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FCC RADIO TEST REPORT

Applicant's company	**Broadcom Corporation**
Applicant Address	190 Mathilda Place Sunnyvale CA 94086 U.S.A.
FCC ID	**QDS-BRCM1085**
Manufacturer's company	**Broadcom Corporation**
Manufacturer Address	190 Mathilda Place Sunnyvale CA 94086 U.S.A.

Product Name	Broadcom 802.11a/b/g/n/ac WLAN + Bluetooth PCI-E NGFF 2230 Card
Brand Name	Broadcom
Model No.	BCM94356Z
Test Rule	47 CFR FCC Part 15 Subpart C § 15.247
Test Freq. Range	2402 ~ 2480MHz
Received Date	Jul. 31, 2014
Final Test Date	Oct. 08, 2014
Submission Type	Original Equipment

Statement

Test result included is only for the Bluetooth LE 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

1. CERTIFICATE OF COMPLIANCE 1
2. SUMMARY OF THE TEST RESULT 2
3. GENERAL INFORMATION 3
3.1. Product Details 3
3.2. Accessories 3
3.3. Table for Filed Antenna 4
3.4. Table for Carrier Frequencies 4
3.5. Table for Test Modes 5
3.6. Table for Testing Locations 6
3.7. Table for Multiple Listing 6
3.8. Table for Supporting Units 7
3.9. Table for Parameters of Test Software Setting 8
3.10. EUT Operation during Test 8
3.11. Duty Cycle 8
3.12. Test Configurations 9
4. TEST RESULT 12
4.1. AC Power Line Conducted Emissions Measurement 12
4.2. Maximum Conducted Output Power Measurement 16
4.3. Power Spectral Density Measurement 18
4.4. 6dB Spectrum Bandwidth Measurement 22
4.5. Radiated Emissions Measurement 25
4.6. Emissions Measurement 35
4.7. Antenna Requirements 43
5. LIST OF MEASURING EQUIPMENTS 44
6. MEASUREMENT UNCERTAINTY 45
APPENDIX A. TEST PHOTOS ..... A1 ~ A8
APPENDIX B. RADIATED EMISSION CO-LOCATION REPORT ..... B1 ~ B5

History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR473142AD	Rev. 01	Initial issue of report.	Sep. 23, 2014
FR473142AD	Rev. 02	Re-test all test items.	Oct. 23, 2014

Certificate No.: CB10309164

1. CERTIFICATE OF COMPLIANCE

Product Name	:	Broadcom 802.11a/b/g/n/ac WLAN + Bluetooth PCI-E NGFF 2230 Card
Brand Name	:	Broadcom
Model No.	:	BCM94356Z
Part No.	:	BCM94356Z, BCM94356ZAE
Applicant	:	Broadcom Corporation
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 Jul. 31, 2014 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	12.54 dB
4.2	15.247(b)(3)	Maximum Conducted Output Power	Complies	23.14 dB
4.3	15.247(e)	Power Spectral Density	Complies	17.93 dB
4.4	15.247(a)(2)	6dB Spectrum Bandwidth	Complies	-
4.5	15.247(d)	Radiated Emissions	Complies	3.42 dB
4.6	15.247(d)	Band Edge Emissions	Complies	6.12 dB
4.7	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	2402 ~ 2480MHz
Channel Number	40 (37 hopping + 3 advertising channel)
Channel Band Width (99%)	1.110 MHz
Maximum Conducted Output Power	6.86 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

Set	Ant.	Brand	Part No.	Antenna Type	Connector	Gain (dBi)				
						2.4G/ BT	5G B1	5G B2	5G B3	5G B4
1	1	MAG.LAYERS	PCA-4077-25GC1-A1-RT	WLAN/BT antenna	I-PEX A13	3.33	5.85	5.85	6.21	6.21
	2	MAG.LAYERS	PCA-4077-25GC1-A1-RT	WLAN/BT antenna	I-PEX A13	3.33	5.85	5.85	6.21	6.21

Note: The EUT has one set of antenna, and each set contains two antennas.

Chain 1: Connect to Ant. 1, Chain 2: Connect to Ant. 2.

For 2.4 GHz WLAN function (2TX/2RX):

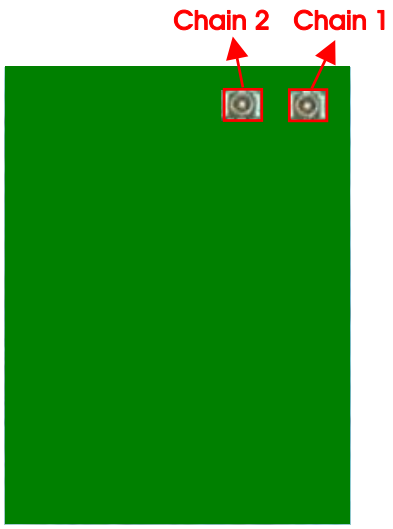
Chain 1 and Chain 2 could transmit/receive simultaneously.

