



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	JNZYR0047B
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-R0047b
Test Rule Part(s)	47 CFR FCC Part 15 Subpart C § 15.249
Test Freq. Range	2400 ~ 2483.5MHz
Received Date	Feb. 26, 2015
Final Test Date	Mar. 09, 2015
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 C63.10-2013** 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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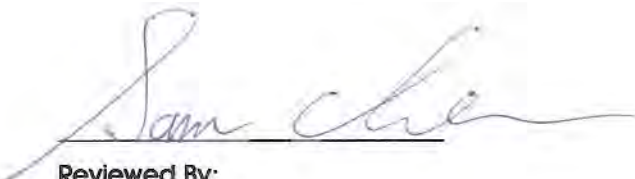
History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR3D1752-01AA	Rev. 01	Initial issue of report	Mar. 16, 2015

1. VERIFICATION OF COMPLIANCE

Product Name : 2.4GHz Cordless Keyboard
Brand Name : Logitech
Model Name : Y-R0047b
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 Feb. 26, 2015 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	15.39 dB
4.2	15.249(a)	Field Strength of Fundamental Emissions	Complies	13.05 dB
4.3	15.215(c)	20dB Spectrum Bandwidth	Complies	-
4.4	15.249(a)/(d)	Radiated Emissions	Complies	5.41 dB
4.5	15.249(d)	Band Edge Emissions	Complies	11.24 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 ~ 2474MHz
Channel Number	12
Channel Band Width (99%)	1.75 MHz
Max. Field Strength	60.55 dBuV/m at 3m (Average)
Carrier Frequencies	Please refer to section 3.4
Antenna	Please refer to section 3.3

3.2. Accessories

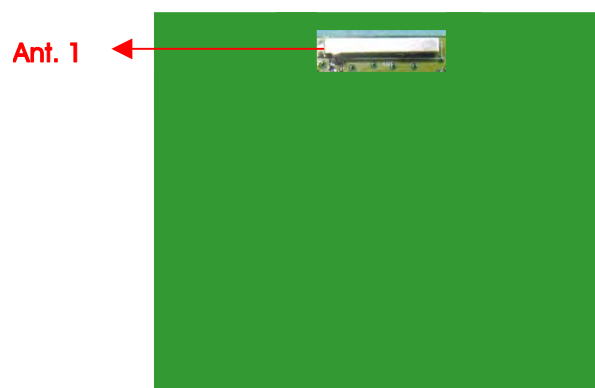
Power	Brand	Model	Rating
Li-polymer Rechargeable Battery	Logitech	603450	1100mAh, 3.7V, 4.07Wh
Other			
USB cable, shielded, 1.3m			

3.3. Table for Filed Antenna

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

Note: The EUT has one antenna.

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	2462 MHz
	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 – Low power (Charged)

For Radiated emissions test below 1GHz:

There are two modes of EUT, one is Charged, the other is Not Charged.

Charged has been evaluated to be the worst case after evaluating. So the measurement will follow this same test configuration.

Mode 1: Normal Link – Low power (Charged)

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); Fully Anechoic Chamber (FAC).

3.7. Table for Supporting Units

For Test Site No.: CO01-CB

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

For Test Site No.: 03CH01-CB (Radiated emissions test below 1GHz)

Support Unit	Brand	Model	FCC ID
NB	DELL	E4300	DoC
Mouse	HP	FM100	DoC
Earphone	E-BOOKI	E-EPC040	N/A
Dongle Receiver	Logitech	C-U0007	DoC

For Test Site No.: 03CH01-CB (Radiated emissions test above 1GHz)

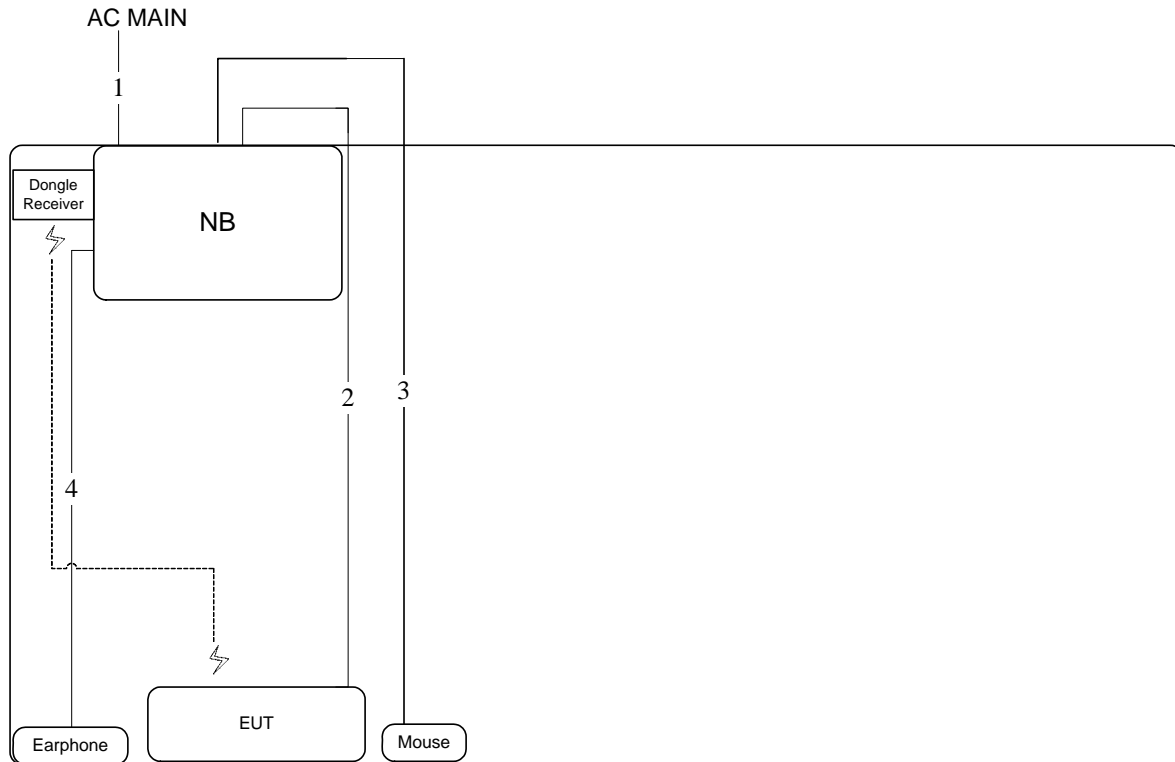
Support Unit	Brand	Model	FCC ID
NB	DELL	M1340	DoC
Keyboard	iCooky	SK068	DoC
Dongle Receiver	Logitech	C-U0007	DoC

