO TEST REPORT

Applicant's company	LOGITECH FAR EAST LTD.
Applicant Address	No. 2, Creation Road IV Science-Based Industrial Park Hsin-Chu, Taiwan
FCC ID	JNZYR0047
Manufacturer's company	LOGITECH FAR EAST LTD.
Manufacturer Address	No. 2, Creation Road IV Science-Based Industrial Park Hsin-Chu, Taiwan

Product Name	2.4GHz Cordless Keyboard
Brand Name	Logitech
Model Name	Y-R0047
Test Rule Part(s)	47 CFR FCC Part 15 Subpart C § 15.249
Test Freq. Range	2400 ~ 2483.5MHz
Received Date	Dec. 17, 2013
Final Test Date	Dec. 25, 2013
Submission Type	Original Equipment

Statement

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.



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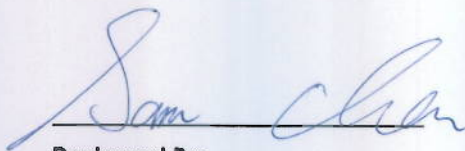
History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR3D1752	Rev. 01	Initial issue of report	Jan. 07, 2014

1. CERTIFICATE OF COMPLIANCE

Product Name : 2.4GHz Cordless Keyboard
Brand Name : Logitech
Model Name : Y-R0047
Applicant : LOGITECH FAR EAST LTD.
Test Rule Part(s) : 47 CFR FCC Part 15 Subpart C § 15.249

Sporton International as requested by the applicant to evaluate the EMC performance of the product sample received on Dec. 17, 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.



Reviewed By:

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	12.02 dB
4.2	15.249(a)	Field Strength of Fundamental Emissions	Complies	9.14 dB
4.3	15.215(c)	20dB Spectrum Bandwidth	Complies	-
4.4	15.249(a)/(d)	Radiated Emissions	Complies	21.62 dB
4.5	15.249(d)	Band Edge Emissions	Complies	6.39 dB
4.6	15.203	Antenna Requirements	Complies	-

3. GENERAL INFORMATION

3.1. Product Details

Items	Description
Power Type	From Host System & Battery
Modulation	GFSK
Frequency Range	2400 ~ 2483.5MHz
Operation Frequency Range	2405 ~ 2474 MHz
Channel Number	12
Channel Band Width (99%)	1.77 MHz
Max. Field Strength	66.21 dBuV/m at 3m (Average)
Carrier Frequencies	Please refer to section 3.4
Antenna	Integrate Antenna (Without any antenna connector)

3.2. Accessories

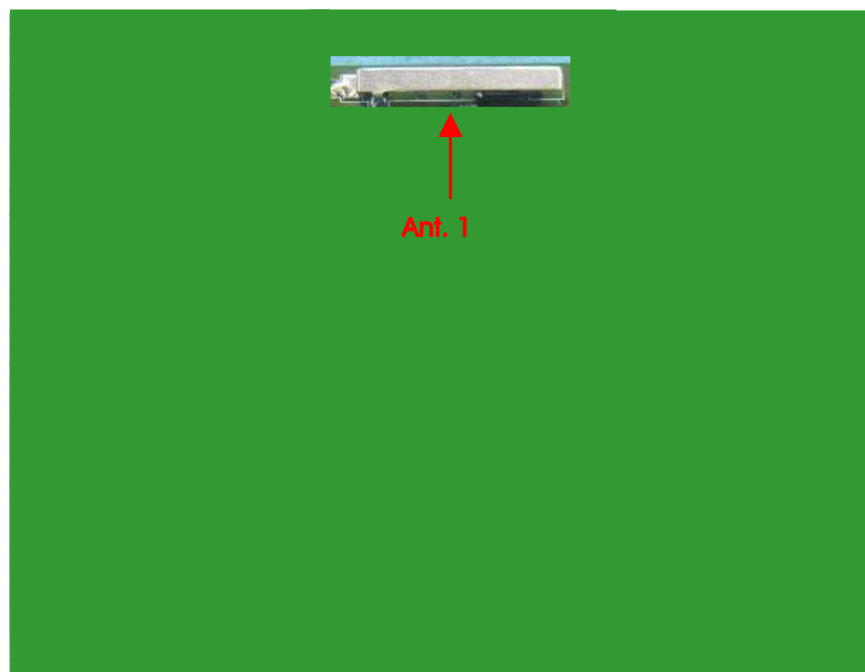
Power	Brand	Model	Rating
Li-polymer Rechargeable Battery	Logitech	603450	1100mAh, 3.7V, 4.07Wh
Others			
USB Cable, shielded, 1.3m			

3.3. Table for Filed Antenna

Ant.	Brand Holder	Part No.	Antenna Type	Connector	Gain (dBi)	Remark
1	SHENSHI ENTERPRISE/FENGHUA SHEN-XIN ELECTRONIC CO.,LTD.	415-002486	PIFA	N/A	4.85	TX / RX Ant.

Note: The EUT has one antennas.

Ant. 1 could transmit/receive simultaneously.



3.4. Table for Carrier Frequencies

Frequency Band	Channel No.	Frequency	Channel No.	Frequency
2400 ~ 2483.5MHz	1	2405 MHz	7	2441 MHz
	2	2408 MHz	8	2444 MHz
	3	2414 MHz	9	2462MHz
	4	2417 MHz	10	2465 MHz
	5	2432 MHz	11	2471 MHz
	6	2435 MHz	12	2474 MHz

3.5. Table for Test Modes

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	Channel	Antenna
AC Power Line Conducted Emissions	Normal Link	-	-
Field Strength of Fundamental Emissions 20dB Spectrum Bandwidth	CTX	1/8/12	1
Radiated Emissions 30MHz ~ 1GHz	Normal Link	-	-
Radiated Emissions 1GHz~10 th Harmonic	CTX	1/8/12	1
Band Edge Emissions	CTX	1/8/12	1

Note: CTX=continuously transmitting

The following test modes were performed for all tests:

<For Conducted Emission test: >

Mode 1: Normal Link – Charged

<For Radiated Emissions Test below 1GHz:>

Mode 1: Normal Link – Charged

Mode 2: Normal Link – Not Charging

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

<For Radiated Emissions Test Above 1GHz:>

Mode 1: CTX

3.6. Table for Testing Locations

Test Site Location					
Address:	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				
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	-
TH01-CB	OVEN Room	Hsin Chu	-	-	-

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

3.7. Table for Supporting Units

Test Site No.: CO01-CB

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E6220	DoC
Earphone	SHYARO CHI	MIC-04	N/A
Dongle Receiver	Logitech	C-U0007	DoC
Mouse	Logitech	M-U0026	DoC

Test Site No.: 03CH01-CB <Below 1GHz>

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E6430	DoC
Mouse	Logitech	M-U0026	DoC
Earphone	E-BOOKI	E-EPC040	N/A
Dongle Receiver	Logitech	C-U0007	DoC

