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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	Feb. 12, 2015
Submission Type	Class II Change

Statement

Test result included is only for the Bluetooth 4.0 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 C63.10-2013**, **47 CFR FCC Part 15 Subpart C** and **KDB 558074 D01 v03r02.**

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
FR322105-48AC	Rev. 01	Initial issue of report	Mar. 11, 2015

1. VERIFICATION 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

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	10.17 dB
4.2	15.247(b)(3)	Maximum Conducted Output Power	Complies	21.91 dB
4.3	15.247(d)	Radiated Emissions	Complies	3.67 dB
4.4	15.247(d)	Band Edge Emissions	Complies	2.66 dB
4.5	15.203	Antenna Requirements	Complies	-

3. GENERAL INFORMATION

3.1. Product Details

Items	Description
Power Type	From host system
Modulation	DSSS
Data Rate (Mbps)	GFSK: 1
Frequency Range	2400 ~ 2483.5MHz
Channel Number	40 (37 hopping + 3 advertising channel)
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	NGFF Board

This project added one configuration of EUT. The more information is listed as below table.

Configuration	Type	Power Type	Antenna Variety	Antenna Connector	Type of Antenna
1	NGFF	PCI-E (WLAN)	-	One	PIFA with I-PEX MHF4 connector
		USB (Bluetooth)			

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

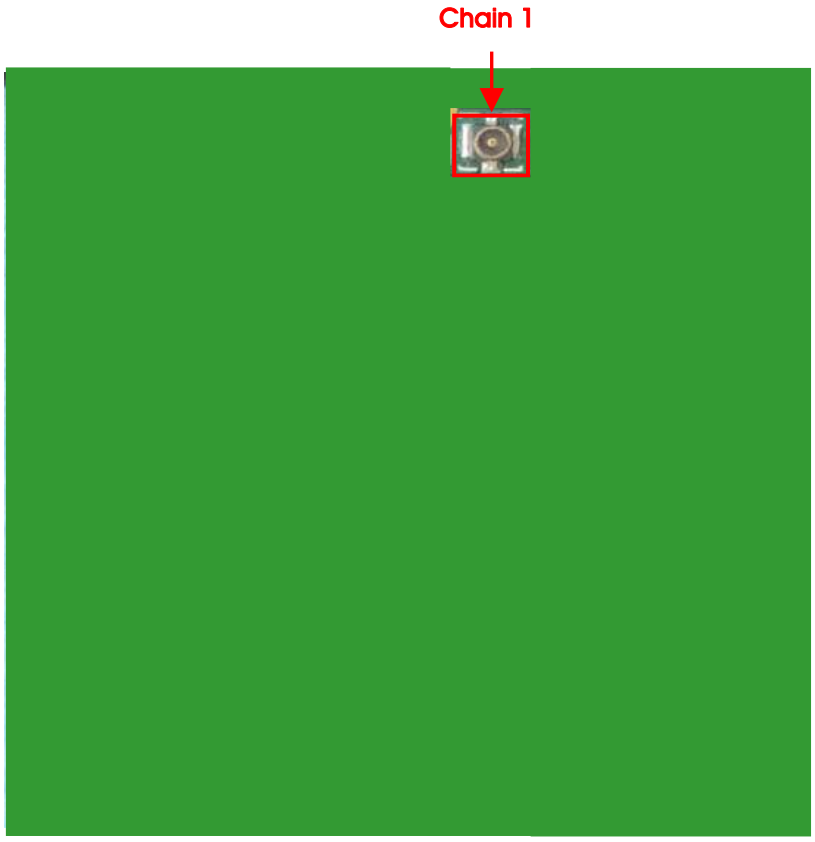
Chain 1 could transmit/receive simultaneously.

For Bluetooth mode:

Chain 1 could transmit/receive simultaneously.

The bluetooth gets into idle mode while the WiFi works.

The WiFi gets into idle mode while the bluetooth works.



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: FR322105-22AC
Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
1. Adding one connector of original certified NGFF type device.	1. AC Power Line Conducted Emissions 2. Radiated Emissions 3. Band Edge Emissions After evaluating, these test items should be tested and recorded in this report.
2. Adding same type of PIFA antenna with lower gain than the original Certificate, and the total antennas amounted to 488 sets.	Do not have to retest assessed.

Note: Radiated Emissions (above 1GHz) and Band Edge Emissions were retested based on Maximum Conducted Output Power of original report: FR322105AC

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	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. NGFF (WLAN) + PIFA Ant.

Mode 2. NGFF (Bluetooth) + PIFA Ant.

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

For Radiated Emission test<Below 1GHz>:

Mode 1. NGFF (WLAN) + PIFA Ant.

Mode 2. NGFF (Bluetooth) + PIFA Ant.

Mode 1 is the worst case, so it was selected to record in this test report.

For Radiated Emission test<Above 1GHz>:

Mode 1. NGFF + PIFA Ant.

3.7. 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.**
03CH01-CB	SAC	Hsin Chu	262045	IC 4086D
CO01-CB	Conduction	Hsin Chu	262045	IC 4086D

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

3.8. Table for Supporting Units

For Test Site No : CO01-CB

Support Unit	Brand	Model	FCC ID
AP Router	Planex	GW-AP54SGX	KA220030603014-1
Test Fixture	Realtek	N/A	N/A
NB	DELL	E4300	N/A
Mouse	HP	FM100	DoC
Earphone	SHYARO CHI	MIC-04	DoC

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

Support Unit	Brand	Model	FCC ID
NB	DELL	M1330	DoC
Mouse	Logitech	M-U0026	DoC
Earphone	E-BOOKI	E-EPC040	N/A
Test Fixture	Realtek	N/A	N/A
Wireless AP	Planex	GW-AP54SGX	N/A