For Bluetooth function (1TX/1RX):

Only Chain 1 could transmit/receive simultaneously.

For 5 GHz WLAN function (2TX/2RX):

Chain 1 and Chain 2 could transmit/receive simultaneously.



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 Test Modes

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

Test Items	Mode	Data Rate	Channel	Chain
AC Power Line Conducted Emissions	Normal Link	-	-	-
Maximum Conducted Output Power Power Spectral Density	GFSK	1 Mbps	0/20/39	1
6dB Spectrum Bandwidth	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 AC Power Line Conducted Emissions test:

Mode 1. 2.4GHz WLAN function + Bluetooth function

Mode 2. 5GHz WLAN function + Bluetooth function

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

For Radiated Emissions 9kHz~1GHz test:

Radiated Emissions 9kHz~1GHz test was perform at its 3-axis (X-axis, Y-axis and Z-axis). After evaluating, X-axis was the worst case. Thus, measurements for Radiated Emissions 9kHz~1GHz test will follow this test mode.

Mode 1. 2.4GHz WLAN function + Bluetooth function

Mode 2. 5GHz WLAN function + Bluetooth function

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

For Radiated Emissions above 1GHz test:

Radiated Emissions above 1GHz test was perform at its 3-axis (X-axis, Y-axis and Z-axis). X-axis was the worst case, so it's recorded in this test report.

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.**
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 Multiple Listing

The EUT has two part numbers which are identical to each other in all aspects except for the following table:

Model No.	Part No.	Description
BCM94356Z	BCM94356Z	The base pin between these two models is different.
	BCM94356ZAE	

From the above models, part number: BCM94356Z was selected as representative model for the test and its data was recorded in this report.

3.8. Table for Supporting Units

For Test Site No: CO01-CB

Support Unit	Brand	Model	FCC ID
Wireless AP	Planex	GW-AP54SGX	KA220030603014-1
Test fixture	Broadcom	BCM9NGFF2EC_1	N/A
Broadcom 802.11a/b/g/n/ac WLAN + Bluetooth PCI-E NGFF 2230 Card (Device)	Broadcom	BCM94356Z	QDS-BRCM1085
NB	DELL	E4300	DoC
Mouse	Logitech	M-U0026	DoC
Earphone	SHYARO CHI	MIC-04	N/A
NB	DELL	E4300	DoC
Test fixture	Broadcom	BCM9NGFF2EC_1	N/A

For Test Site No: TH01-CB

Support Unit	Brand	Model	FCC ID
NB	DELL	E6430	DoC
Test fixture	Broadcom	BCM9NGFF2EC_1	N/A

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

Support Unit	Brand	Model	FCC ID
Wireless AP	Netgear	R6300V2	PY313200227
Test fixture	Broadcom	BCM9NGFF2EC_1	N/A
Broadcom 802.11a/b/g/n/ac WLAN + Bluetooth PCI-E NGFF 2230 Card (Device)	Broadcom	BCM94356Z	QDS-BRCM1085
NB	DELL	M1340	E2K4965AGNM
Mouse	Logitech	M-U0026	DoC
Earphone	E-BOOKI	E-EPC040	N/A
NB	DELL	E4300	RSE-TG233
Test fixture	Broadcom	BCM9NGFF2EC_1	N/A

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

Support Unit	Brand	Model	FCC ID
NB	DELL	E4300	RSE-TG233
Test fixture	Broadcom	BCM9NGFF2EC_1	N/A

3.9. Table for Parameters of Test Software Setting

During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Power Parameters:

Test Software Version	Broandcom Blue Tool Version:1.4.8.9		
Frequency	2402 MHz	2442 MHz	2480 MHz
Power Parameters	Default	Default	Default