Test Site No.: 03CH01-CB <Above 1GHz>

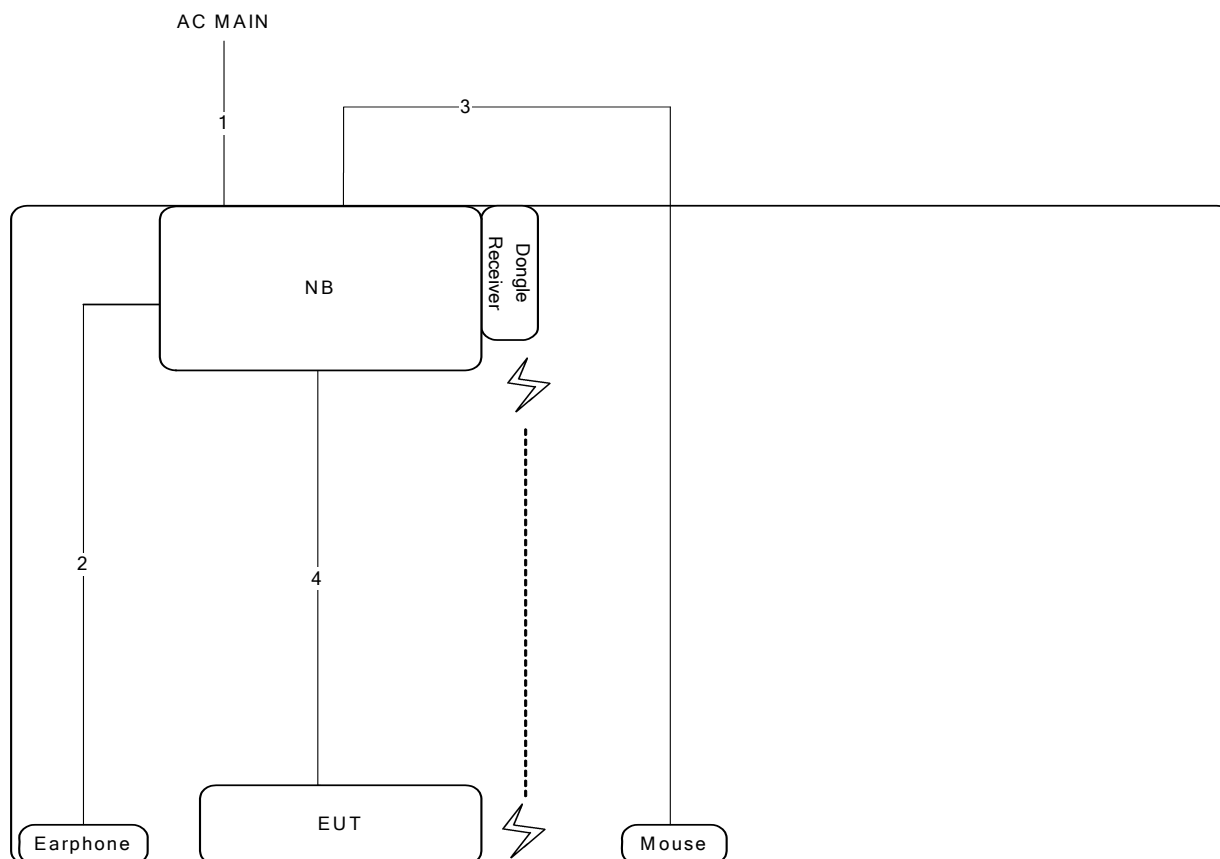
Support Unit	Brand	Model	FCC ID
Notebook	DELL	E6430	DoC
Keyboard	iCooky	SK068	DoC
Dongle Receiver	Logitech	C-U0007	DoC

Test Site No.: TH01-CB

Support Unit	Brand	Model	FCC ID
Notebook	DELL	E6430	DoC
Dongle Receiver	Logitech	C-U0007	DoC
Keyboard	iCooky	SK068	DoC

3.8. Test Configurations

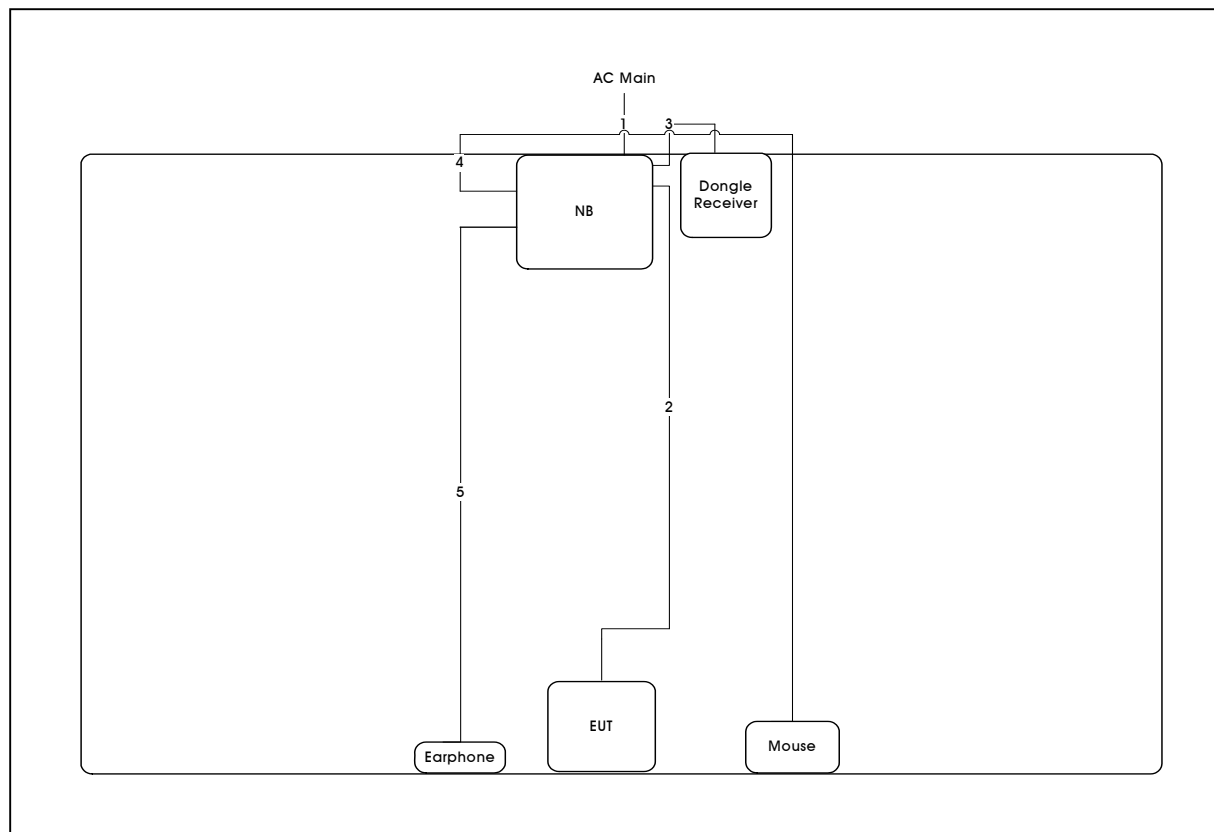
3.8.1. AC Power Line Conduction Emissions Test Configuration



Item	Connection	Shield	Length
1	AC Power cable	No	2.6m
2	Audio cable	No	1.1m
3	USB cable	Yes	1.8m
4	USB cable	Yes	1.3m