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

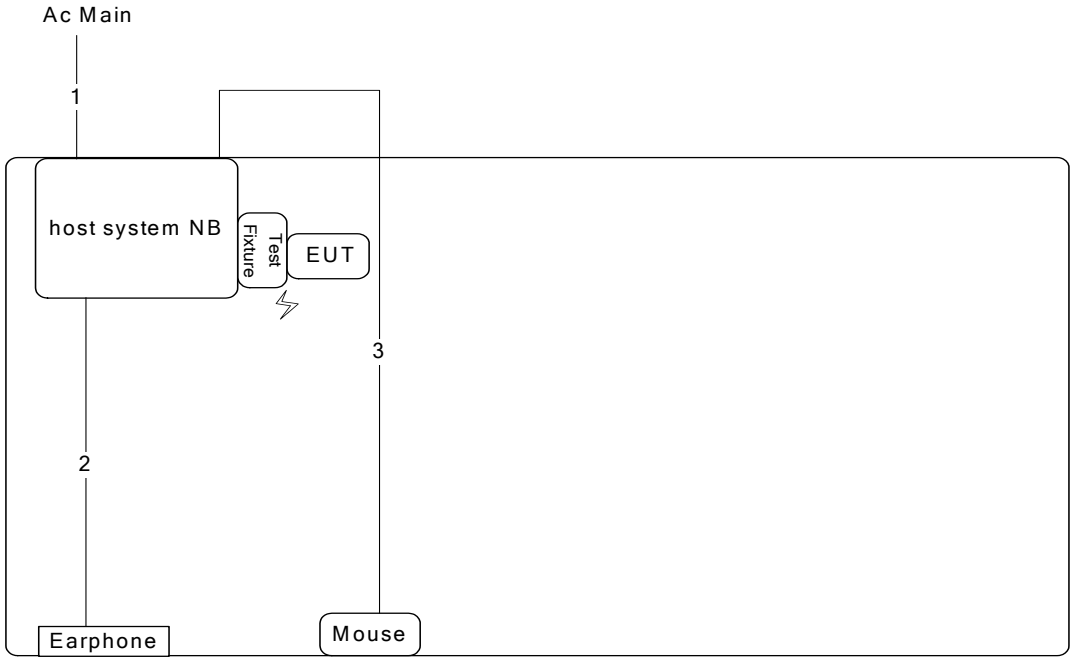
Support Unit	Brand	Model	FCC ID
NB	DELL	M1330	DoC
Test Fixture	Realtek	N/A	N/A

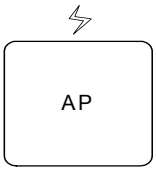
For Test Site No : TH01-CB

Support Unit	Brand	Model	FCC ID
NB	DELL	M1330	E2KWM3945ABG
Test Fixture	Realtek	N/A	N/A

3.9. Test Configurations

3.9.1. AC Power Line Conduction Emissions Test Configuration

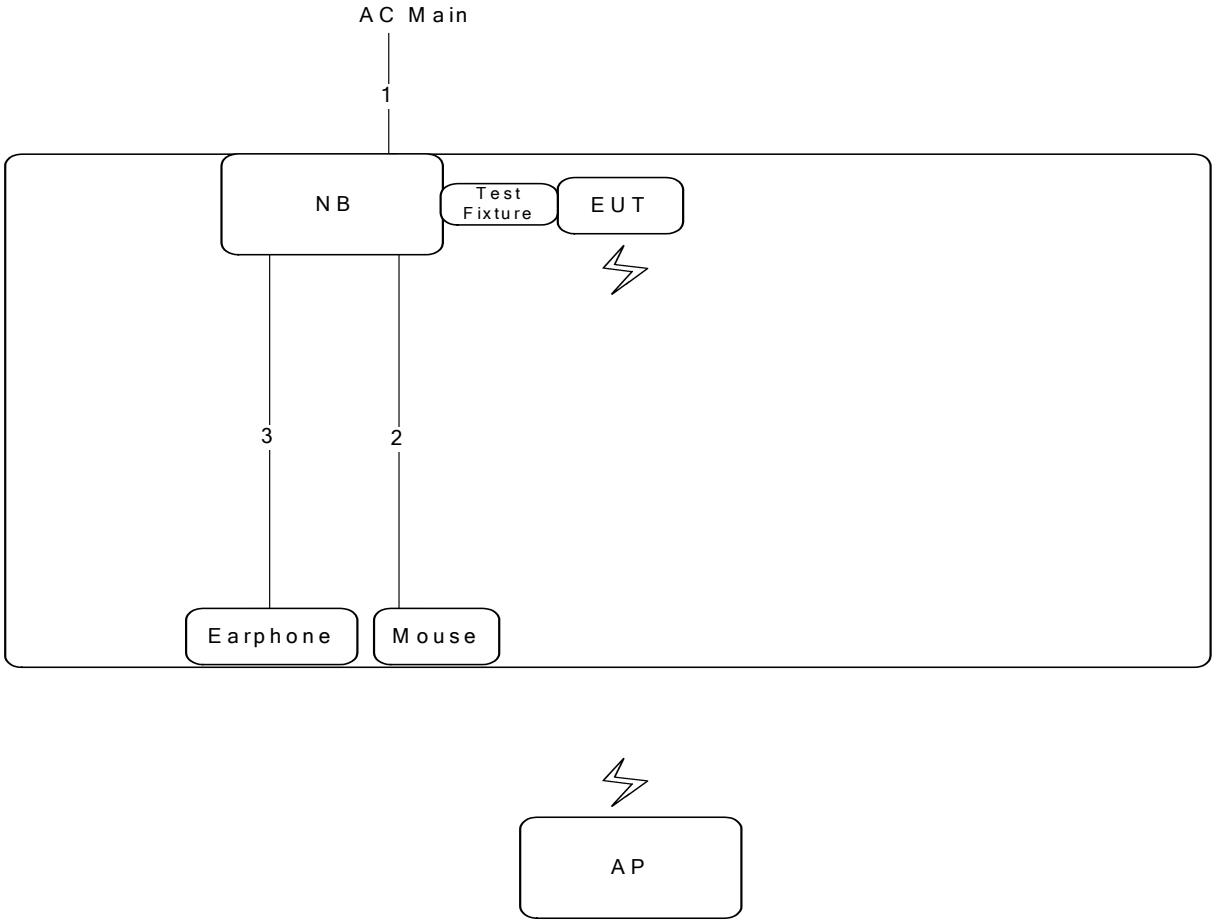




Item	Connection	Shield	Length
1	Power cable	No	2.6m
2	Audio cable	No	1.1m
3	USB cable	Yes	1.8m