For Test Site No.: TH01-CB

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

3.8. Test Configurations

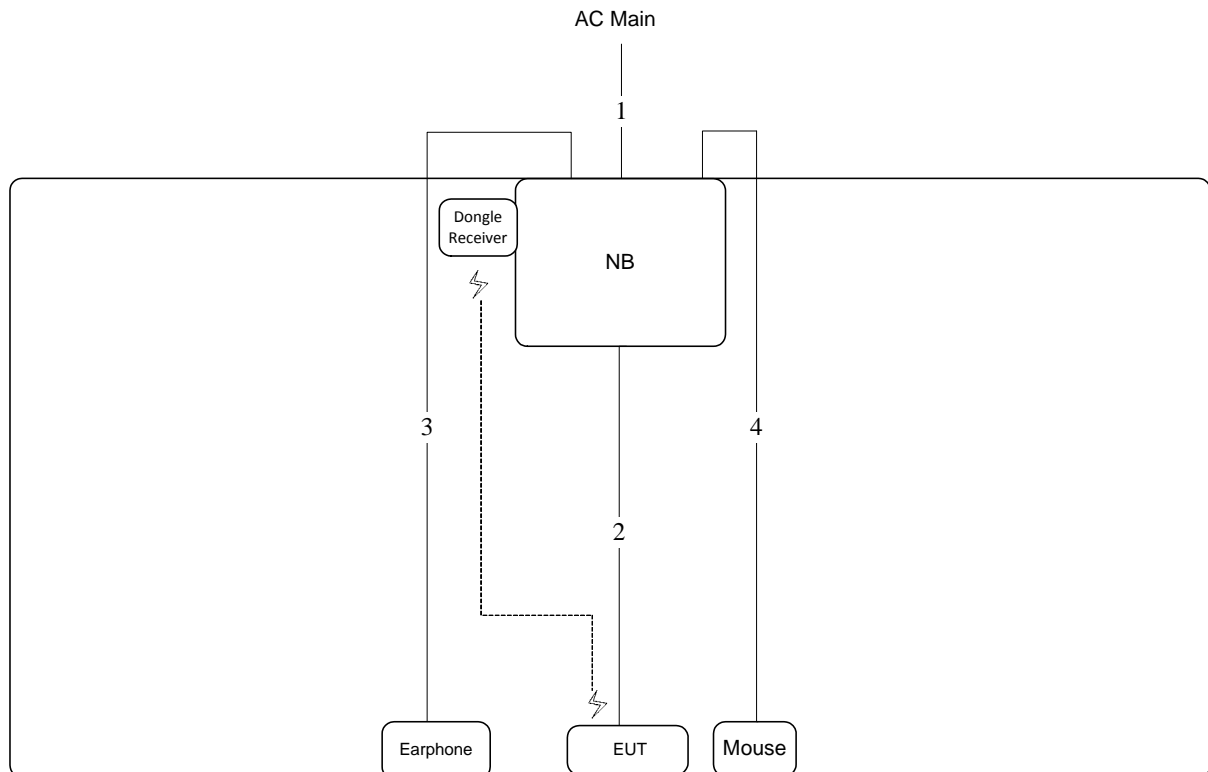
3.8.1. AC Power Line Conduction Emissions Test Configuration



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

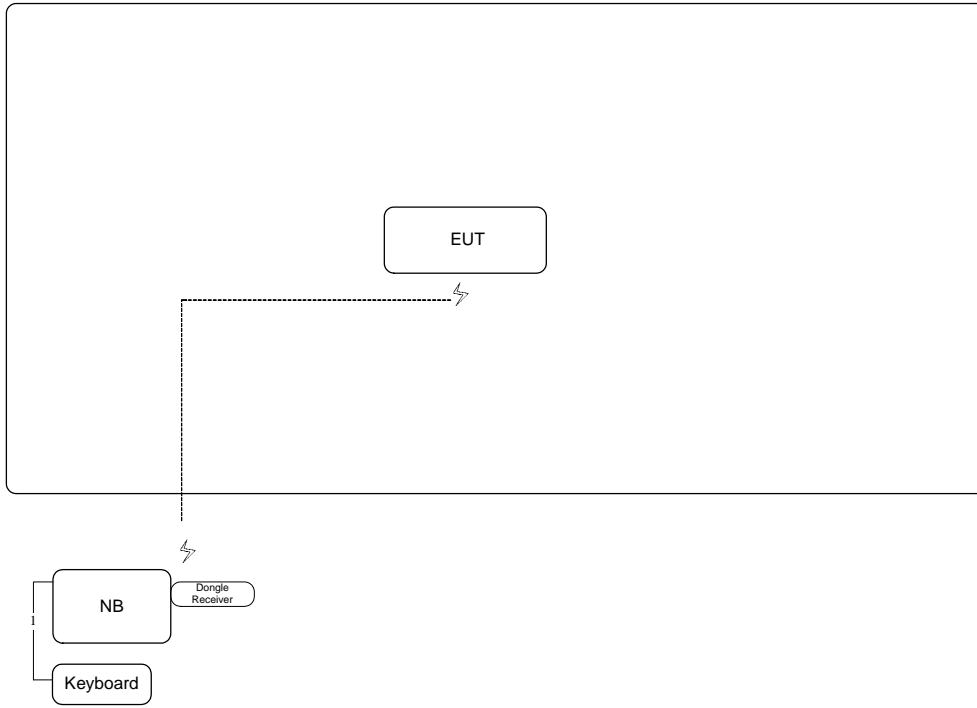
3.8.2. Radiation Emissions Test Configuration