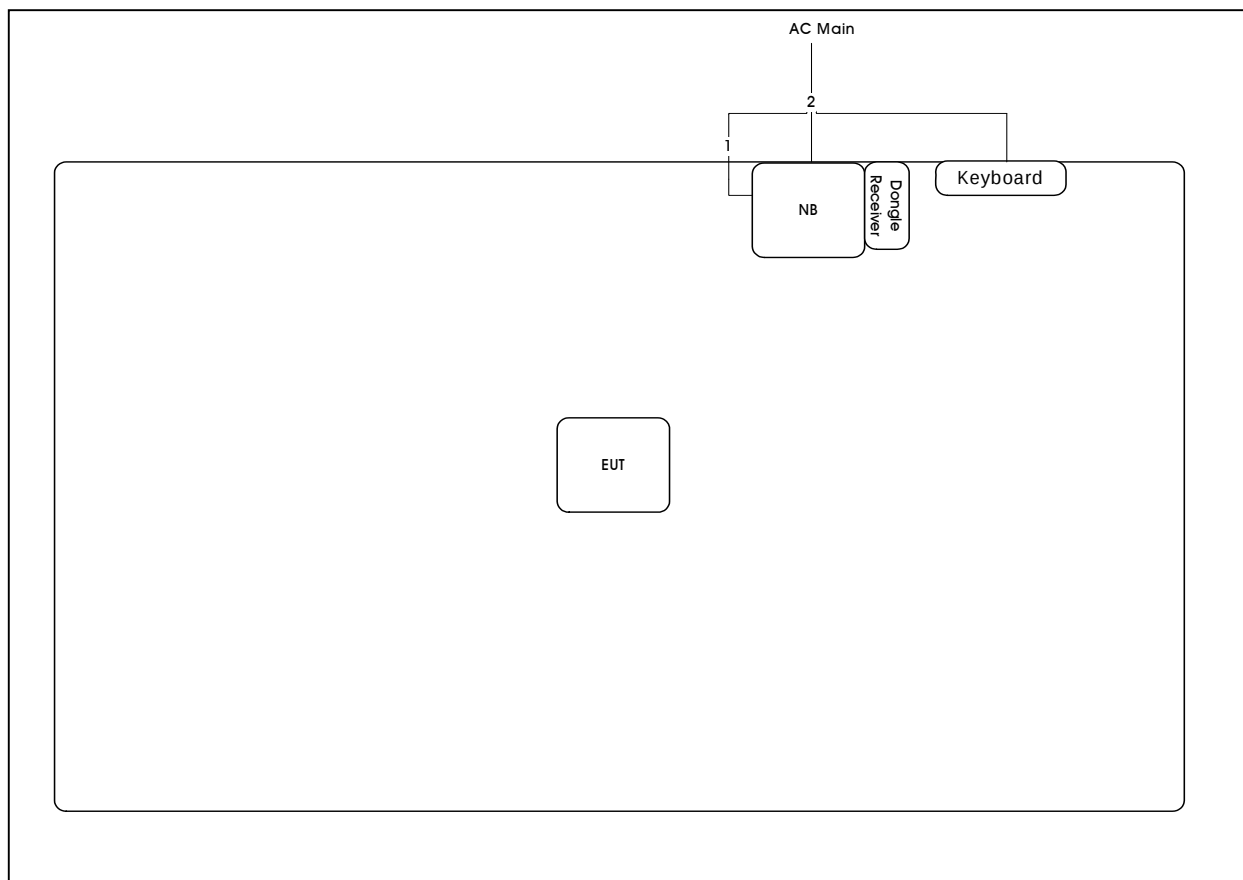
3.8.2. Radiation Emissions Test Configuration

Test Configuration: 30MHz~1GHz



Item	Connection	Shield	Length(m)
1	AC Power Cable	No	2.6m
2	USB Cable	Yes	1.3m
3	USB Cable	Yes	1.6m
4	USB Cable	Yes	1.8m
5	Audio cable	No	1.1m

Test Configuration: Above 1GHz



Item	Connection	Shield	Length(m)
1	USB Cable	Yes	1.8m
2	AC Power Cable	No	2.6m

4. TEST RESULT

4.1. AC Power Line Conducted Emissions Measurement

4.1.1. Limit

For this product 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

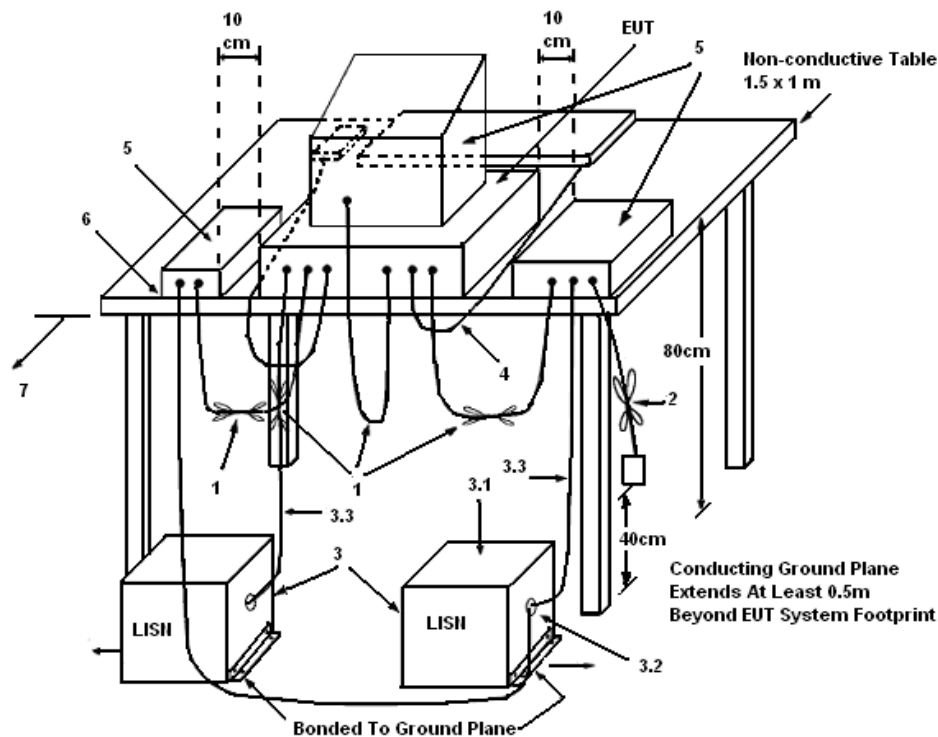
Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

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

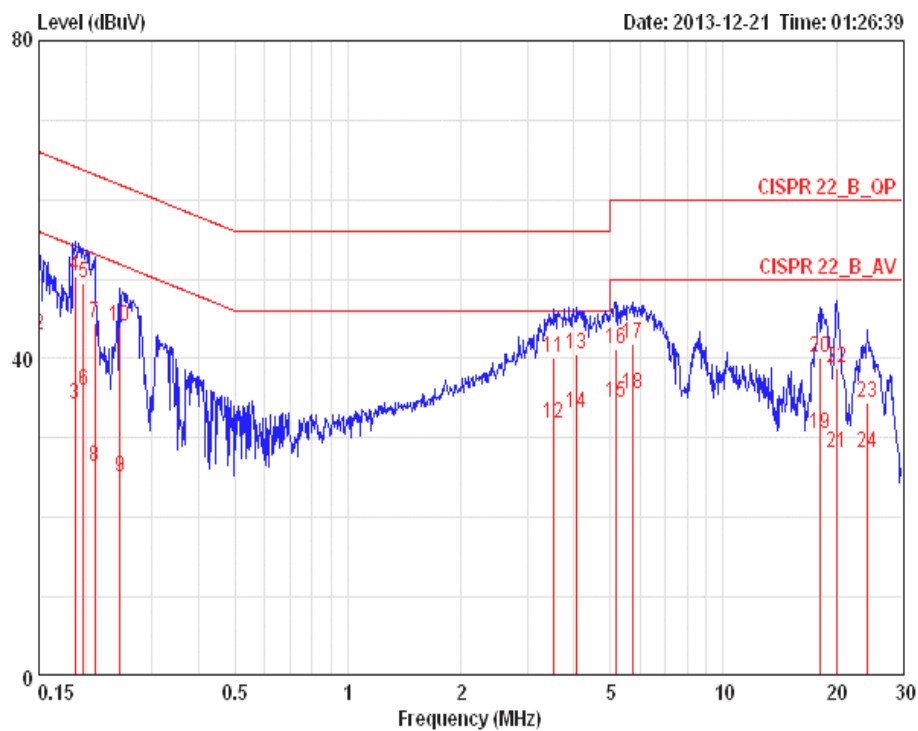
There is no deviation with the original standard.