3.10. EUT Operation during Test

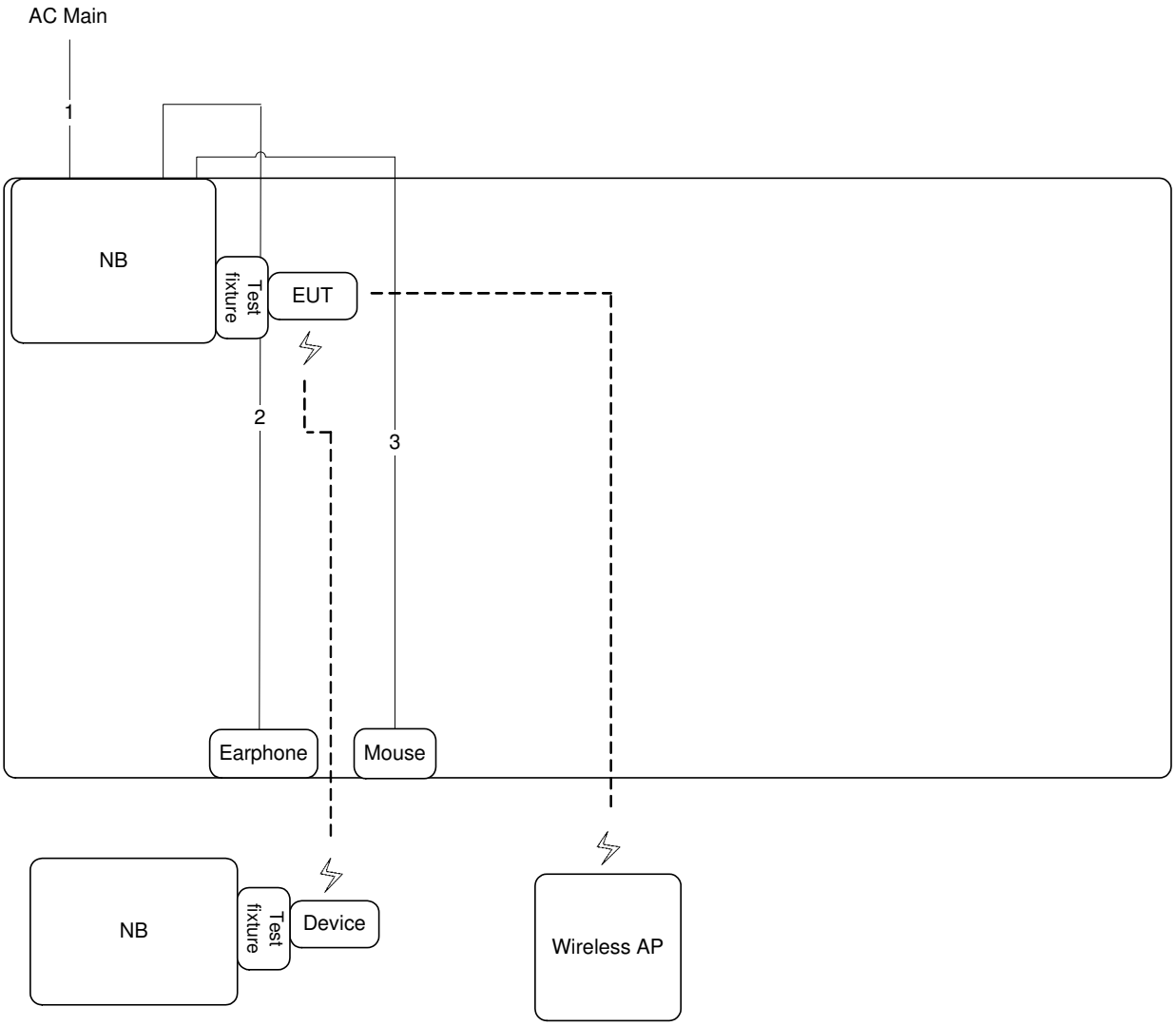
The EUT was programmed to be in continuously transmitting mode.

3.11. Duty Cycle

Mode	On Time (ms)	On+Off Time (ms)	Duty Cycle (%)	Duty Factor (dB)	1/T Minimum VBW (kHz)
GFSK	0.092	0.612	15.03	8.23	10.87