Test Configuration: 30MHz~1GHz



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

Test Configuration: Above 1GHz



Item	Connection	Shielded	Length
1	USB cable	Yes	1.8m

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

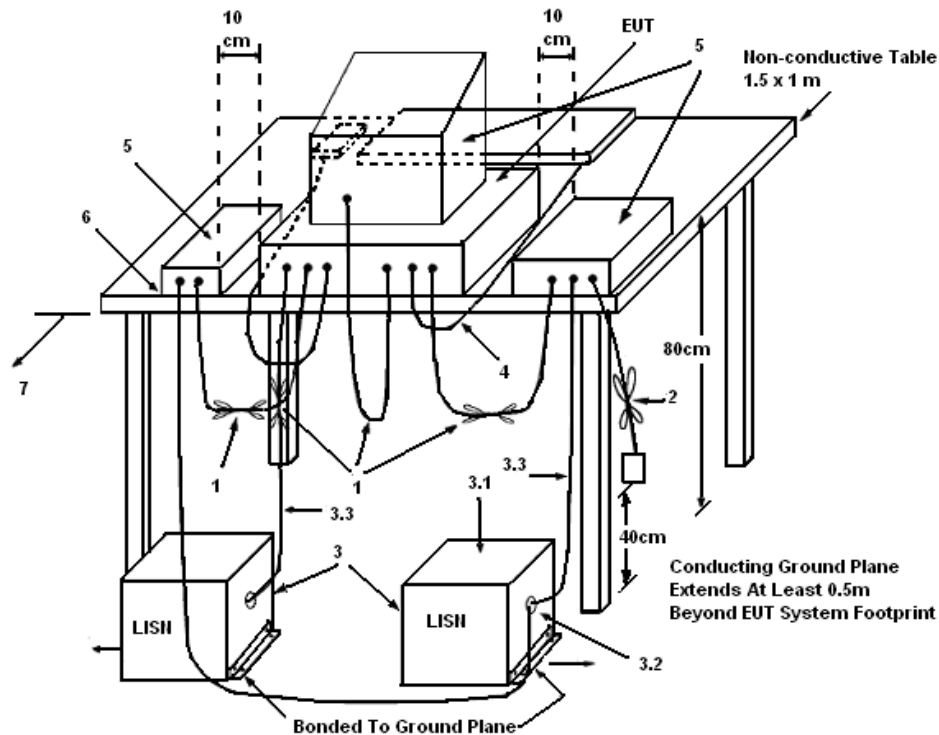
Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

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

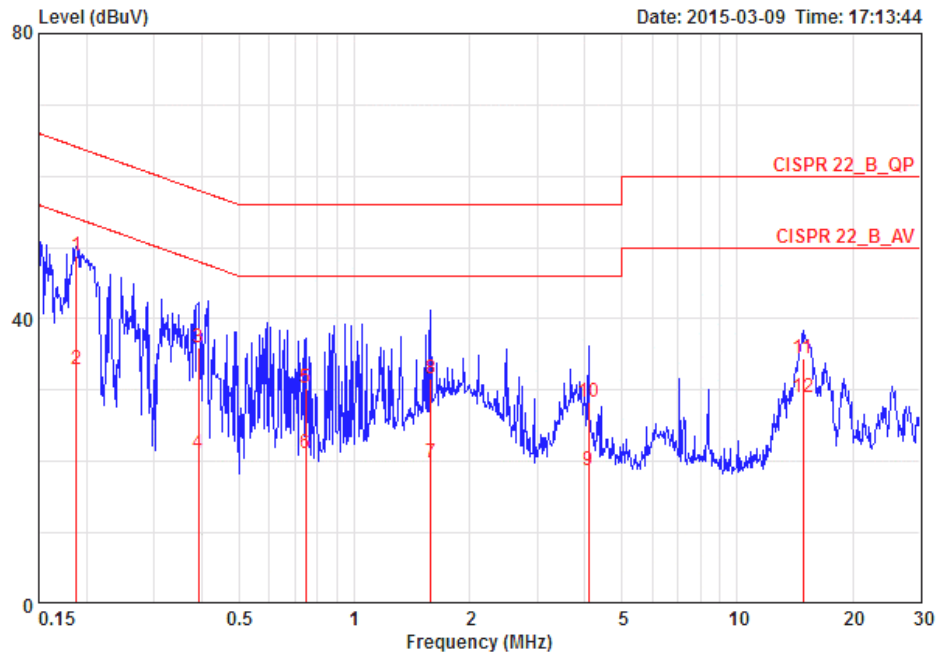
There is no deviation with the original standard.

4.1.6. EUT Operation during Test

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

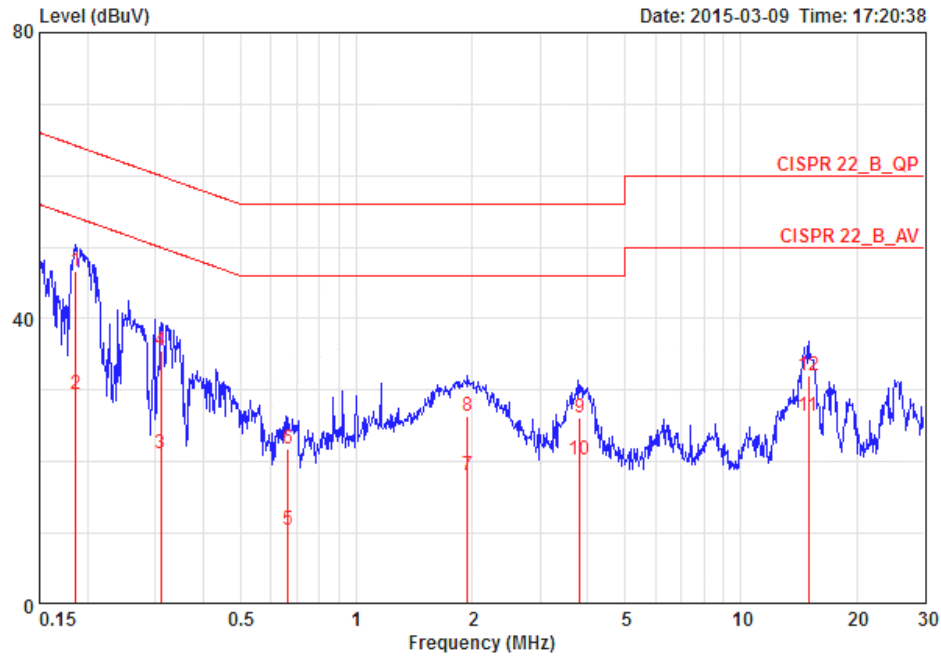
4.1.7. Results of AC Power Line Conducted Emissions Measurement

Temperature	24°C	Humidity	52%
Test Engineer	Parody Lin	Phase	Line
Configuration	Normal Link		