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

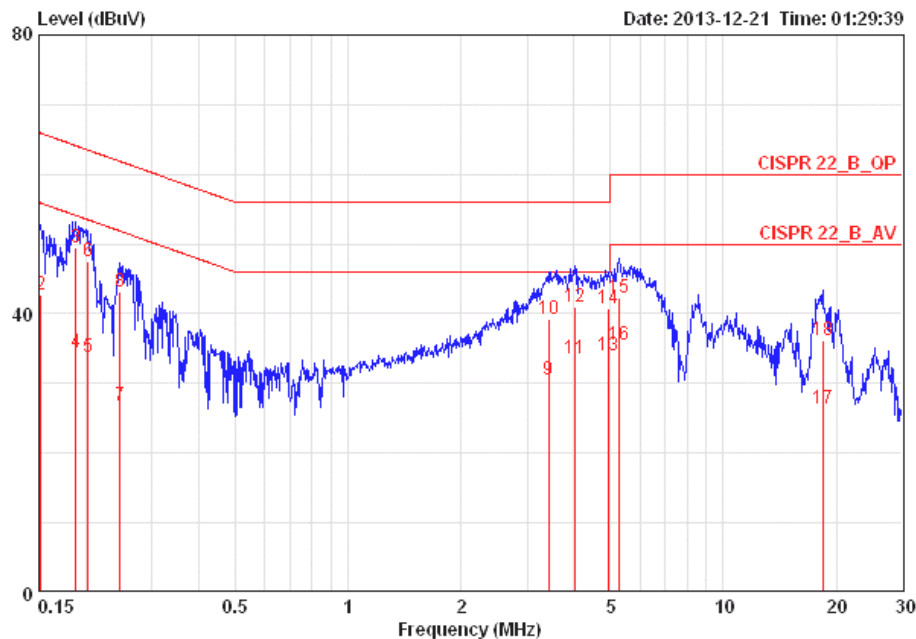
Temperature	24°C	Humidity	56%
Test Engineer	Ryo Fan	Phase	Line
Configuration	Normal Link	Test Mode	Mode 1



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	0.15000	28.03	-27.97	56.00	27.70	0.15	0.18	LINE	AVERAGE
2	0.15000	43.00	-23.00	66.00	42.67	0.15	0.18	LINE	QP
3	0.18739	34.25	-19.91	54.15	33.90	0.15	0.20	LINE	AVERAGE
4	0.18739	50.36	-13.80	64.15	50.01	0.15	0.20	LINE	QP
5	0.19758	49.41	-14.30	63.71	49.06	0.15	0.20	LINE	QP
6	0.19758	35.92	-17.79	53.71	35.57	0.15	0.20	LINE	AVERAGE
7	0.21167	44.40	-18.74	63.14	44.05	0.15	0.20	LINE	QP
8	0.21167	26.36	-26.78	53.14	26.01	0.15	0.20	LINE	AVERAGE
9	0.24682	25.02	-26.84	51.86	24.67	0.15	0.20	LINE	AVERAGE
10	0.24682	44.02	-17.84	61.86	43.67	0.15	0.20	LINE	QP
11	3.547	40.07	-15.93	56.00	39.53	0.26	0.28	LINE	QP
12	3.547	31.83	-14.17	46.00	31.29	0.26	0.28	LINE	AVERAGE

13	4.070	40.47	-15.53	56.00	39.89	0.28	0.30	LINE	QP
14	4.070	33.11	-12.89	46.00	32.53	0.28	0.30	LINE	AVERAGE
15	5.166	34.53	-15.47	50.00	33.91	0.30	0.32	LINE	AVERAGE
16	5.166	41.11	-18.89	60.00	40.49	0.30	0.32	LINE	QP
17	5.713	41.90	-18.10	60.00	41.27	0.31	0.33	LINE	QP
18	5.713	35.52	-14.48	50.00	34.89	0.31	0.33	LINE	AVERAGE
19	18.039	30.56	-19.44	50.00	29.52	0.55	0.48	LINE	AVERAGE
20	18.039	40.01	-19.99	60.00	38.97	0.55	0.48	LINE	QP
21	20.056	28.21	-21.79	50.00	27.11	0.60	0.50	LINE	AVERAGE
22	20.056	38.86	-21.14	60.00	37.76	0.60	0.50	LINE	QP
23	24.142	34.40	-25.60	60.00	33.12	0.73	0.55	LINE	QP
24	24.142	28.12	-21.88	50.00	26.84	0.73	0.55	LINE	AVERAGE

Temperature	24°C	Humidity	56%
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	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	0.15160	26.95	-28.96	55.91	26.70	0.07	0.18	NEUTRAL	AVERAGE
2	0.15160	42.77	-23.14	65.91	42.52	0.07	0.18	NEUTRAL	QP
3	0.18838	49.40	-14.71	64.11	49.13	0.07	0.20	NEUTRAL	QP
4	0.18838	34.36	-19.75	54.11	34.09	0.07	0.20	NEUTRAL	AVERAGE
5	0.20289	33.87	-19.62	53.49	33.60	0.07	0.20	NEUTRAL	AVERAGE
6	0.20289	47.60	-15.89	63.49	47.33	0.07	0.20	NEUTRAL	QP
7	0.24682	26.71	-25.15	51.86	26.44	0.07	0.20	NEUTRAL	AVERAGE
8	0.24682	43.22	-18.64	61.86	42.95	0.07	0.20	NEUTRAL	QP
9	3.417	30.46	-15.54	46.00	30.06	0.12	0.27	NEUTRAL	AVERAGE
10	3.417	39.27	-16.73	56.00	38.87	0.12	0.27	NEUTRAL	QP
11	4.006	33.54	-12.46	46.00	33.11	0.13	0.30	NEUTRAL	AVERAGE
12	4.006	41.07	-14.93	56.00	40.64	0.13	0.30	NEUTRAL	QP
13	4.926	33.98	-12.02	46.00	33.51	0.15	0.32	NEUTRAL	AVERAGE
14	4.926	40.82	-15.18	56.00	40.35	0.15	0.32	NEUTRAL	QP
15	5.277	42.18	-17.82	60.00	41.70	0.16	0.32	NEUTRAL	QP
16	5.277	35.46	-14.54	50.00	34.98	0.16	0.32	NEUTRAL	AVERAGE
17	18.426	26.33	-23.67	50.00	25.42	0.42	0.49	NEUTRAL	AVERAGE
18	18.426	36.08	-23.92	60.00	35.17	0.42	0.49	NEUTRAL	QP

Note:

Level = Read Level + LISN Factor + Cable Loss

4.2. Field Strength of Fundamental Emissions Measurement

4.2.1. Limit

The field strength of fundamental emissions within these bands specified at a distance of 3 meters (measurement instrumentation employing an average detector) shall comply with the following table.

Frequency Band (MHz)	Fundamental Emissions Limit (dBuV/m) at 3m
2400-2483.5	94 (Average)
	114 (Peak)

4.2.2. Measuring Instruments and Setting

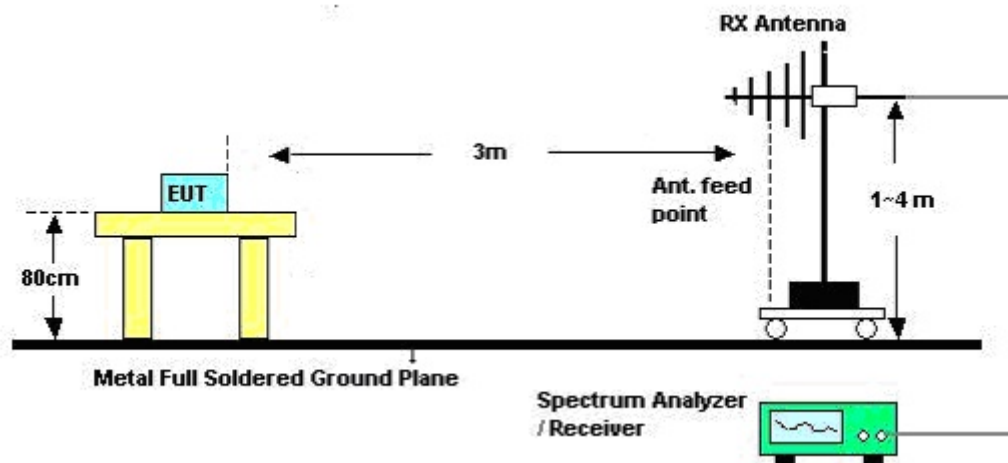
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Power Meter Parameter	Setting
RBW	1 MHz Peak / 3MHz Peak
VBW	1 MHz Peak / 10Hz Average
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

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.
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. For Fundamental emissions, use 1MHz VBW and 3MHz RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer.
6. 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.