3.12. Test Configurations

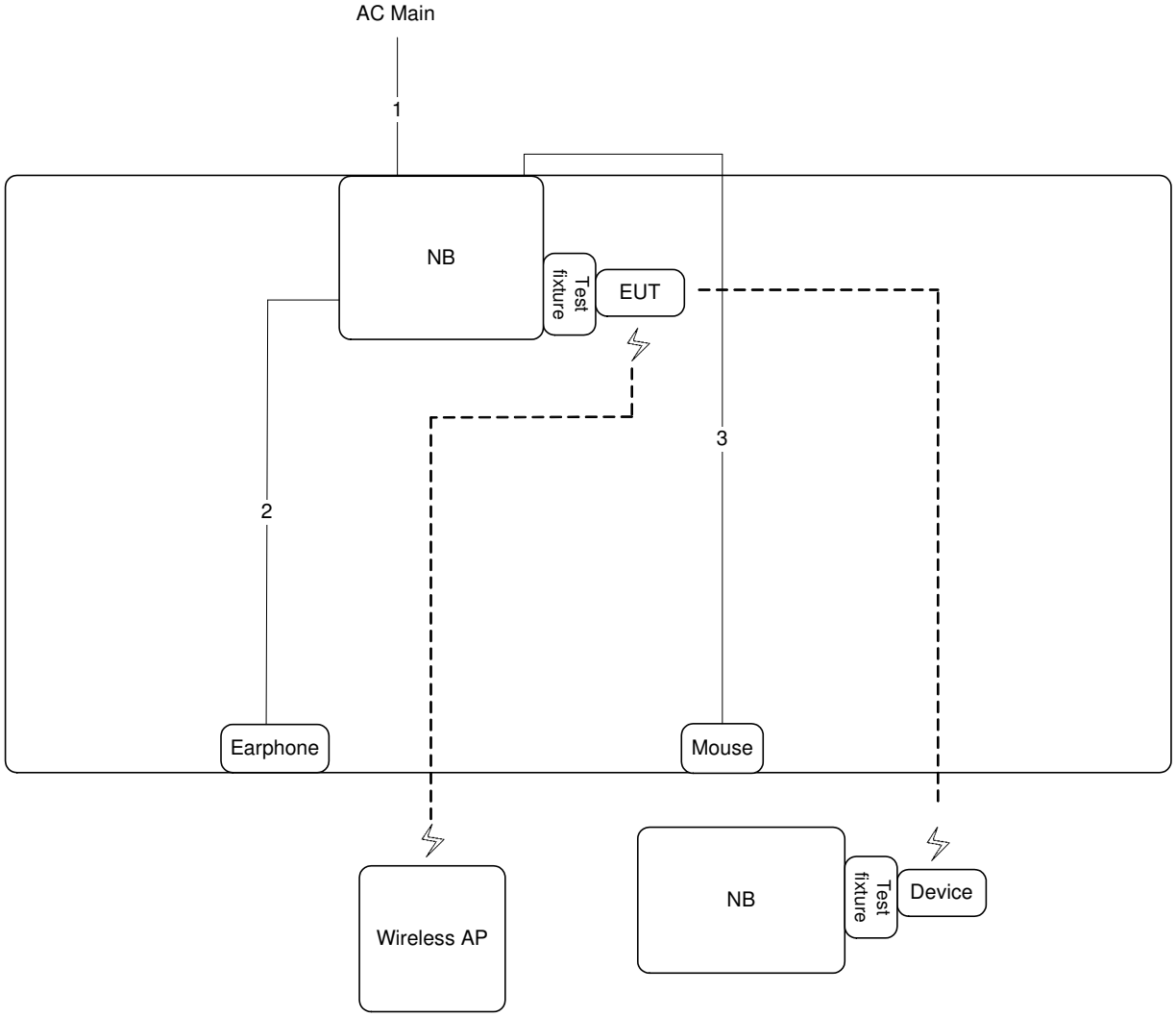
3.12.1. AC Power Line Conduction Emissions Test Configuration



Item	Connection	Shielded	Length
1	Power cable	No	2.6m
2	Audio cable	No	1.5m
3	USB cable	Yes	1.8m

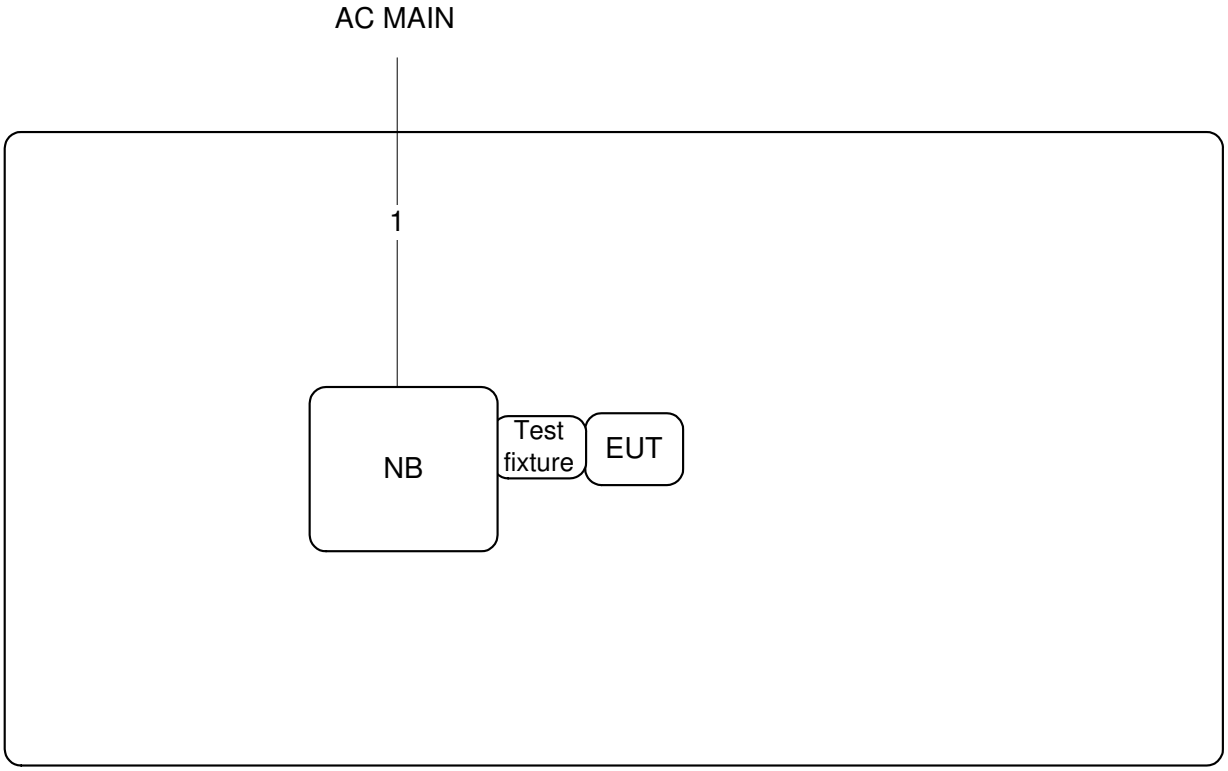
3.12.2. Radiation Emissions Test Configuration