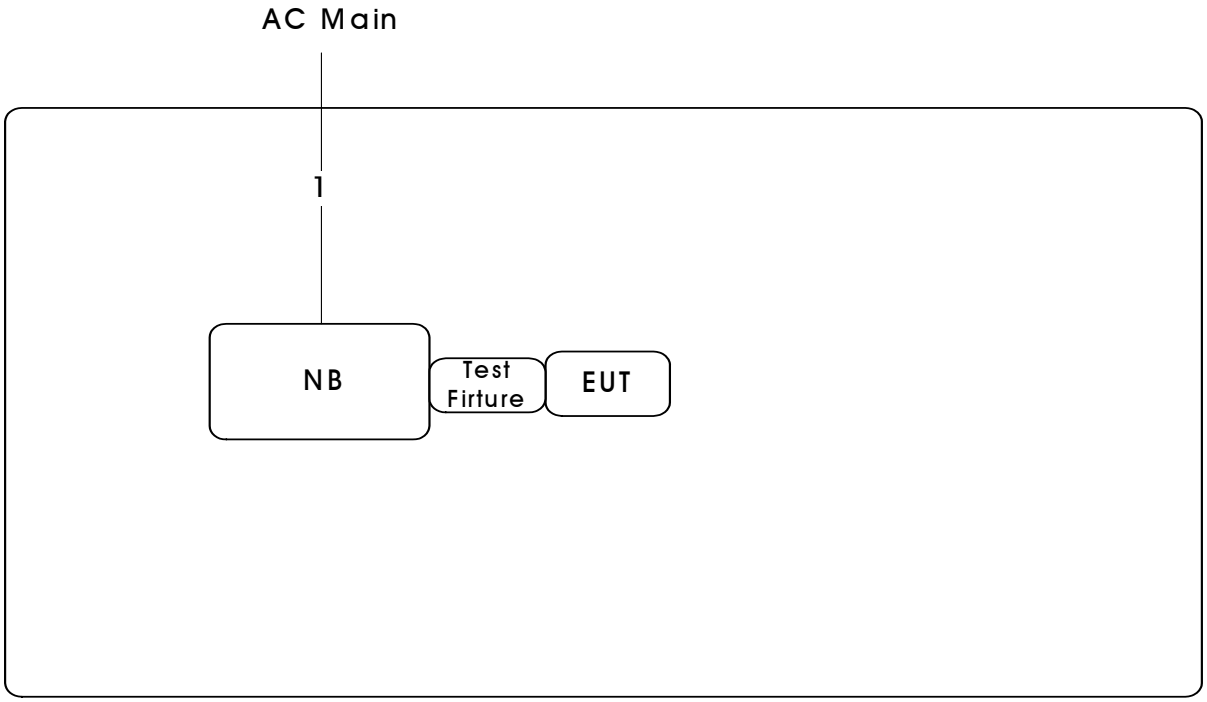
3.9.2. Radiation Emissions Test Configuration

Test Configuration: 30MHz~1GHz



Item	Connection	Shield	Length
1	Power cable	No	2.6m
2	USB cable	Yes	1m
3	Audio cable	Yes	1m

Test Configuration: above 1GHz



Item	Connection	Shield	Length
1	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

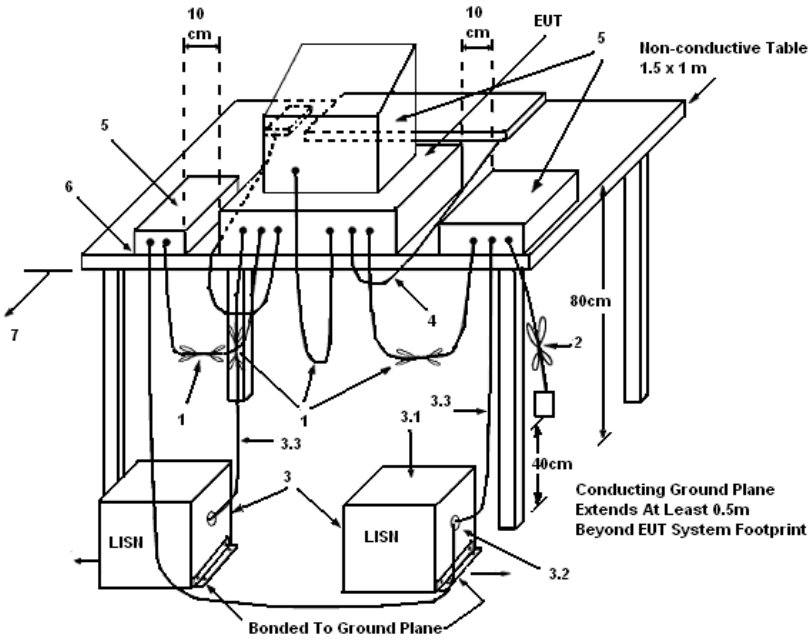
Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

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

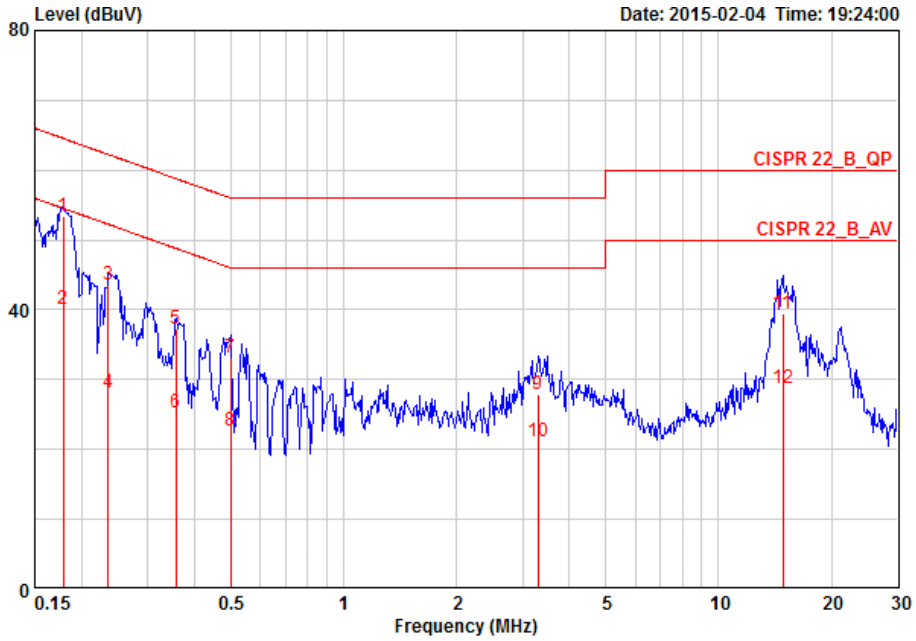
There is no deviation with the original standard.

4.1.6. EUT Operation during Test

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

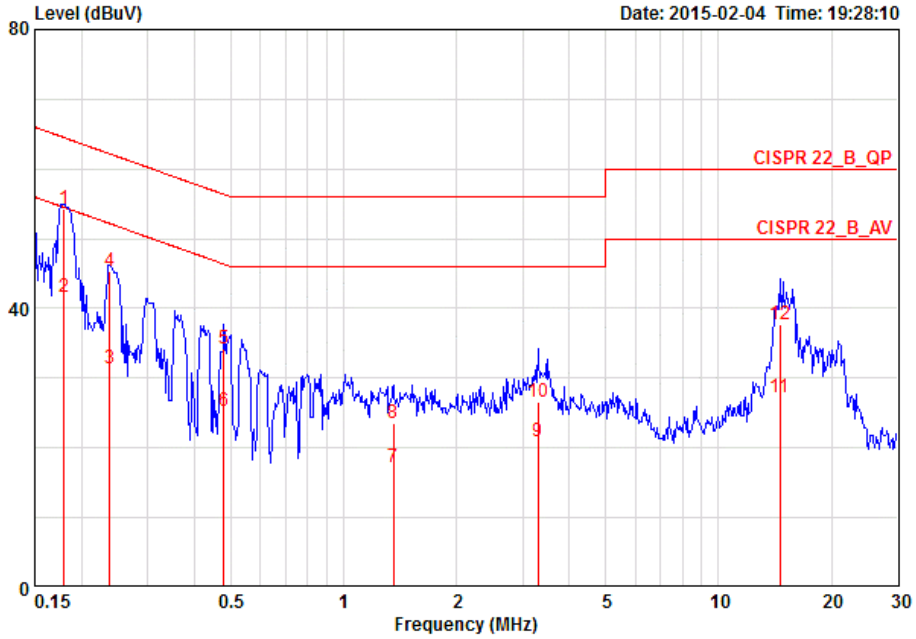
4.1.7. Results of AC Power Line Conducted Emissions Measurement