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 Field Strength of Fundamental Emissions

Temperature	19°C	Humidity	49%
Test Engineer	YC Chen	Configurations	Channel 1/8/12
Test Date	Dec. 12, 2013		

Channel 1

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	2405.32	65.72	94.00	-28.28	35.29	2.22	28.21	0.00	Average	100	15	HORIZONTAL
2	2405.32	104.38	114.00	-9.62	73.95	2.22	28.21	0.00	Peak	100	15	HORIZONTAL

Channel 8

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	2443.65	66.21	94.00	-27.79	35.68	2.24	28.29	0.00	Average	100	17	HORIZONTAL
2	2443.65	104.86	114.00	-9.14	74.33	2.24	28.29	0.00	Peak	100	17	HORIZONTAL

Channel 12

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	2474.00	65.35	94.00	-28.65	34.71	2.26	28.38	0.00	Average	100	26	HORIZONTAL
2	2474.00	104.01	114.00	-9.99	73.37	2.26	28.38	0.00	Peak	100	26	HORIZONTAL

Note:

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

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

4.3. 20dB Spectrum Bandwidth Measurement

4.3.1. Limit

Intentional radiators must be designed to ensure that the 20 dB bandwidth of the emissions in the specific band (2400 ~ 2483.5MHz).

4.3.2. Measuring Instruments and Setting

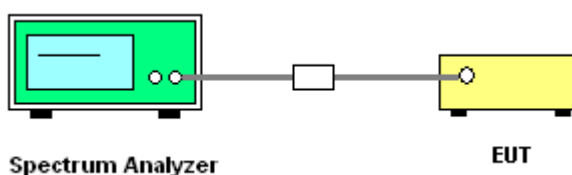
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> 20dB Bandwidth
RBW	100 kHz
VBW	100 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

4.3.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.
2. The resolution bandwidth of 100 kHz and the video bandwidth of 100 kHz were used.
3. Measured the spectrum width with power higher than 6dB below carrier.

4.3.4. Test Setup Layout



4.3.5. Test Deviation

There is no deviation with the original standard.

4.3.6. EUT Operation during Test

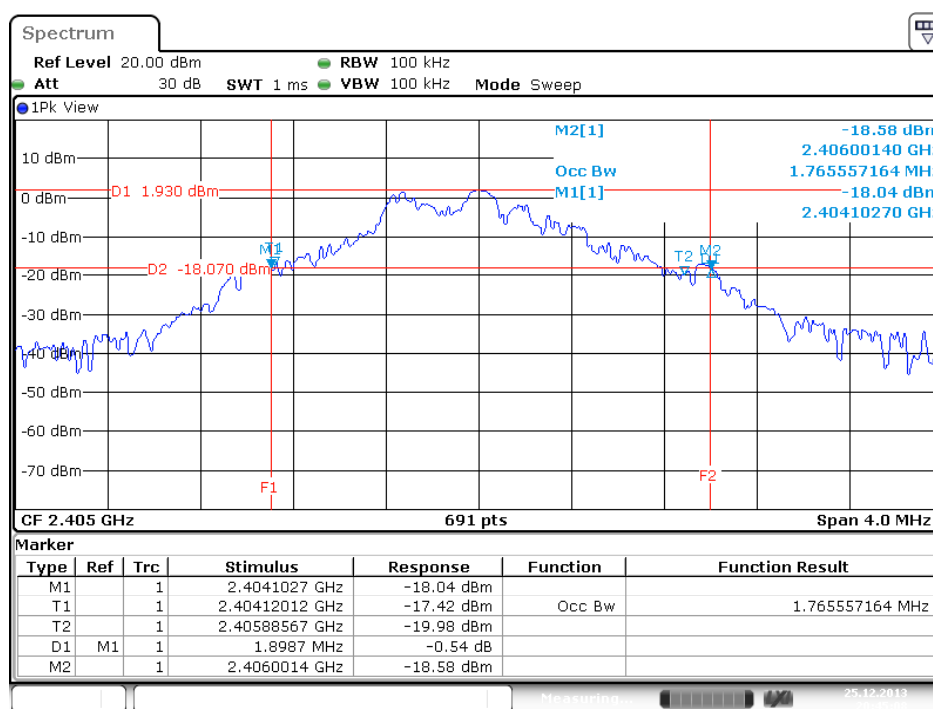
The EUT was programmed to be in continuously transmitting mode.

4.3.7. Test Result of 20dB Spectrum Bandwidth

Temperature	20°C	Humidity	56%
Test Engineer	David Tseng	Configurations	Channel 1/8/12

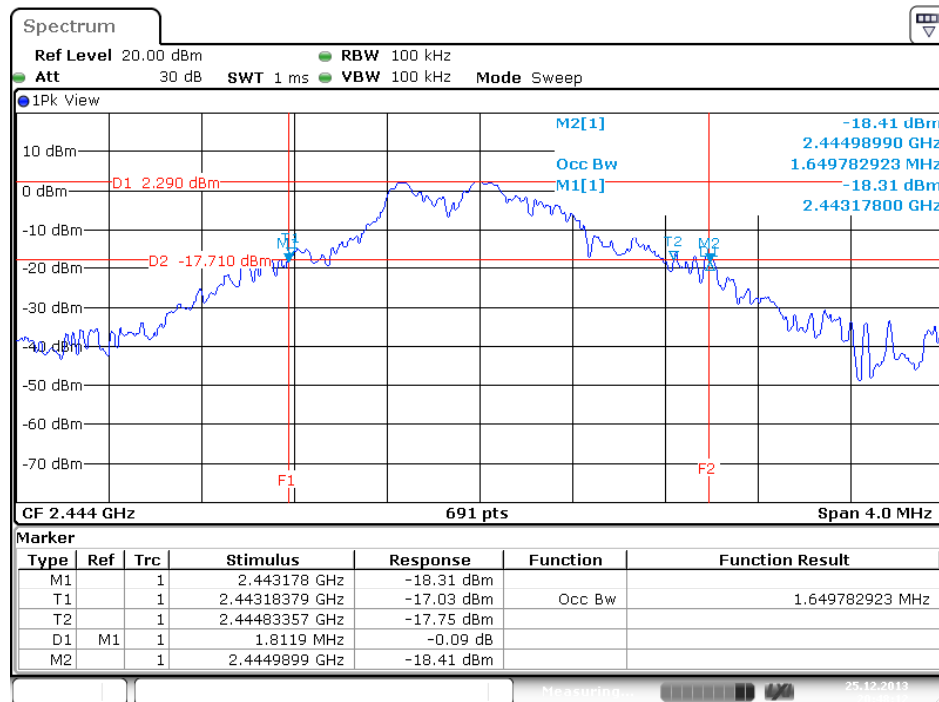
Frequency	20dB BW (MHz)	99% OBW (MHz)	Frequency range (MHz) $f_L > 2400\text{MHz}$	Frequency range (MHz) $f_H < 2483.5\text{MHz}$	Test Result
2405 MHz	1.90	1.77	2404.1027	-	Complies
2444 MHz	1.81	1.65	-	-	Complies
2474 MHz	1.85	1.60	-	2475.0130	Complies