	Freq	Level	Over	Limit	Read	LISN	Cable	Remark	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	0.18838	48.72	-15.39	64.11	38.55	9.93	0.24	QP	LINE
2	0.18838	32.93	-21.18	54.11	22.76	9.93	0.24	AVERAGE	LINE
3	0.39136	36.01	-22.03	58.03	25.78	9.93	0.30	QP	LINE
4	0.39136	21.19	-26.85	48.03	10.96	9.93	0.30	AVERAGE	LINE
5	0.74697	30.19	-25.81	56.00	19.92	9.95	0.32	QP	LINE
6	0.74697	21.11	-24.89	46.00	10.84	9.95	0.32	AVERAGE	LINE
7	1.585	19.91	-26.09	46.00	9.59	9.98	0.34	AVERAGE	LINE
8	1.585	31.57	-24.43	56.00	21.25	9.98	0.34	QP	LINE
9	4.092	18.75	-27.25	46.00	8.36	10.02	0.37	AVERAGE	LINE
10	4.092	28.30	-27.70	56.00	17.91	10.02	0.37	QP	LINE
11	14.828	34.52	-25.48	60.00	23.76	10.33	0.43	QP	LINE
12	14.828	29.02	-20.98	50.00	18.26	10.33	0.43	AVERAGE	LINE

Temperature	24°C	Humidity	52%
Test Engineer	Parody Lin	Phase	Neutral
Configuration	Normal Link		



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1	0.18640	46.60	-17.60	64.20	36.57	9.79	0.24	QP	NEUTRAL
2	0.18640	29.47	-24.73	54.20	19.44	9.79	0.24	AVERAGE	NEUTRAL
3	0.30998	21.20	-28.77	49.97	11.13	9.79	0.28	AVERAGE	NEUTRAL
4	0.30998	35.49	-24.48	59.97	25.42	9.79	0.28	QP	NEUTRAL
5	0.66478	10.42	-35.58	46.00	0.30	9.80	0.32	AVERAGE	NEUTRAL
6	0.66478	21.74	-34.26	56.00	11.62	9.80	0.32	QP	NEUTRAL
7	1.949	18.14	-27.86	46.00	7.95	9.84	0.35	AVERAGE	NEUTRAL
8	1.949	26.44	-29.56	56.00	16.25	9.84	0.35	QP	NEUTRAL
9	3.820	26.22	-29.78	56.00	15.98	9.87	0.37	QP	NEUTRAL
10	3.820	20.29	-25.71	46.00	10.05	9.87	0.37	AVERAGE	NEUTRAL
11	14.986	26.42	-23.58	50.00	15.88	10.11	0.43	AVERAGE	NEUTRAL
12	14.986	32.10	-27.90	60.00	21.56	10.11	0.43	QP	NEUTRAL

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)

Measuring Instruments and Setting

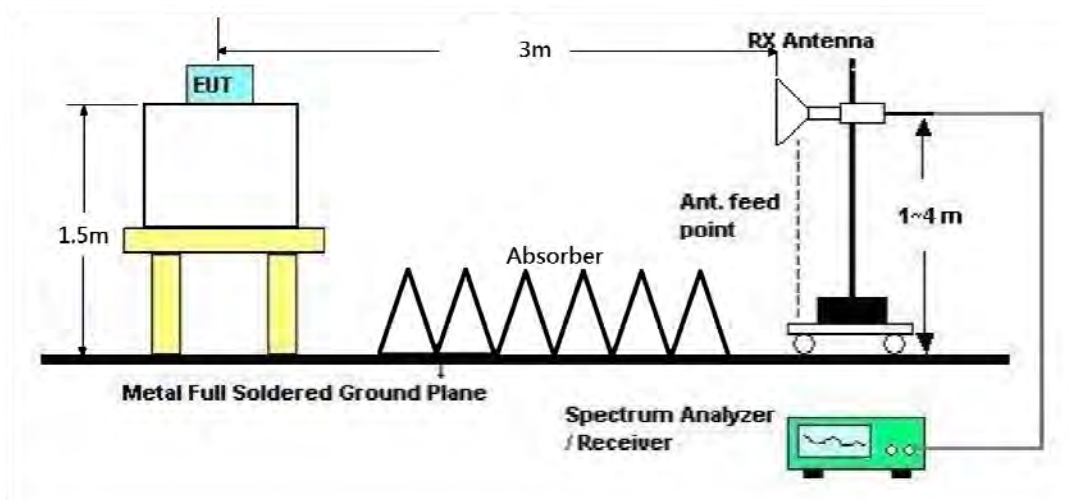
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

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

4.2.2. Test Procedures

1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 1.5 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.

4.2.3. Test Setup Layout



4.2.4. Test Deviation

There is no deviation with the original standard.

4.2.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.2.6. Test Result of Field Strength of Fundamental Emissions

Temperature	26°C	Humidity	68%
Test Engineer	Gino Huang	Configurations	Channel 1/8/12
Test Date	Mar. 02, 2015		

Channel 1

	Freq	Level	Limit Line	Over Limit	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	cm	deg		
1	2405.32	60.26	94.00	-33.74	29.53	27.90	2.83	0.00	154	263	HORIZONTAL	Average
2	2405.32	100.66	114.00	-13.34	69.93	27.90	2.83	0.00	154	263	HORIZONTAL	Peak

Channel 8

	Freq	Level	Limit Line	Over Limit	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	cm	deg		
1	2444.31	60.55	94.00	-33.45	29.79	27.90	2.86	0.00	153	266	HORIZONTAL	Average
2	2444.31	100.95	114.00	-13.05	70.19	27.90	2.86	0.00	153	266	HORIZONTAL	Peak

Channel 12

	Freq	Level	Limit Line	Over Limit	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	A/Pos	T/Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	cm	deg		
1	2473.65	59.66	94.00	-34.34	28.89	27.90	2.87	0.00	146	270	HORIZONTAL	Average
2	2473.65	100.06	114.00	-13.94	69.29	27.90	2.87	0.00	146	270	HORIZONTAL	Peak

Note:

$$\text{Emission level (dBuV/m)} = 20 \log \text{Emission level (uV/m)}$$

$$\text{Corrected Reading: Antenna Factor} + \text{Cable Loss} + \text{Read Level} - \text{Preamp Factor} = \text{Level}$$