Temperature	24℃	Humidity	68%
Test Engineer	Parody Lin	Phase	Line
Configuration	Normal Link	Test Mode	Mode 1



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1 @	0.17866	53.35	-11.20	64.55	43.09	10.03	0.23	QP	LINE
2	0.17866	40.02	-14.53	54.55	29.76	10.03	0.23	AVERAGE	LINE
3	0.23533	43.58	-18.68	62.26	33.29	10.03	0.26	QP	LINE
4	0.23533	28.05	-24.21	52.26	17.76	10.03	0.26	AVERAGE	LINE
5	0.35765	37.22	-21.56	58.78	26.90	10.03	0.29	QP	LINE
6	0.35765	25.20	-23.58	48.78	14.88	10.03	0.29	AVERAGE	LINE
7	0.49937	33.05	-22.96	56.01	22.72	10.03	0.31	QP	LINE
8	0.49937	22.61	-23.40	46.01	12.28	10.03	0.31	AVERAGE	LINE
9	3.293	27.88	-28.12	56.00	17.49	10.03	0.36	QP	LINE
10	3.293	21.20	-24.80	46.00	10.81	10.03	0.36	AVERAGE	LINE
11	14.828	39.53	-20.47	60.00	28.97	10.13	0.43	QP	LINE
12	14.828	28.78	-21.22	50.00	18.22	10.13	0.43	AVERAGE	LINE

Temperature	24℃	Humidity	68%
Test Engineer	Parody Lin	Phase	Neutral
Configuration	Normal Link	Test Mode	Mode 1



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark	Pol/Phase
	MHz	dBuV	dB	dBuV	dBuV	dB	dB		
1 @	0.17961	54.34	-10.17	64.50	44.14	9.96	0.23	QP	NEUTRAL
2	0.17961	41.74	-12.77	54.50	31.54	9.96	0.23	AVERAGE	NEUTRAL
3	0.23784	31.48	-20.69	52.17	21.26	9.95	0.26	AVERAGE	NEUTRAL
4	0.23784	45.31	-16.86	62.17	35.09	9.95	0.26	QP	NEUTRAL
5	0.47865	34.19	-22.18	56.36	24.00	9.88	0.31	QP	NEUTRAL
6	0.47865	25.39	-20.98	46.36	15.20	9.88	0.31	AVERAGE	NEUTRAL
7	1.359	17.19	-28.81	46.00	6.96	9.89	0.34	AVERAGE	NEUTRAL
8	1.359	23.51	-32.49	56.00	13.28	9.89	0.34	QP	NEUTRAL
9	3.293	20.93	-25.07	46.00	10.68	9.89	0.36	AVERAGE	NEUTRAL
10	3.293	26.66	-29.34	56.00	16.41	9.89	0.36	QP	NEUTRAL
11	14.594	27.30	-22.70	50.00	16.90	9.97	0.43	AVERAGE	NEUTRAL
12	14.594	37.74	-22.26	60.00	27.34	9.97	0.43	QP	NEUTRAL

Note:

Level = Read Level + LISN Factor + Cable Loss.

4.2. Maximum Conducted Output Power Measurement

4.2.1. Limit

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. 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

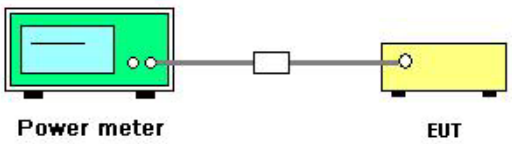
Please refer to section 5 of equipments list in this report. The following table is the setting of the power meter.

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

4.2.3. Test Procedures

1. Test procedures refer KDB 558074 D01 v03r02 section 9.2.3.2 Measurement using a power meter (PM).
2. 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	23°C	Humidity	63%
Test Engineer	Benson Peng	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, 1 MHz / 10Hz for Average
RBW / VBW (Emission in non-restricted band)	100kHz / 300kHz for peak

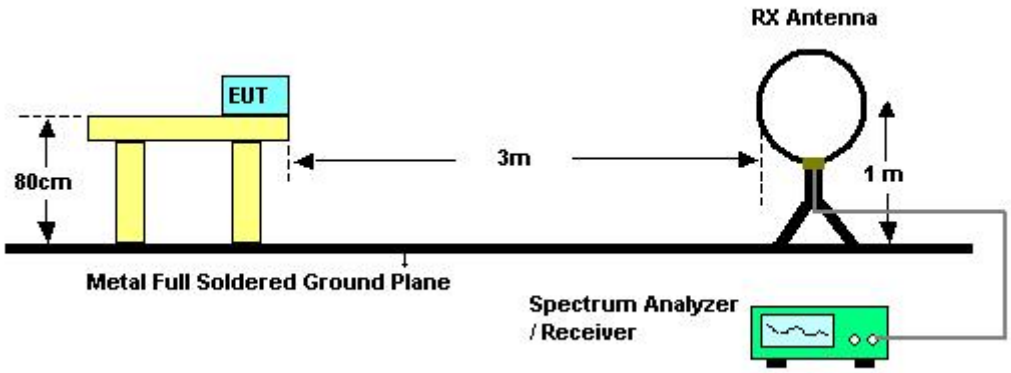
Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RBW 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RBW 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RBW 120kHz for QP