20 dB/99% Bandwidth Plot on 2405 MHz



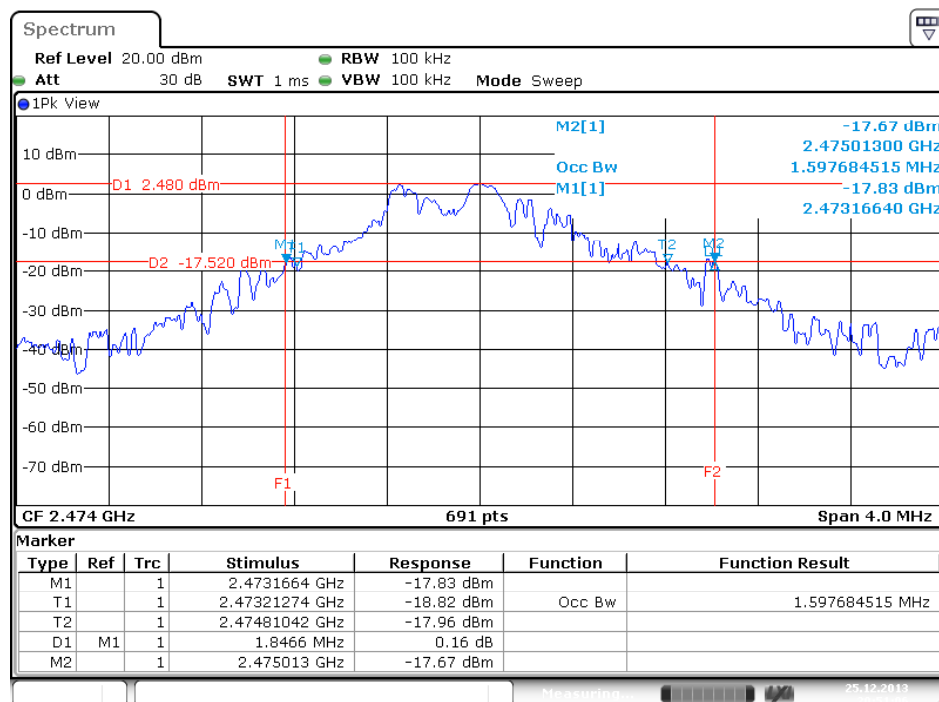
Date: 25.DEC.2013 20:45:08

20 dB/99% Bandwidth Plot on 2444 MHz



Date: 25.DEC.2013 20:48:13

20 dB/99% Bandwidth Plot on 2474 MHz



Date: 25.DEC.2013 20:51:06

4.4. Radiated Emissions Measurement

4.4.1. Limit

Harmonic emissions limits comply with below 54 dBuV/m at 3m. Other emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or comply with the radiated emissions limits specified in section 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 and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1 000 MHz
Stop Frequency	10th carrier harmonic
RBW / VBW (Emission in restricted band)	1 MHz / 3MHz for Peak, 1 MHz / 10Hz for Average
RBW / VBW (Emission in non-restricted band)	100kHz/300kHz for Peak

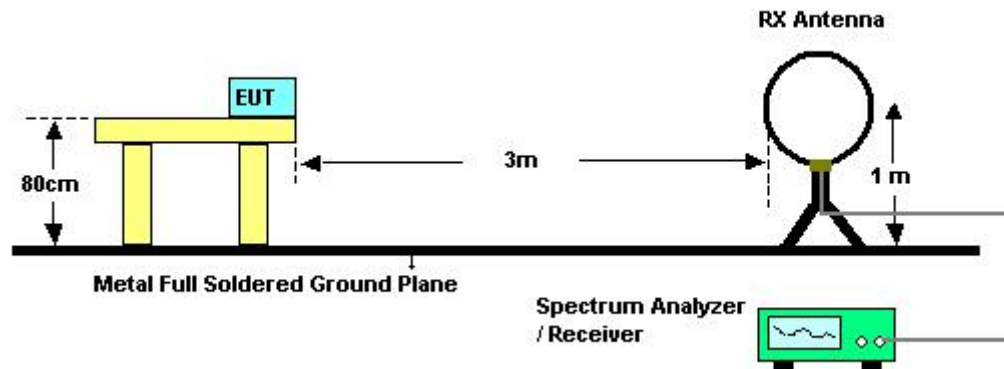
Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RBW 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RBW 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RBW 120kHz for QP

4.4.3. Test Procedures

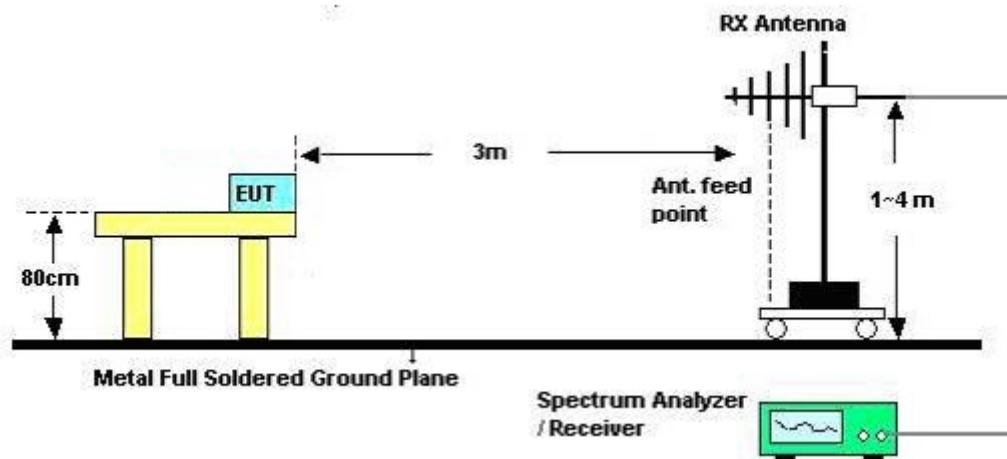
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting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

4.4.4. Test Setup Layout

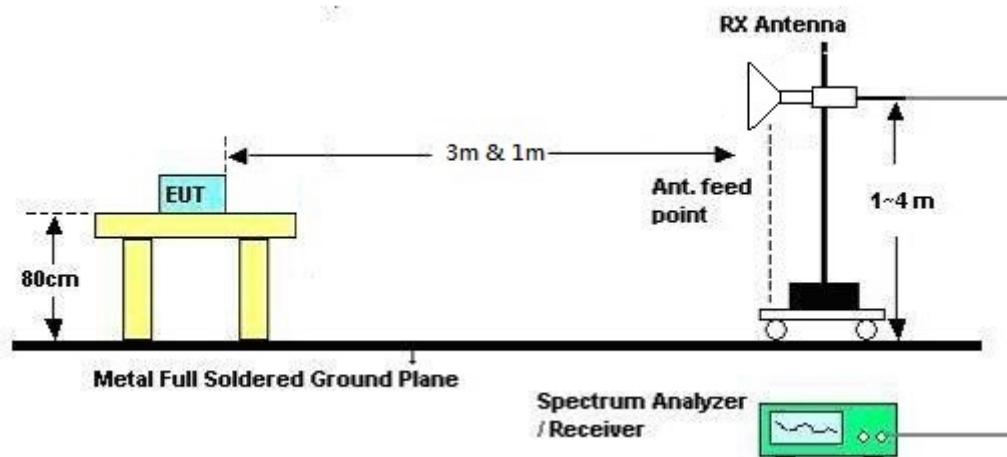
For Radiated Emissions: 9kHz ~30MHz



For Radiated Emissions: 30MHz~1GHz



For Radiated Emissions: Above 1GHz



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

Temperature	19°C	Humidity	49%
Test Engineer	YC Chen	Configurations	Normal Link
Test Date	Dec. 22, 2013	Test Mode	Mode 1

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 20dB below the permissible value has no need to be reported.