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

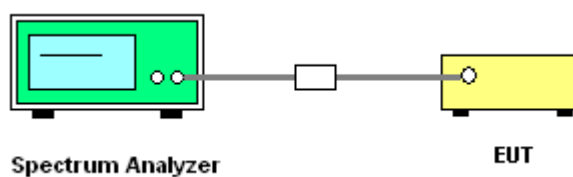
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

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

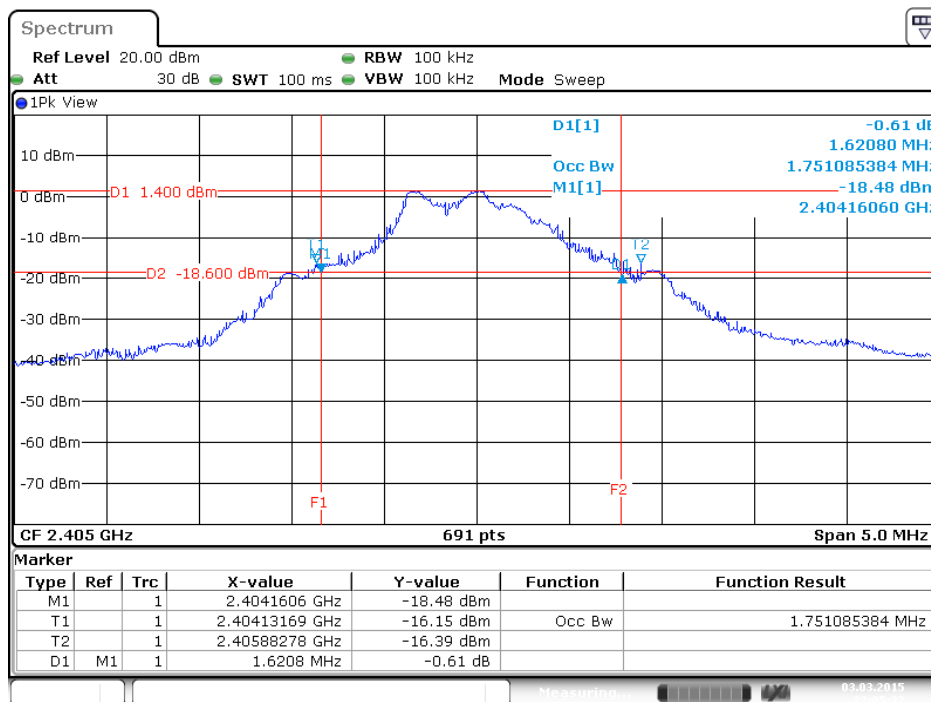
The EUT was programmed to be in continuously transmitting mode.

4.3.7. Test Result of 20dB Spectrum Bandwidth

Temperature	20°C	Humidity	63%
Test Engineer	Lucas Huang	Configurations	Channel 1/8/12

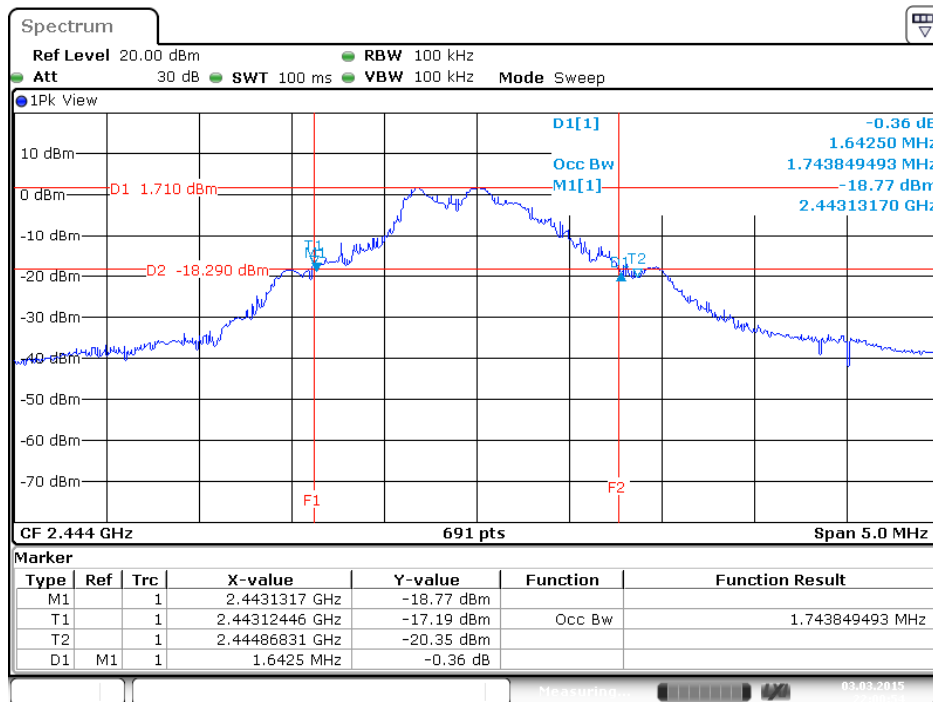
Frequency	20dB BW (MHz)	99% OBW (MHz)	Frequency range (MHz) $f_L > 2400\text{MHz}$	Frequency range (MHz) $f_H < 2483.5\text{MHz}$	Test Result
2405 MHz	1.62	1.75	2404.1606	-	Complies
2444 MHz	1.64	1.74	-	-	Complies
2474 MHz	1.48	1.74	-	2474.7959	Complies