Test Configuration: 30MHz~1GHz



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

Test Configuration: above 1GHz



Item	Connection	Shielded	Length
1	Power cable	No	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

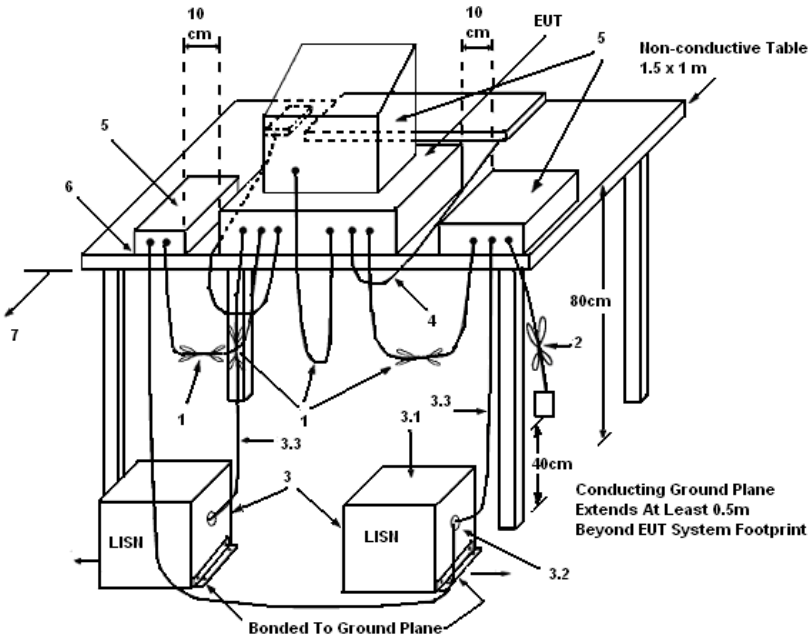
Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

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

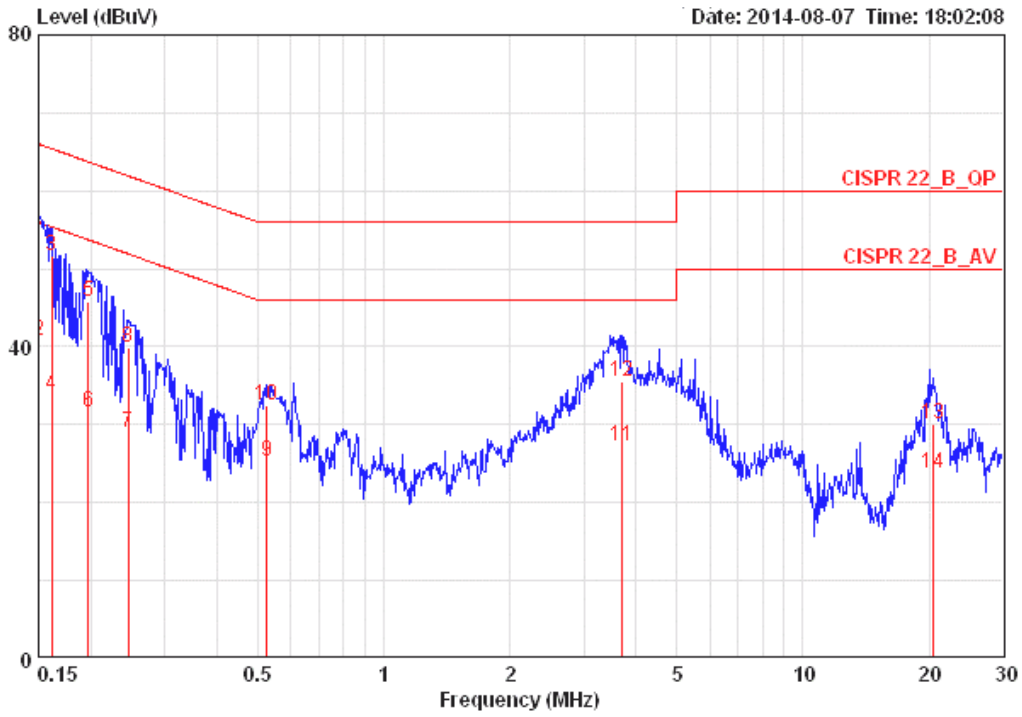
There is no deviation with the original standard.