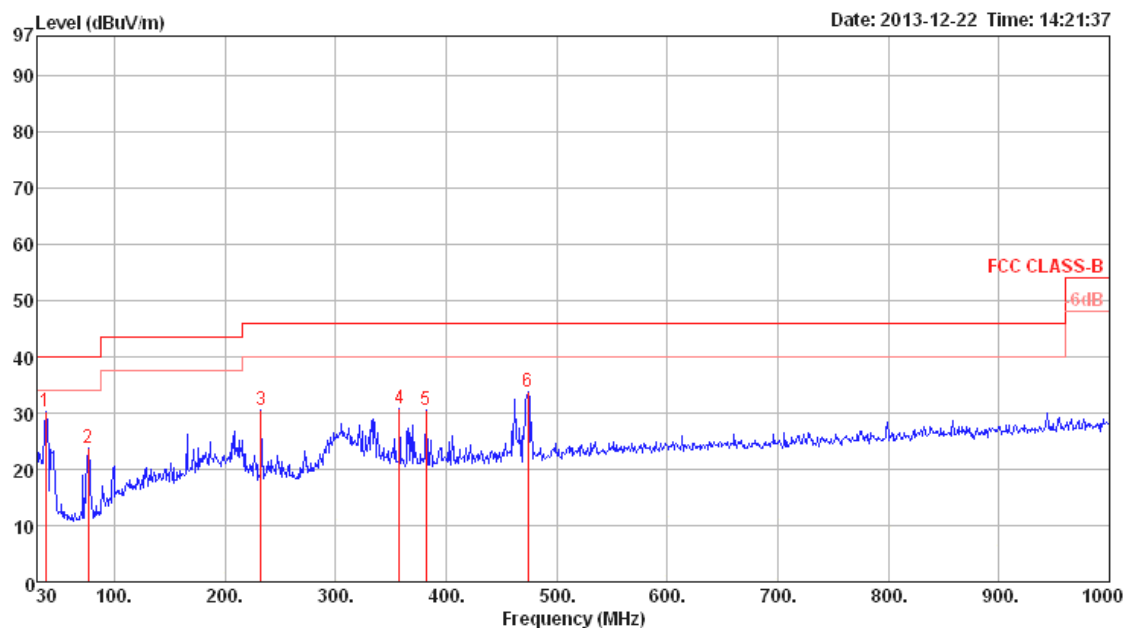
Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB);

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

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

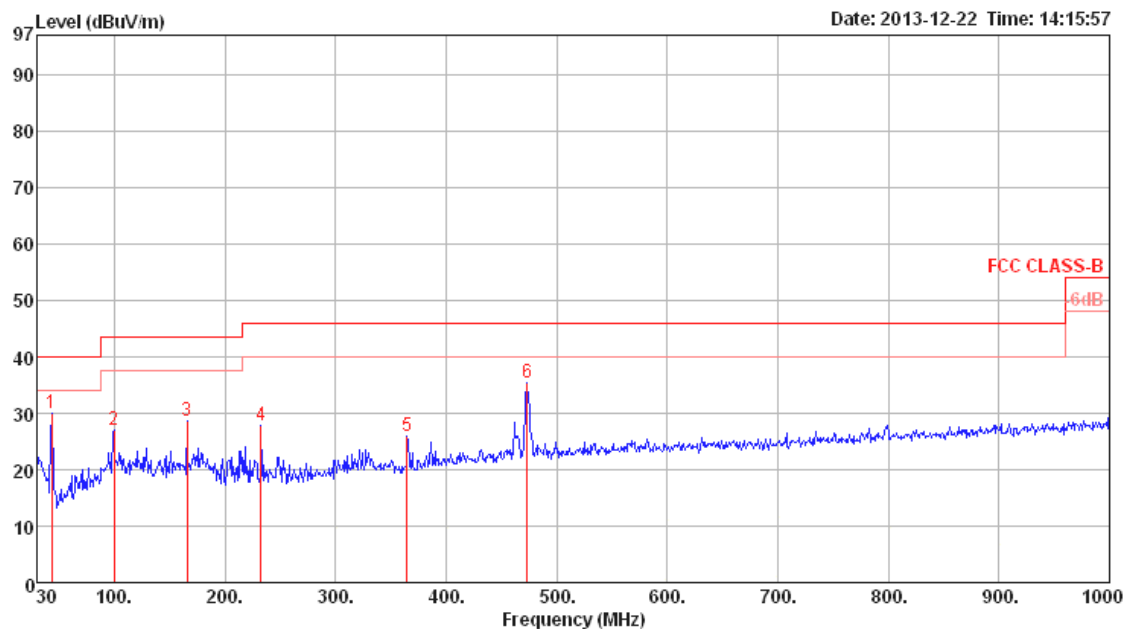
Temperature	19°C	Humidity	49%
Test Engineer	YC Chen	Configurations	Normal Link
Test Mode	Mode 1		

Horizontal



	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp		A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	Remark	cm	deg	
1	37.76	30.24	40.00	-9.76	43.06	0.68	14.30	27.80	Peak	100	0	HORIZONTAL
2	76.56	23.67	40.00	-16.33	43.45	0.94	6.98	27.70	Peak	100	0	HORIZONTAL
3	232.73	30.58	46.00	-15.42	44.39	1.74	11.48	27.03	Peak	100	0	HORIZONTAL
4	357.86	30.80	46.00	-15.20	41.04	2.13	14.93	27.30	Peak	100	0	HORIZONTAL
5	382.11	30.63	46.00	-15.37	40.28	2.23	15.59	27.47	Peak	100	0	HORIZONTAL
6	474.26	33.76	46.00	-12.24	41.94	2.57	17.22	27.97	Peak	100	0	HORIZONTAL

Vertical



	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	43.58	29.96	40.00	-10.04	46.16	0.72	10.88	27.80	Peak	400	0	VERTICAL
2	99.84	27.08	43.50	-16.42	42.52	1.17	10.99	27.60	Peak	400	0	VERTICAL
3	165.80	28.64	43.50	-14.86	41.99	1.45	12.47	27.27	Peak	400	0	VERTICAL
4	232.73	27.78	46.00	-18.22	41.59	1.74	11.48	27.03	Peak	400	0	VERTICAL
5	364.65	25.91	46.00	-20.09	35.98	2.16	15.12	27.35	Peak	400	0	VERTICAL
6	473.29	35.45	46.00	-10.55	43.65	2.56	17.21	27.97	Peak	400	0	VERTICAL

Note:

The amplitude of spurious emissions which 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.

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

Temperature	19°C	Humidity	49%
Test Engineer	YC Chen	Configurations	Channel 1
Test Date	Dec. 22, 2013		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss	Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	4810.12	4.76	54.00	-49.24	3.49	3.29	33.02	35.04	Average	114	92	HORIZONTAL
2	4810.12	43.41	74.00	-30.59	42.14	3.29	33.02	35.04	Peak	114	92	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss	Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	4809.89	4.33	54.00	-49.67	3.06	3.29	33.02	35.04	Average	141	105	VERTICAL
2	4809.89	42.98	74.00	-31.02	41.71	3.29	33.02	35.04	Peak	141	105	VERTICAL