4.3.3. Test Procedures

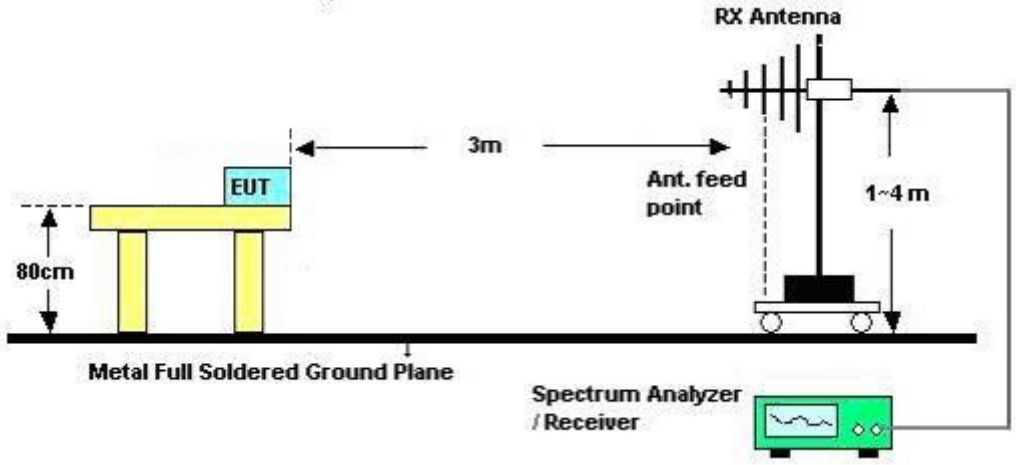
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting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

4.3.4. Test Setup Layout

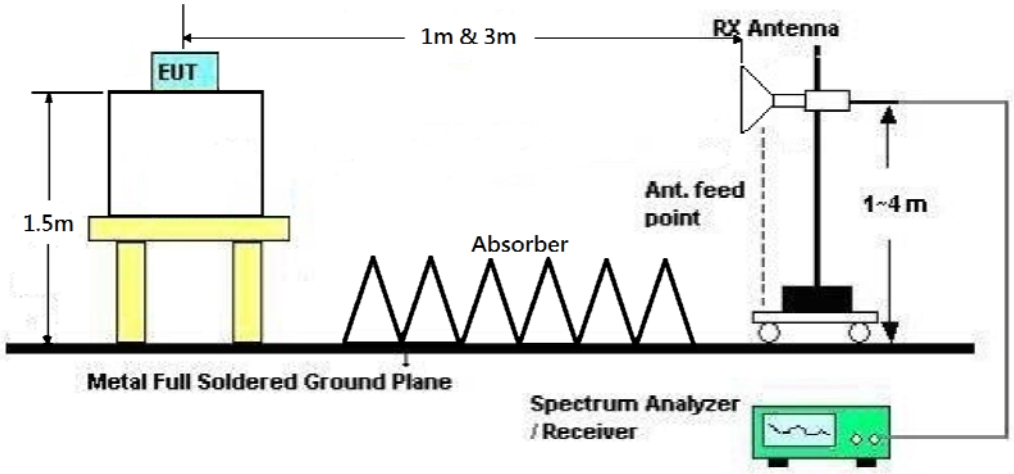
For Radiated Emissions: 9kHz ~30MHz



For Radiated Emissions: 30MHz~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	26℃	Humidity	68%
Test Engineer	Eddie Weng	Configurations	Normal Link
Test Date	Feb. 12, 2015	Test Mode	Mode 1

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

Note:

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

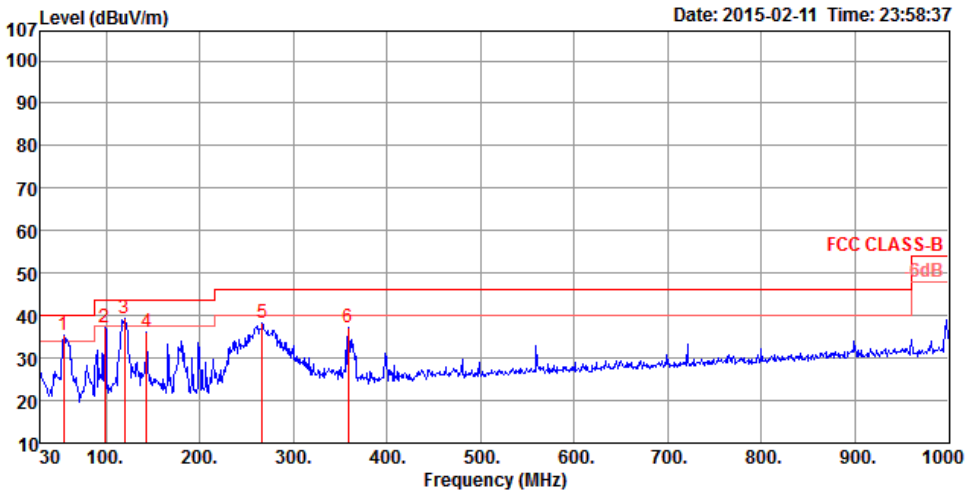
Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

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

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

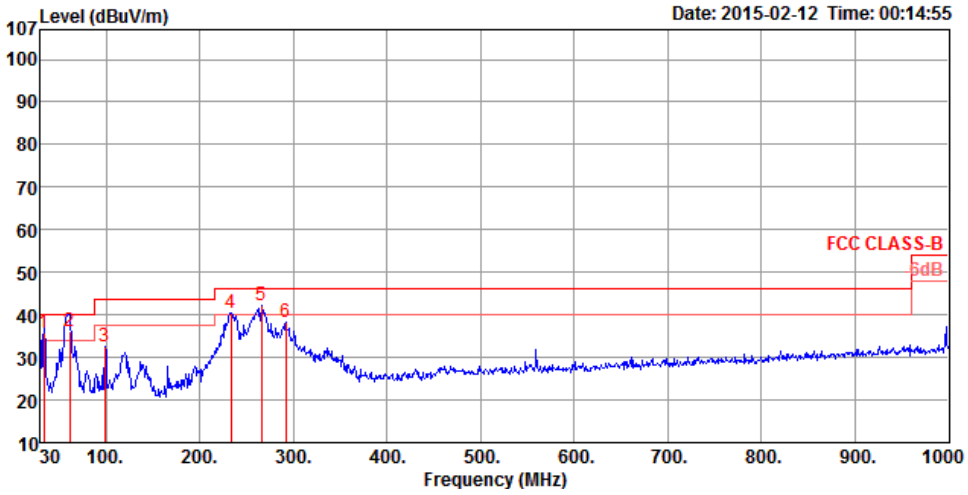
Temperature	26℃	Humidity	68%
Test Engineer	Eddie Weng	Configurations	Normal Link
Test Mode	Mode 1		

Horizontal



	Freq	Level	Limit Line	Over Limit	Read 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	54.25	35.41	40.00	-4.59	59.13	8.02	0.76	32.50	400	288	HORIZONTAL	Peak
2	98.87	37.12	43.50	-6.38	57.69	10.90	0.98	32.45	300	190	HORIZONTAL	Peak
3	119.24	39.27	43.50	-4.23	57.91	12.67	1.10	32.41	300	322	HORIZONTAL	Peak
4	143.49	36.12	43.50	-7.38	55.57	11.71	1.21	32.37	200	148	HORIZONTAL	Peak
5	266.68	38.10	46.00	-7.90	55.15	13.77	1.62	32.44	100	204	HORIZONTAL	Peak
6	358.83	37.37	46.00	-8.63	52.34	15.52	1.88	32.37	125	326	HORIZONTAL	Peak