4.1.6. EUT Operation during Test

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

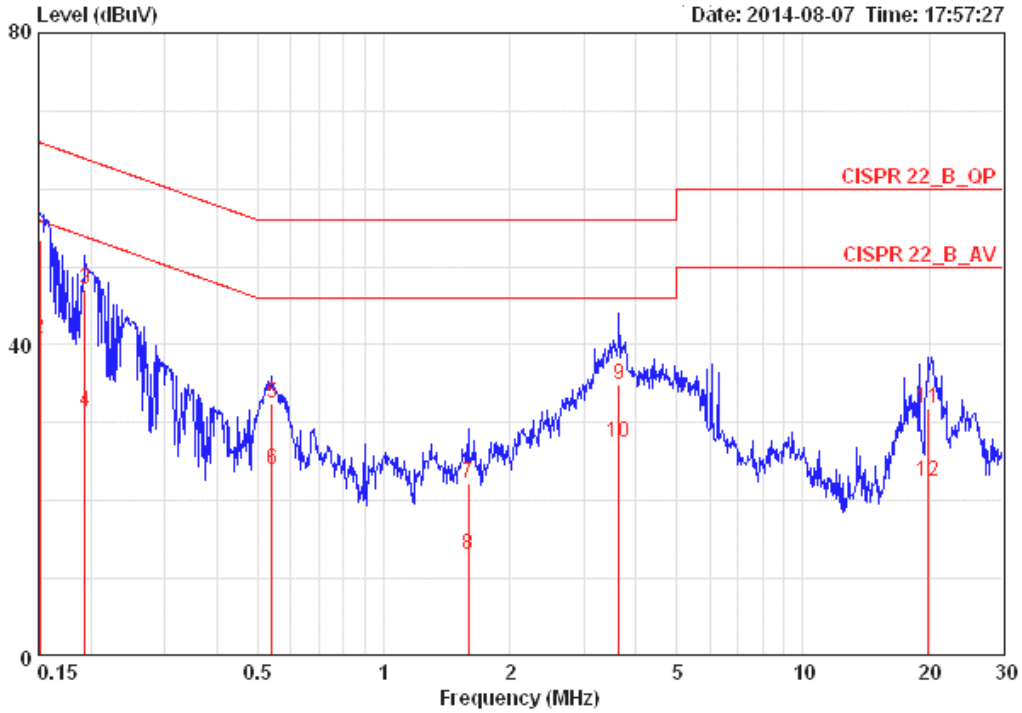
4.1.7. Results of AC Power Line Conducted Emissions Measurement

Temperature	25°C	Humidity	52%
Test Engineer	Parody Lin	Phase	Line
Configuration	Normal Link	Test Mode	Mode 1



	Freq	Level	Over Limit	Limit Line	LISN Factor	Read Level	Cable Loss	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dB	dBuV	dB		
1 @	0.15000	53.37	-12.63	66.00	0.10	53.11	0.16	LINE	QP
2 @	0.15000	40.67	-15.33	56.00	0.10	40.41	0.16	LINE	AVERAGE
3 @	0.16155	51.63	-13.75	65.38	0.10	51.37	0.16	LINE	QP
4	0.16155	33.77	-21.61	55.38	0.10	33.51	0.16	LINE	AVERAGE
5	0.19758	45.86	-17.85	63.71	0.10	45.60	0.16	LINE	QP
6	0.19758	31.55	-22.16	53.71	0.10	31.29	0.16	LINE	AVERAGE
7	0.24552	28.97	-22.94	51.91	0.10	28.70	0.17	LINE	AVERAGE
8	0.24552	39.91	-22.00	61.91	0.10	39.64	0.17	LINE	QP
9	0.52655	25.28	-20.72	46.00	0.11	24.98	0.19	LINE	AVERAGE
10	0.52655	32.56	-23.44	56.00	0.11	32.26	0.19	LINE	QP
11	3.700	27.30	-18.70	46.00	0.20	26.80	0.29	LINE	AVERAGE
12	3.700	35.62	-20.38	56.00	0.20	35.12	0.29	LINE	QP
13	20.377	30.19	-29.81	60.00	0.48	29.19	0.52	LINE	QP
14	20.377	23.83	-26.17	50.00	0.48	22.83	0.52	LINE	AVERAGE