Temperature	19°C	Humidity	49%
Test Engineer	YC Chen	Configurations	Channel 8
Test Date	Dec. 22, 2013		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	4887.99	6.39	54.00	-47.61	4.90	3.33	33.19	35.03	Average	169	127	HORIZONTAL
2	4887.99	45.04	74.00	-28.96	43.55	3.33	33.19	35.03	Peak	169	127	HORIZONTAL
3	7330.99	11.49	54.00	-42.51	6.84	4.06	35.99	35.40	Average	143	112	HORIZONTAL
4	7330.99	50.14	74.00	-23.86	45.49	4.06	35.99	35.40	Peak	143	112	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	4888.03	6.63	54.00	-47.37	5.14	3.33	33.19	35.03	Average	100	282	VERTICAL
2	4888.03	45.29	74.00	-28.71	43.80	3.33	33.19	35.03	Peak	100	282	VERTICAL
3	7331.04	13.73	54.00	-40.27	9.08	4.06	35.99	35.40	Average	155	303	VERTICAL
4	7331.04	52.38	74.00	-21.62	47.73	4.06	35.99	35.40	Peak	155	303	VERTICAL

Temperature	19°C	Humidity	49%
Test Engineer	YC Chen	Configurations	Channel 12
Test Date	Dec. 22, 2013		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	4947.95	6.95	54.00	-47.05	5.29	3.37	33.30	35.01	Average	100	55	HORIZONTAL
2	4947.95	45.60	74.00	-28.40	43.94	3.37	33.30	35.01	Peak	100	55	HORIZONTAL
3	7426.54	8.52	54.00	-45.48	3.69	4.07	36.16	35.40	Average	158	310	HORIZONTAL
4	7426.54	47.17	74.00	-26.83	42.34	4.07	36.16	35.40	Peak	158	310	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	4947.68	10.40	54.00	-43.60	8.74	3.37	33.30	35.01	Average	100	323	VERTICAL
2	4947.68	48.05	74.00	-25.95	46.39	3.37	33.30	35.01	Peak	100	323	VERTICAL
3	7422.06	10.41	54.00	-43.59	5.58	4.07	36.16	35.40	Average	173	21	VERTICAL
4	7422.06	49.06	74.00	-24.94	44.23	4.07	36.16	35.40	Peak	173	21	VERTICAL

Note:

The amplitude of spurious emissions which 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.

4.5. Band Edge Emissions Measurement

4.5.1. Limit

Band edge emissions radiated outside of the specified frequency bands shall be attenuated by at least 50 dB below the level of the fundamental or comply with the radiated emissions limits specified in section 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

4.5.2. 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, 1 MHz / 10Hz for Average
RBW / VBW (Emission in non-restricted band)	100kHz/300kHz for Peak

4.5.3. Test Procedures

- The test procedure is the same as section 4.4.3, only the frequency range investigated is limited to 2MHz around bandedges.
- In case the emission is fail due to the used RBW/VBW is too wide, marker-delta method of FCC Public Notice DA00-705 will be followed.

4.5.4. Test Setup Layout

This test setup layout is the same as that shown in section 4.4.4.

4.5.5. Test Deviation

There is no deviation with the original standard.

4.5.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.5.7. Test Result of Band Edge and Fundamental Emissions

Temperature	19°C	Humidity	49%
Test Engineer	YC Chen	Configurations	Channel 1/8/12
Test Date	Dec. 22, 2013		

Channel 1

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	2388.08	26.82	54.00	-27.18	-3.56	2.21	28.17	0.00	Average	100	15	HORIZONTAL
2	2388.08	65.47	74.00	-8.53	35.09	2.21	28.17	0.00	Peak	100	15	HORIZONTAL
3	2404.84	65.65			35.22	2.22	28.21	0.00	Average	100	15	HORIZONTAL
4	2404.84	104.30			73.87	2.22	28.21	0.00	Peak	100	15	HORIZONTAL

Item 3, 4 are the fundamental frequency at 2405 MHz.

Channel 8

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	2386.47	19.84	54.00	-34.16	-10.54	2.21	28.17	0.00	Average	100	17	HORIZONTAL
2	2386.47	58.49	74.00	-15.51	28.11	2.21	28.17	0.00	Peak	100	17	HORIZONTAL
3	2443.68	66.25			35.72	2.24	28.29	0.00	Average	100	17	HORIZONTAL
4	2443.68	104.90			74.37	2.24	28.29	0.00	Peak	100	17	HORIZONTAL
5	2484.78	19.88	54.00	-34.12	-10.76	2.26	28.38	0.00	Average	100	17	HORIZONTAL
6	2484.78	58.53	74.00	-15.47	27.89	2.26	28.38	0.00	Peak	100	17	HORIZONTAL

Item 3, 4 are the fundamental frequency at 2444 MHz.

Channel 12

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	2473.68	64.72			34.08	2.26	28.38	0.00	Average	100	26	HORIZONTAL
2	2473.68	103.37			72.73	2.26	28.38	0.00	Peak	100	26	HORIZONTAL
3	2483.50	28.96	54.00	-25.04	-1.68	2.26	28.38	0.00	Average	100	26	HORIZONTAL
4	2483.50	67.61	74.00	-6.39	36.97	2.26	28.38	0.00	Peak	100	26	HORIZONTAL

Item 1, 2 are the fundamental frequency at 2472 MHz.

Note:

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

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

4.6. Antenna Requirements

4.6.1. 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.

4.6.2. Antenna Connector Construction

Please refer to section 3.1 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. 23, 2013	Conduction (CO01-CB)
Artificial Mains Network	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Nov. 23, 2013	Conduction (CO01-CB)
COND Cable	Woken	Cable	01	150 kHz ~ 30 MHz	Dec. 04, 2013	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. 01, 2013	Radiation (03CH01-CB)
Horn Antenna	SCHWARZBECK	BBHA 9170	9170-507	15MHz ~ 40GHz	Jan. 14, 2013	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10991	0.1MHz ~ 1.3GHz	Nov. 12, 2013	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02660	1GHz ~ 26.5GHz	May 17, 2013	Radiation (03CH01-CB)
Pre-Amplifier	WM	TF-130N-R1	923365	26GHz ~ 40GHz	Oct. 23, 2013	Radiation (03CH01-CB)
Spectrum analyzer	Agilent	N9010A	MY52220557	9KHz~44GHz	Nov. 29, 2013	Radiation (03CH01-CB)
EMI Test Receiver	Agilent	N9038A	MY52260123	9kHz ~ 8GHz	Dec. 12, 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. 17, 2013	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. 17, 2013	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. 17, 2013	Radiation (03CH01-CB)
Signal analyzer	R&S	FSV40	100979	9kHz~40GHz	Nov. 29, 2013	Conducted (TH01-CB)
Temp. and Humidity Chamber	Ten Billion	TTH-D3SP	TBN-931011	-30~100 degree	Jun. 04, 2013	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-7	-	1 GHz ~ 26.5 GHz	Nov. 17, 2013	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-8	-	1 GHz ~ 26.5 GHz	Nov. 17, 2013	Conducted (TH01-CB)

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
RF Cable-high	Woken	High Cable-9	-	1 GHz – 26.5 GHz	Nov. 17, 2013	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-10	-	1 GHz – 26.5 GHz	Nov. 17, 2013	Conducted (TH01-CB)
RF Cable-high	Woken	High Cable-11	-	1 GHz – 26.5 GHz	Nov. 17, 2013	Conducted (TH01-CB)
Power Sensor	Anritsu	MA2411B	0917223	300MHz~40GHz	Sep. 18, 2013	Conducted (TH01-CB)
Power Meter	Anritsu	ML2495A	1035008	300MHz~40GHz	Sep. 18, 2013	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. 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 $U_c(y)$				1.2
Measuring uncertainty for a level of confidence of 95% $U=2U_c(y)$				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 $U_c(y)$				1.778
Measuring uncertainty for a level of confidence of 95% $U=2U_c(y)$				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 $U_c(y)$				1.839
Measuring uncertainty for a level of confidence of 95% $U=2U_c(y)$				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 $U_c(y)$				1.771
Measuring uncertainty for a level of confidence of 95% $U=2U_c(y)$				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 $U_c(y)$				0.863
Measuring uncertainty for a level of confidence of 95% $U = 2U_c(y)$				1.726