Vertical



	Freq	Level	Limit Line	Over Limit	Read 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	33.55	35.85	40.00	-4.15	50.08	17.60	0.59	32.42	100	177	VERTICAL	QP
2	61.15	36.13	40.00	-3.87	61.04	6.80	0.79	32.50	285	6	VERTICAL	QP
3	98.87	32.70	43.50	-10.80	53.26	10.91	0.98	32.45	100	234	VERTICAL	Peak
4	233.70	40.50	46.00	-5.50	59.55	11.66	1.52	32.23	100	360	VERTICAL	Peak
5	265.71	42.33	46.00	-3.67	59.37	13.78	1.62	32.44	200	174	VERTICAL	Peak
6	291.90	38.31	46.00	-7.69	55.16	13.74	1.69	32.28	125	29	VERTICAL	Peak

Note:

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

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

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

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

Temperature	26°C	Humidity	68%
Test Engineer	Eddie Weng	Configurations	Channel 0 / Chain 1
Test Date	Feb. 11, 2015		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read 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	4803.87	34.57	54.00	-19.43	30.18	31.06	7.04	33.71	142	334	HORIZONTAL	Average
2	4804.27	48.45	74.00	-25.55	44.06	31.06	7.04	33.71	142	334	HORIZONTAL	Peak
3	12011.14	46.80	54.00	-7.20	31.72	38.89	11.24	35.05	194	316	HORIZONTAL	Average
4	12011.92	61.58	74.00	-12.42	46.50	38.89	11.24	35.05	194	316	HORIZONTAL	Peak

Vertical

	Freq	Level	Limit Line	Over Limit	Read 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	4803.66	35.11	54.00	-18.89	30.72	31.06	7.04	33.71	100	267	VERTICAL	Average
2	4803.85	49.12	74.00	-24.88	44.73	31.06	7.04	33.71	100	267	VERTICAL	Peak
3	12008.88	47.04	54.00	-6.96	31.95	38.90	11.24	35.05	131	308	VERTICAL	Average
4	12012.09	62.22	74.00	-11.78	47.13	38.90	11.24	35.05	131	308	VERTICAL	Peak

Temperature	26℃	Humidity	68%
Test Engineer	Eddie Weng	Configurations	Channel 20 / Chain 1
Test Date	Feb. 11, 2015		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read 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	4841.53	48.04	74.00	-25.96	43.55	31.12	7.07	33.70	194	255	HORIZONTAL	Peak
2	4841.73	33.73	54.00	-20.27	29.23	31.13	7.07	33.70	194	255	HORIZONTAL	Average
3	7244.12	40.69	54.00	-13.31	29.92	35.90	8.81	33.94	206	220	HORIZONTAL	Average
4	7247.41	55.03	74.00	-18.97	44.26	35.90	8.81	33.94	206	220	HORIZONTAL	Peak
5	12050.35	46.70	74.00	-27.30	31.62	38.85	11.26	35.03	183	197	HORIZONTAL	Peak
6	12050.35	46.70	54.00	-7.30	31.62	38.85	11.26	35.03	183	197	HORIZONTAL	Average

Vertical

	Freq	Level	Limit Line	Over Limit	Read 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	4841.88	33.79	54.00	-20.21	29.29	31.13	7.07	33.70	207	248	VERTICAL	Average
2	4844.22	48.68	74.00	-25.32	44.18	31.13	7.07	33.70	207	248	VERTICAL	Peak
3	7243.97	40.78	54.00	-13.22	30.01	35.90	8.81	33.94	106	108	VERTICAL	Average
4	7247.47	55.50	74.00	-18.50	44.73	35.90	8.81	33.94	106	108	VERTICAL	Peak
5	12053.50	46.79	54.00	-7.21	31.70	38.86	11.26	35.03	147	254	VERTICAL	Average
6	12053.91	61.36	74.00	-12.64	46.27	38.86	11.26	35.03	147	254	VERTICAL	Peak

Temperature	26℃	Humidity	68%
Test Engineer	Eddie Weng	Configurations	Channel 39 / Chain 1
Test Date	Feb. 11, 2015		

Horizontal

	Freq	Level	Limit Line	Over Limit	Read 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	4959.11	33.94	54.00	-20.06	29.11	31.33	7.15	33.65	147	209	HORIZONTAL	Average
2	4960.15	49.03	74.00	-24.97	44.20	31.33	7.15	33.65	147	209	HORIZONTAL	Peak
3	7439.46	55.55	74.00	-18.45	44.35	36.36	8.96	34.12	180	154	HORIZONTAL	Peak
4	7439.71	41.42	54.00	-12.58	30.22	36.36	8.96	34.12	180	154	HORIZONTAL	Average
5	12397.66	46.41	54.00	-7.59	31.47	38.50	11.37	34.93	168	197	HORIZONTAL	Average
6	12402.02	49.54	74.00	-24.46	34.60	38.50	11.37	34.93	168	197	HORIZONTAL	Peak

Vertical

	Freq	Level	Limit Line	Over Limit	Read 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	4959.73	34.52	54.00	-19.48	29.69	31.33	7.15	33.65	131	280	VERTICAL	Average
2	4960.70	49.50	74.00	-24.50	44.67	31.33	7.15	33.65	131	280	VERTICAL	Peak
3	7441.16	41.42	54.00	-12.58	30.23	36.35	8.96	34.12	227	281	VERTICAL	Average
4	7441.66	56.04	74.00	-17.96	44.85	36.35	8.96	34.12	227	281	VERTICAL	Peak
5	12397.58	46.54	74.00	-27.46	31.59	38.51	11.37	34.93	148	220	VERTICAL	Peak
6	12397.58	46.54	54.00	-7.46	31.59	38.51	11.37	34.93	148	220	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.