Temperature	25°C	Humidity	52%
Test Engineer	Parody Lin	Phase	Neutral
Configuration	Normal Link	Test Mode	Mode 1



	Freq	Level	Over Limit	Limit Line	LISN Factor	Read Level	Cable Loss	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dB	dBuV	dB		
1 @	0.15080	53.42	-12.54	65.96	0.09	53.17	0.16	NEUTRAL	QP
2 @	0.15080	40.74	-15.22	55.96	0.09	40.49	0.16	NEUTRAL	AVERAGE
3 @	0.19344	47.04	-16.84	63.89	0.09	46.79	0.16	NEUTRAL	QP
4	0.19344	31.48	-22.40	53.89	0.09	31.23	0.16	NEUTRAL	AVERAGE
5	0.54068	32.46	-23.54	56.00	0.10	32.17	0.19	NEUTRAL	QP
6	0.54068	23.97	-22.03	46.00	0.10	23.68	0.19	NEUTRAL	AVERAGE
7	1.593	22.20	-33.80	56.00	0.13	21.83	0.23	NEUTRAL	QP
8	1.593	12.98	-33.02	46.00	0.13	12.61	0.23	NEUTRAL	AVERAGE
9	3.642	34.87	-21.13	56.00	0.18	34.39	0.29	NEUTRAL	QP
10	3.642	27.37	-18.63	46.00	0.18	26.89	0.29	NEUTRAL	AVERAGE
11	19.950	31.75	-28.25	60.00	0.44	30.80	0.51	NEUTRAL	QP
12	19.950	22.55	-27.45	50.00	0.44	21.60	0.51	NEUTRAL	AVERAGE

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

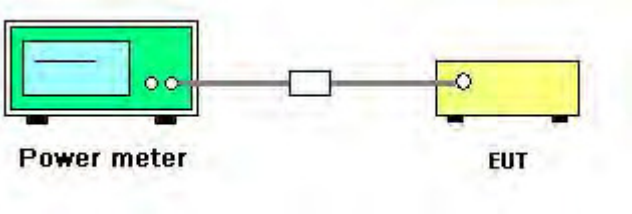
Please refer to section 5 of equipments list in this report. The following table is the setting of the power meter.

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.
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	20°C	Humidity	52%
Test Engineer	Kenneth Huang	Configurations	GFSK
Test Date	Oct. 08, 2014		

Channel	Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
0	2402 MHz	3.63	30.00	Complies
20	2442 MHz	5.64	30.00	Complies
39	2480 MHz	6.86	30.00	Complies

4.3. Power Spectral Density Measurement

4.3.1. Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

4.3.2. Measuring Instruments and Setting

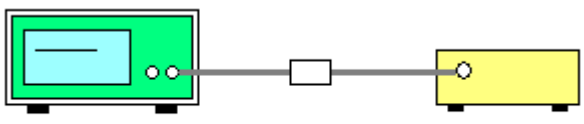
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	5-30 % greater than the DTS channel bandwidth.
RBW	3 kHz ≤ RBW ≤ 100kHz
VBW	≥ 3 x RBW
Detector	Peak
Trace	Max Hold
Sweep Time	Auto couple

4.3.3. Test Procedures

1. Test was performed in accordance with KDB 558074 D01 v03r02 for Performing Compliance Measurements on Digital Transmission Systems (DTS) - section 10.2 Method PKPSD (peak PSD).
2. Use this procedure when the maximum conducted output power in the fundamental emission is used to demonstrate compliance. The EUT must be configured to transmit continuously at full power over the measurement duration.
3. Ensure that the number of measurement points in the sweep ≥ 2 x span/RBW (use of a greater number of measurement points than this minimum requirement is recommended).
4. Use the peak marker function to determine the maximum level in any 3 kHz band segment within the fundamental EBW.
5. The resulting PSD level must be ≤ 8 dBm.

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 Power Spectral Density

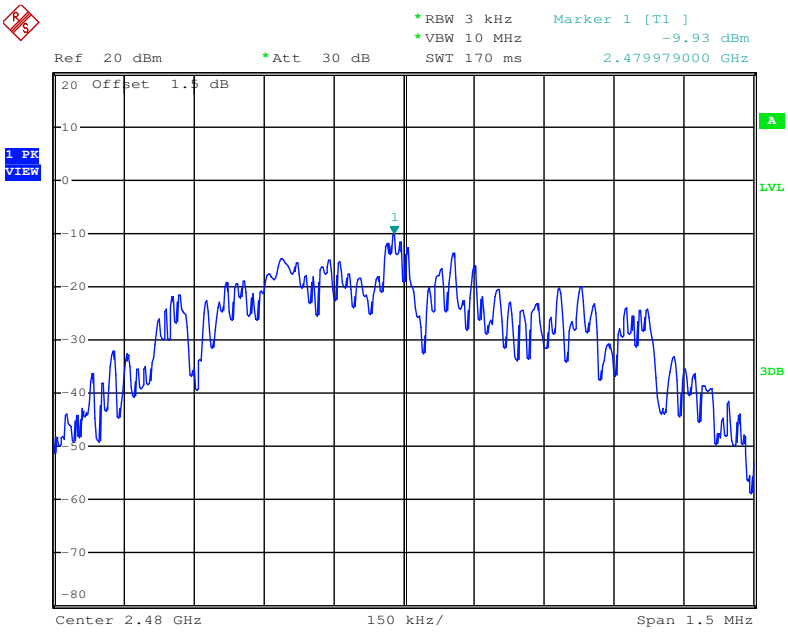
Temperature	20°C	Humidity	52%
Test Engineer	Kenneth Huang	Configurations	GFSK