20 dB/99% Bandwidth Plot on 2405 MHz



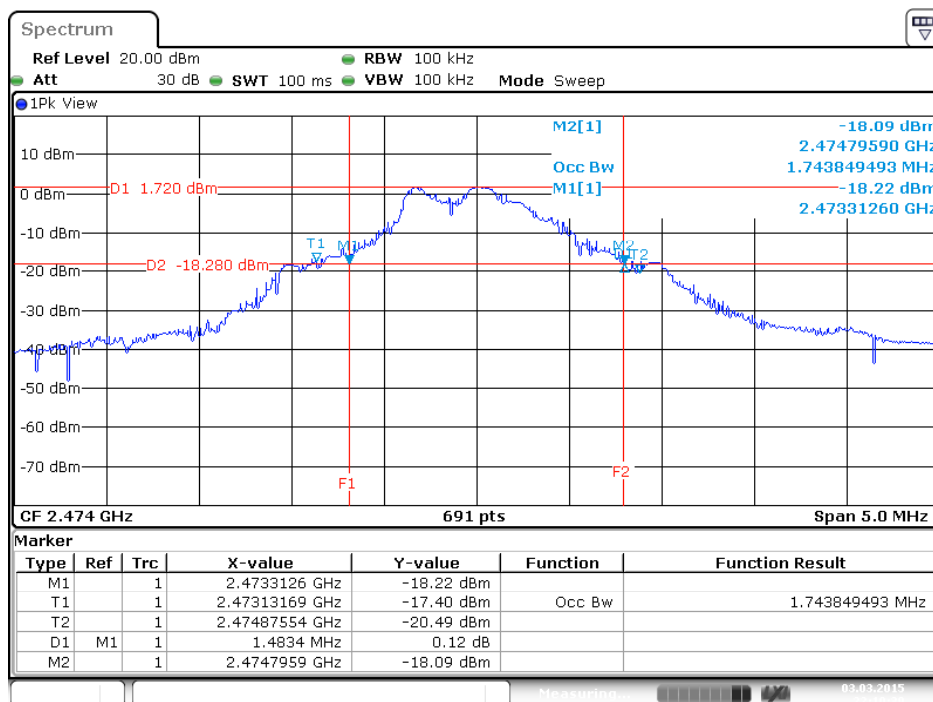
Date: 3 MAR 2015 22:05:33

20 dB/99% Bandwidth Plot on 2444 MHz



Date: 3 MAR 2015 22:00:54

20 dB/99% Bandwidth Plot on 2474 MHz



Date: 3 MAR 2015 22:10:39

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)	1MHz / 3MHz for Peak, 1 MHz / 10Hz for Average
RBW / VBW (Emission in non-restricted band)	100kHz/300kHz for Peak

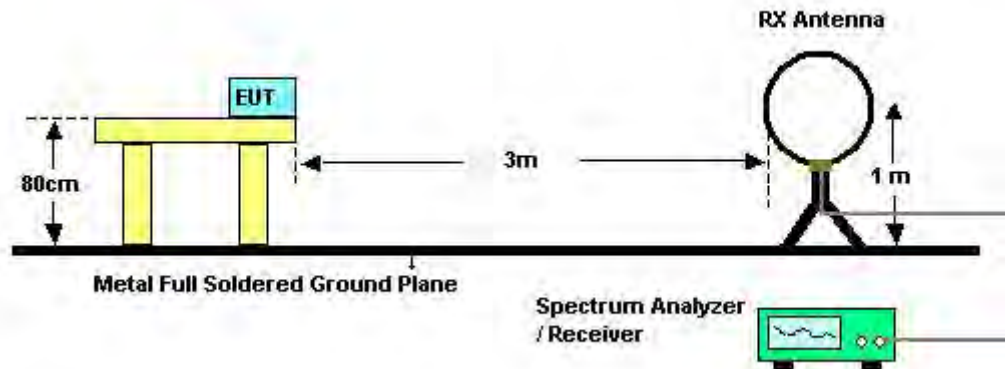
Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RBW 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RBW 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RBW 120kHz for QP

4.4.3. Test Procedures

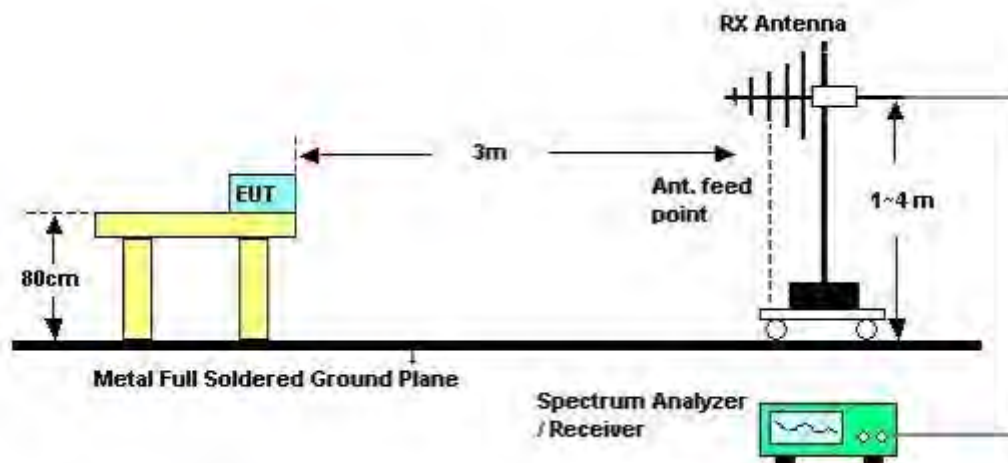
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting 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

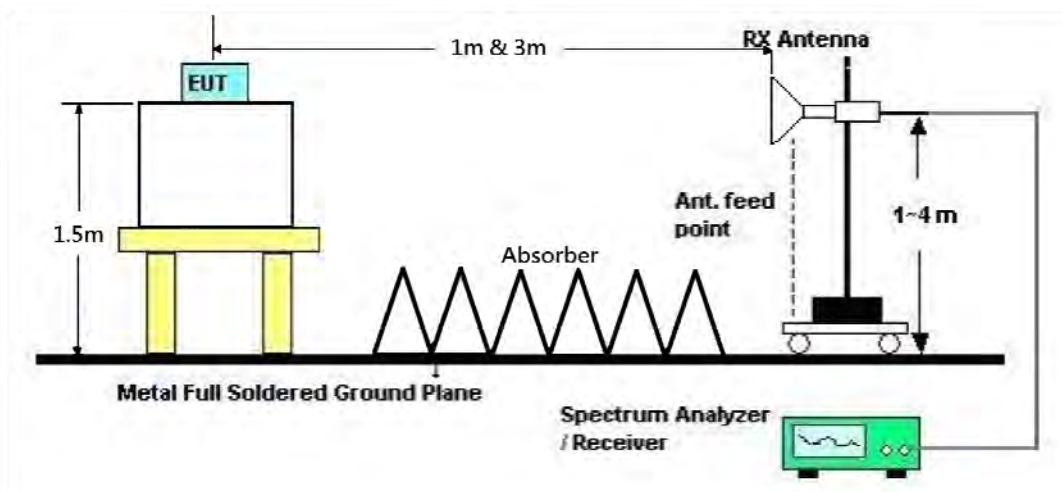
For Radiated Emissions: 9kHz ~30MHz



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	26°C	Humidity	68%
Test Engineer	Gino Huang	Configurations	Normal Link
Test Date	Mar. 07, 2015		

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.