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, 1 MHz / 10Hz for Average
RBW / VBW (30dBc in any 100 kHz bandwidth emission)	100 kHz / 300 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 Conducted Out of Band Emission Measurement:

1. Test was performed in accordance with KDB 558074 D01 v03r02 Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 10.1, Unwanted Emissions into Non-Restricted Frequency Bands Measurement Procedure
2. The conducted 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 Conducted 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	26℃	Humidity	68%
Test Engineer	Eddie Weng	Configurations	Channel 0, 20, 39 / Chain 1
Test Date	Feb. 11, 2015		

Channel 0

	Freq	Level	Limit Line	Over Limit	Read 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	2361.20	61.10	74.00	-12.90	29.25	26.97	4.88	0.00	102	158	HORIZONTAL	Peak
2	2361.92	51.34	54.00	-2.66	19.49	26.97	4.88	0.00	102	158	HORIZONTAL	Average
3	2401.86	102.80			70.80	27.07	4.93	0.00	102	158	HORIZONTAL	Peak
4	2402.00	101.51			69.51	27.07	4.93	0.00	102	158	HORIZONTAL	Average

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

Channel 20

	Freq	Level	Limit Line	Over Limit	Read 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	2375.24	60.83	74.00	-13.17	28.93	27.00	4.90	0.00	102	154	HORIZONTAL	Peak
2	2390.00	48.20	54.00	-5.80	16.24	27.04	4.92	0.00	102	154	HORIZONTAL	Average
3	2442.00	104.33			72.20	27.16	4.97	0.00	102	154	HORIZONTAL	Peak
4	2442.00	102.82			70.69	27.16	4.97	0.00	102	154	HORIZONTAL	Average
5	2483.50	49.66	54.00	-4.34	17.39	27.26	5.01	0.00	102	154	HORIZONTAL	Average
6	2498.55	62.74	74.00	-11.26	30.41	27.30	5.03	0.00	102	154	HORIZONTAL	Peak

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

Channel 39

	Freq	Level	Limit Line	Over Limit	Read 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	2479.86	98.26			66.00	27.25	5.01	0.00	293	115	VERTICAL	Peak
2	2480.00	96.86			64.60	27.25	5.01	0.00	293	115	VERTICAL	Average
3	2483.50	49.45	54.00	-4.55	17.17	27.27	5.01	0.00	293	115	VERTICAL	Average
4	2489.43	62.59	74.00	-11.41	30.29	27.28	5.02	0.00	293	115	VERTICAL	Peak

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

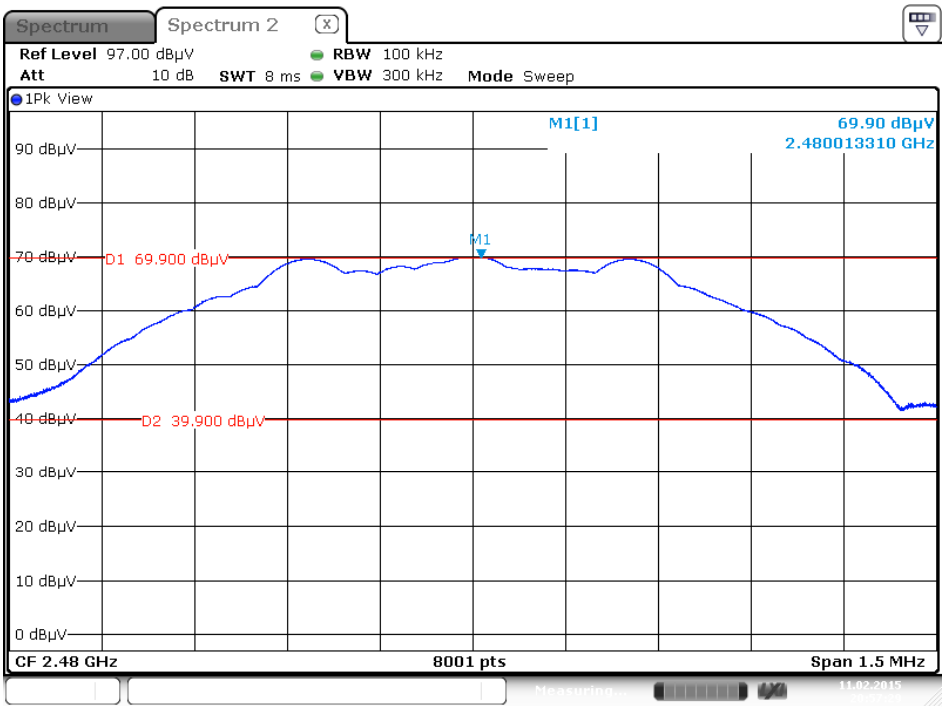
Note:

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

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

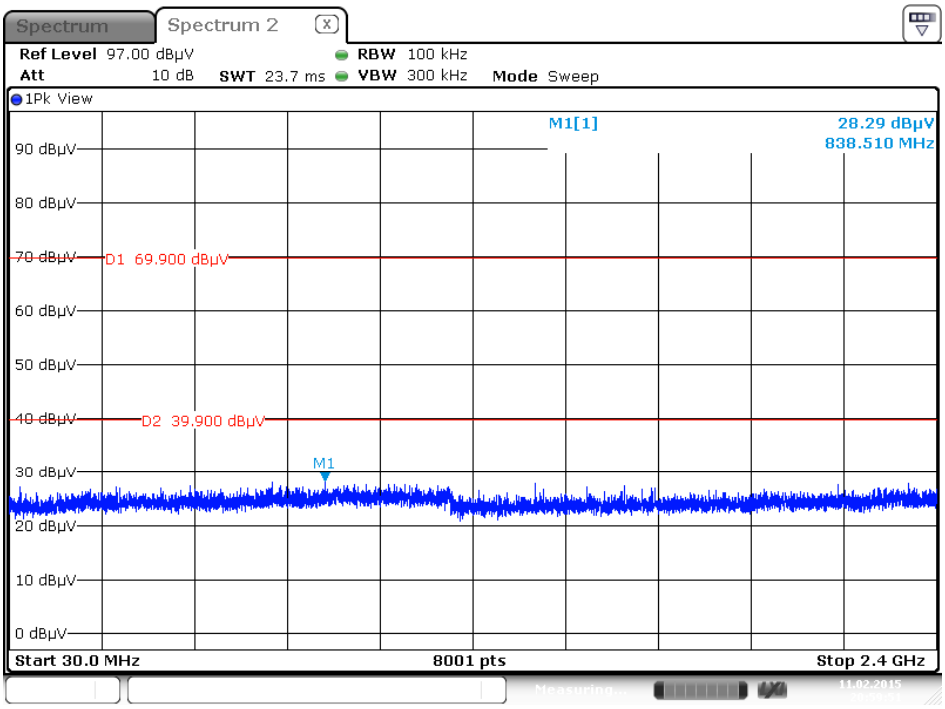
For Emission not in Restricted Band

Plot on Configuration / Reference Level



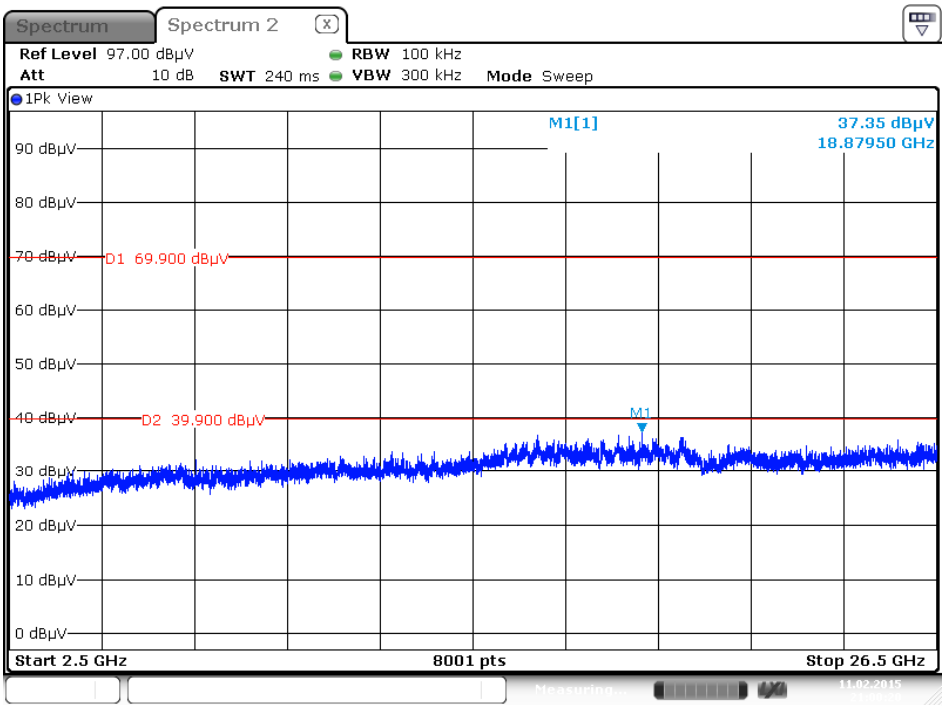
Date: 11.FEB.2015 20:57:29

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



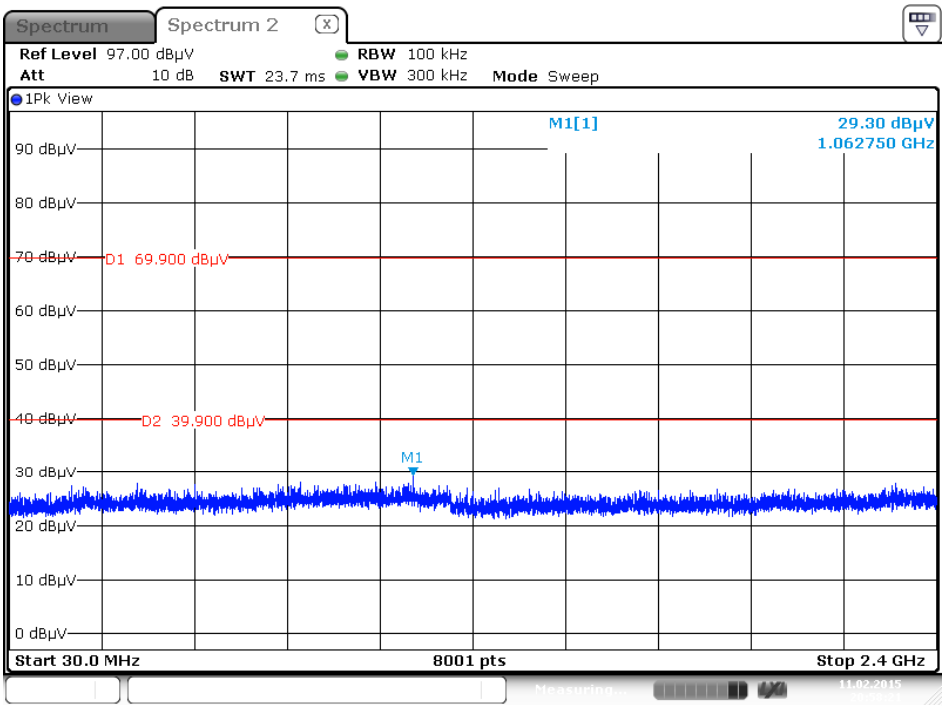
Date: 11.FEB.2015 20:59:51

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



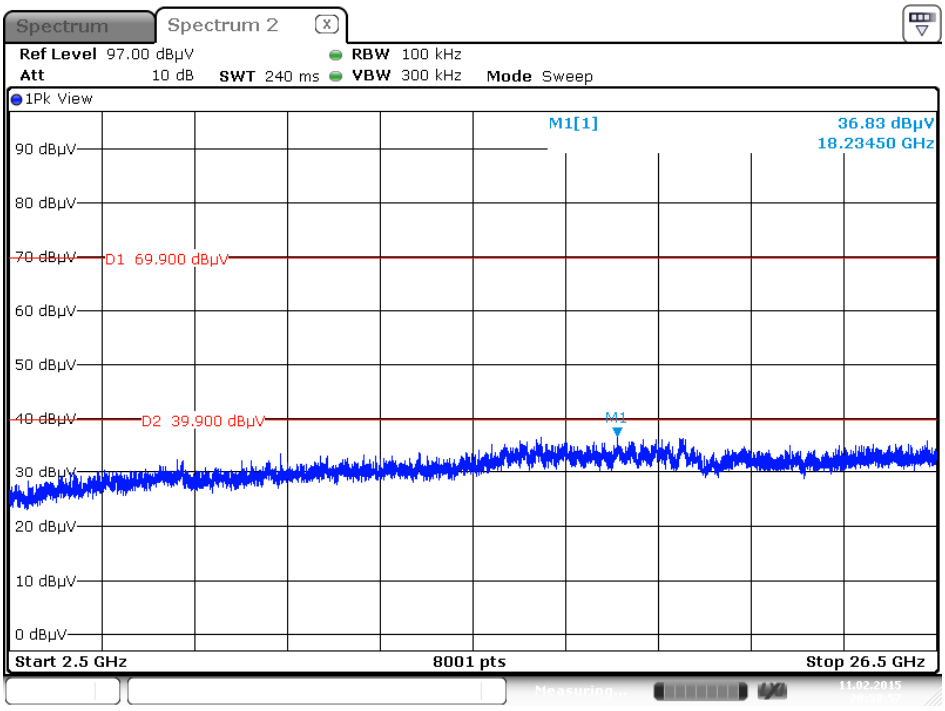
Date:11.FEB.2015 21:00:20

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



Date:11.FEB.2015 20:58:21

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



Date: 11.FEB.2015 20:58:57

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	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	Nov. 15, 2014	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 12, 2015	Radiation (03CH01-CB)
Pre-Amplifier	WM	TF-130N-R1	923365	26GHz ~ 40GHz	Nov. 25, 2014	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-16	N/A	1 GHz ~ 18 GHz	Nov. 15, 2014	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-17	N/A	1 GHz ~ 18 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	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)

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
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.
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%