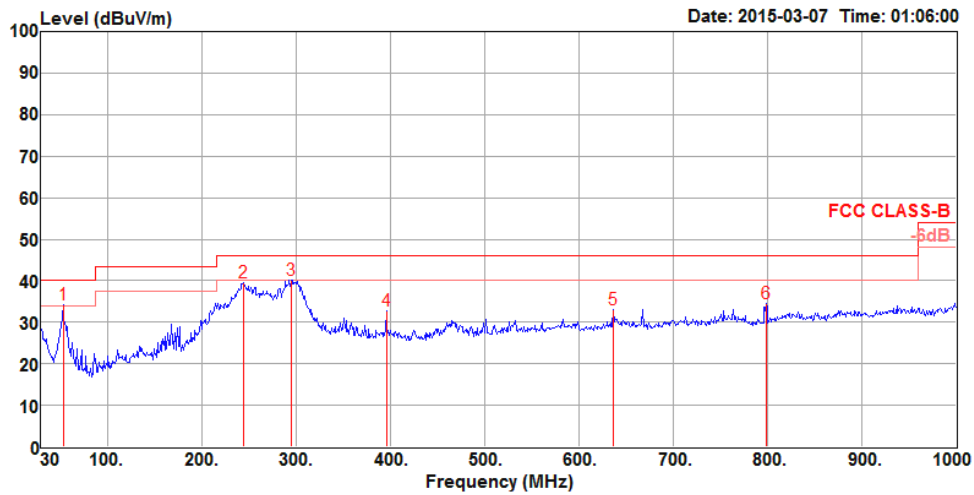
Distance extrapolation factor = $40 \log(\text{specific distance} / \text{test distance})$ (dB);

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

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

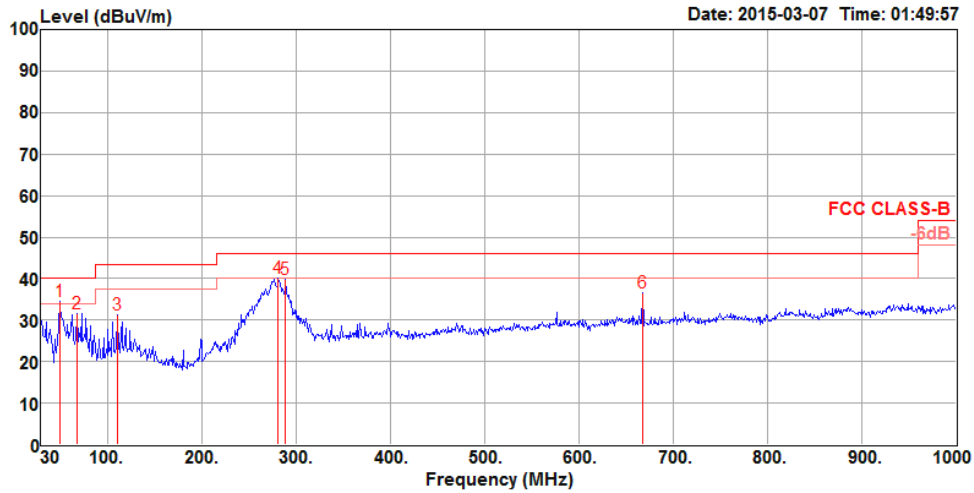
Temperature	26°C	Humidity	68%
Test Engineer	Gino Huang	Configurations	Normal Link

Horizontal



	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss	Antenna Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBUV/m	dBUV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	53.28	34.14	40.00	-5.86	57.45	0.63	8.37	32.31	400	310	Peak	HORIZONTAL
2	244.37	39.60	46.00	-6.40	57.86	1.36	12.52	32.14	100	144	Peak	HORIZONTAL
3	294.81	40.20	46.00	-5.80	56.99	1.48	13.80	32.07	200	104	Peak	HORIZONTAL
4	395.69	32.79	46.00	-13.21	46.68	1.74	16.41	32.04	100	324	Peak	HORIZONTAL
5	636.25	32.97	46.00	-13.03	43.44	2.20	19.46	32.13	150	1	Peak	HORIZONTAL
6	798.24	34.44	46.00	-11.56	43.28	2.46	20.78	32.08	100	147	Peak	HORIZONTAL

Vertical



	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	49.40	34.59	40.00	-5.41	57.05	0.60	9.26	32.32	400	151	Peak VERTICAL
2	67.83	31.65	40.00	-8.35	56.45	0.71	6.82	32.33	125	287	Peak VERTICAL
3	110.51	31.18	43.50	-12.32	50.20	0.91	12.33	32.26	100	248	Peak VERTICAL
4	281.23	40.00	46.00	-6.00	57.20	1.45	13.52	32.17	200	171	Peak VERTICAL
5	288.99	39.85	46.00	-6.15	56.79	1.47	13.68	32.09	200	171	Peak VERTICAL
6	667.29	36.68	46.00	-9.32	46.87	2.25	19.64	32.08	100	269	Peak 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	26°C	Humidity	68%
Test Engineer	Gino Huang	Configurations	Channel 1
Test Date	Feb. 27, 2015		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	4810.62	31.50	74.00	-42.50	29.48	4.09	32.52	34.59	146	138	Peak	HORIZONTAL
2	4810.62	-8.90	54.00	-62.90	-10.92	4.09	32.52	34.59	146	138	Average	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	4810.28	32.13	74.00	-41.87	30.11	4.09	32.52	34.59	81	151	Peak	VERTICAL
2	4810.28	-8.27	54.00	-62.27	-10.29	4.09	32.52	34.59	81	151	Average	VERTICAL



Temperature	26°C	Humidity	68%
Test Engineer	Gino Huang	Configurations	Channel 8
Test Date	Feb. 27, 2015		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	4888.90	31.51	74.00	-42.49	29.25	4.13	32.69	34.56	219	166	Peak	HORIZONTAL
2	4888.90	-8.89	54.00	-62.89	-11.15	4.13	32.69	34.56	219	166	Average	HORIZONTAL
3	7332.48	38.41	74.00	-35.59	31.05	5.10	37.09	34.83	241	188	Peak	HORIZONTAL
4	7332.48	-1.99	54.00	-55.99	-9.35	5.10	37.09	34.83	241	188	Average	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	4887.74	32.78	74.00	-41.22	30.53	4.13	32.69	34.57	121	181	Peak	VERTICAL
2	4887.74	-7.62	54.00	-61.62	-9.87	4.13	32.69	34.57	121	181	Average	VERTICAL
3	7332.08	37.36	74.00	-36.64	30.00	5.10	37.09	34.83	160	208	Peak	VERTICAL
4	7332.08	-3.04	54.00	-57.04	-10.40	5.10	37.09	34.83	160	208	Average	VERTICAL



Temperature	26°C	Humidity	68%
Test Engineer	Gino Huang	Configurations	Channel 12
Test Date	Feb. 27, 2015		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	4948.46	32.74	74.00	-41.26	30.32	4.16	32.80	34.54	195	156	Peak	HORIZONTAL
2	4948.46	-7.66	54.00	-61.66	-10.08	4.16	32.80	34.54	195	156	Average	HORIZONTAL
3	7422.72	38.25	74.00	-35.75	30.76	5.12	37.22	34.85	145	133	Peak	HORIZONTAL
4	7422.72	-2.15	54.00	-56.15	-9.64	5.12	37.22	34.85	145	133	Average	HORIZONTAL

Vertical

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	deg	cm		
1	4948.88	31.59	74.00	-42.41	29.17	4.16	32.80	34.54	354	156	Peak	VERTICAL
2	4948.88	-8.81	54.00	-62.81	-11.23	4.16	32.80	34.54	354	156	Average	VERTICAL
3	7422.91	39.17	74.00	-34.83	31.68	5.12	37.22	34.85	313	141	Peak	VERTICAL
4	7422.91	-1.23	54.00	-55.23	-8.72	5.12	37.22	34.85	313	141	Average	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

1. The test procedure is the same as section 4.4.3, only the frequency range investigated is limited to 2MHz around bandedges.
2. 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	26°C	Humidity	68%
Test Engineer	Gino Huang	Configurations	Channel 1, 8, 12
Test Date	Feb. 27, 2015		

Channel 1

	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	deg	cm		
1	2379.40	61.48	74.00	-12.52	30.69	2.85	27.94	0.00	270	188 Peak	HORIZONTAL
2	2379.40	21.08	54.00	-32.92	-9.71	2.85	27.94	0.00	270	188 Average	HORIZONTAL
3	2405.40	100.16			69.39	2.87	27.90	0.00	270	188 Peak	HORIZONTAL
4	2405.40	59.75			28.98	2.87	27.90	0.00	270	188 Average	HORIZONTAL

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

Channel 8

	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	deg	cm		
1	2352.80	54.65	74.00	-19.35	23.85	2.83	27.97	0.00	267	152 Peak	HORIZONTAL
2	2352.80	14.25	54.00	-39.75	-16.55	2.83	27.97	0.00	267	152 Average	HORIZONTAL
3	2443.60	100.48			69.73	2.89	27.86	0.00	267	152 Peak	HORIZONTAL
4	2443.60	60.08			29.33	2.89	27.86	0.00	267	152 Average	HORIZONTAL
5	2483.50	54.82	74.00	-19.18	24.09	2.91	27.82	0.00	267	152 Peak	HORIZONTAL
6	2483.50	14.42	54.00	-39.58	-16.31	2.91	27.82	0.00	267	152 Average	HORIZONTAL

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

Channel 12

	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	T/Pos	A/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	deg	cm		
1	2473.80	98.18			67.45	2.91	27.82	0.00	258	140 Peak	HORIZONTAL
2	2473.80	57.78			27.05	2.91	27.82	0.00	258	140 Average	HORIZONTAL
3	2483.50	62.76	74.00	-11.24	32.03	2.91	27.82	0.00	258	140 Peak	HORIZONTAL
4	2483.50	22.35	54.00	-31.65	-8.38	2.91	27.82	0.00	258	140 Average	HORIZONTAL

Item 1, 2 are the fundamental frequency at 2474 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	9kHz ~ 2.75GHz	Apr. 23, 2014	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150kHz ~ 100MHz	Dec. 02, 2014	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Dec. 02, 2014	Conduction (CO01-CB)
COND Cable	Woken	Cable	01	150kHz ~ 30MHz	Dec. 03, 2014	Conduction (CO01-CB)
Software	Audix	E3	5.410e	-	N.C.R.	Conduction (CO01-CB)
BILOG ANTENNA	Schaffner	CBL6112D	22021	20MHz ~ 2GHz	May 26, 2014	Radiation (03CH01-CB)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz ~ 30 MHz	Jul. 28, 2014	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz ~ 18GHz	Oct. 28, 2014	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Aug. 22, 2014	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10991	0.1MHz ~ 1.3GHz	Feb. 24, 2015	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 12, 2015	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	Nov. 06, 2014	Radiation (03CH01-CB)
EMI Test Receiver	Agilent	N9038A	MY52260123	9kHz ~ 8GHz	Jan. 21, 2015	Radiation (03CH01-CB)
EMI Test Receiver	R&S	ESR26	101289	9kHz ~ 26GHz	Aug. 22, 2014	Radiation (03CH01-CB)
Turn Table	INN CO	CO 2000	N/A	0 ~ 360 degree	N.C.R.	Radiation (03CH01-CB)
Antenna Mast	INN CO	CO 2000	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. 15, 2014	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G-1	N/A	1 GHz ~ 40 GHz	Nov. 15, 2014	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G-2	N/A	1 GHz ~ 40 GHz	Nov. 15, 2014	Radiation (03CH01-CB)
Signal analyzer	R&S	FSV40	100979	9kHz~40GHz	Dec. 12, 2014	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-7	1 GHz ~ 26.5 GHz	Nov. 15, 2014	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-8	1 GHz ~ 26.5 GHz	Nov. 15, 2014	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-9	1 GHz ~ 26.5 GHz	Nov. 15, 2014	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-10	1 GHz ~ 26.5 GHz	Nov. 15, 2014	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-6	1 GHz ~ 26.5 GHz	Nov. 15, 2014	Conducted (TH01-CB)
Power Sensor	Agilent	U2021XA	MY53410001	50MHz~18GHz	Nov. 03, 2014	Conducted (TH01-CB)

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

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

6. MEASUREMENT UNCERTAINTY

Test Items	Uncertainty	Remark
Conducted Emission (150kHz ~ 30MHz)	2.4 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	3.6 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	3.7 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	3.5 dB	Confidence levels of 95%
Conducted Emission	1.7 dB	Confidence levels of 95%