Channel	Frequency	Power Density (dBm/3kHz)	Power Density Limit (dBm/3kHz)	Result
0	2402 MHz	-13.12	8.00	Complies
20	2442 MHz	-11.07	8.00	Complies
39	2480 MHz	-9.93	8.00	Complies

Note: All the test values were listed in the report.

For plots, only the channel with worse result was shown.

Power Density Plot on Configuration Bluetooth / 2480 MHz



4.4. 6dB Spectrum Bandwidth Measurement

4.4.1. Limit

For digital modulation systems, the minimum 6dB bandwidth shall be at least 500 kHz.

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 Parameters	Setting
Attenuation	Auto
Span Frequency	> 6dB Bandwidth
RBW	100kHz
VBW	≥ 3 x RBW
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

4.4.3. Test Procedures

For Radiated 6dB Bandwidth Measurement:

1. The transmitter was radiated to the spectrum analyzer in peak hold mode.
2. Test was performed in accordance with KDB 558074 D01 v03r02 for Performing Compliance Measurements on Digital Transmission Systems (DTS) - section 8.0 DTS bandwidth=> 8.1 Option 1.
3. Measured the spectrum width with power higher than 6dB below carrier.

4.4.4. Test Setup Layout

For Radiated 6dB Bandwidth Measurement:

This test setup layout is the same as that shown in section 4.5.4.

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 6dB Spectrum Bandwidth

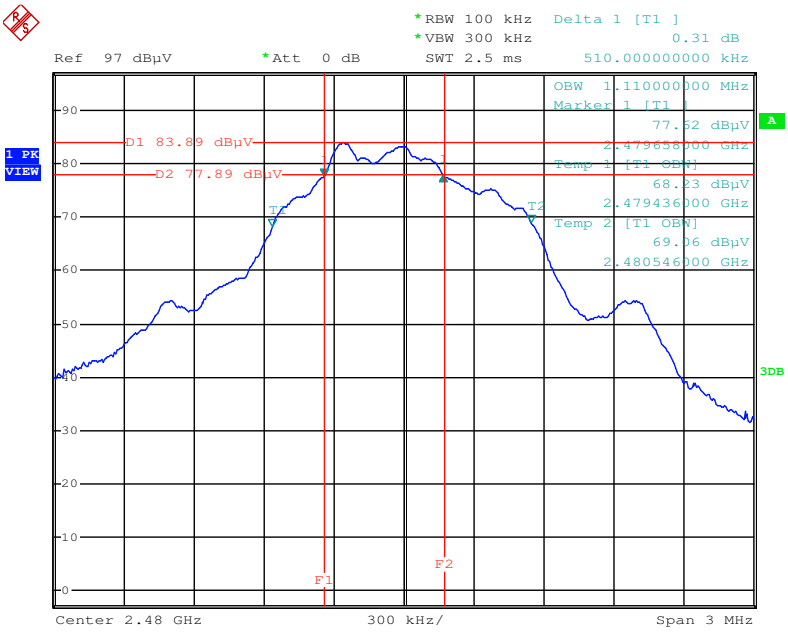
Temperature	20°C	Humidity	52%
Test Engineer	Kenneth Huang	Configurations	GFSK

Channel	Frequency	6dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Min. Limit (kHz)	Test Result
0	2402 MHz	0.528	1.104	500	Complies
20	2442 MHz	0.522	1.110	500	Complies
39	2480 MHz	0.510	1.110	500	Complies

Note: All the test values were listed in the report.

For plots, only the channel with worse result was shown.

6 dB Bandwidth Plot on Configuration Bluetooth / 2480 MHz



Date: 8.OCT.2014 20:18:32

4.5. Radiated Emissions Measurement

4.5.1. 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

4.5.2. Measuring Instruments and Setting

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

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RBW / VBW (Emission in restricted band)	1MHz / 3MHz for Peak, 1MHz / 1/T for Average
RBW / VBW (Emission in non-restricted band)	100kHz / 300kHz for peak

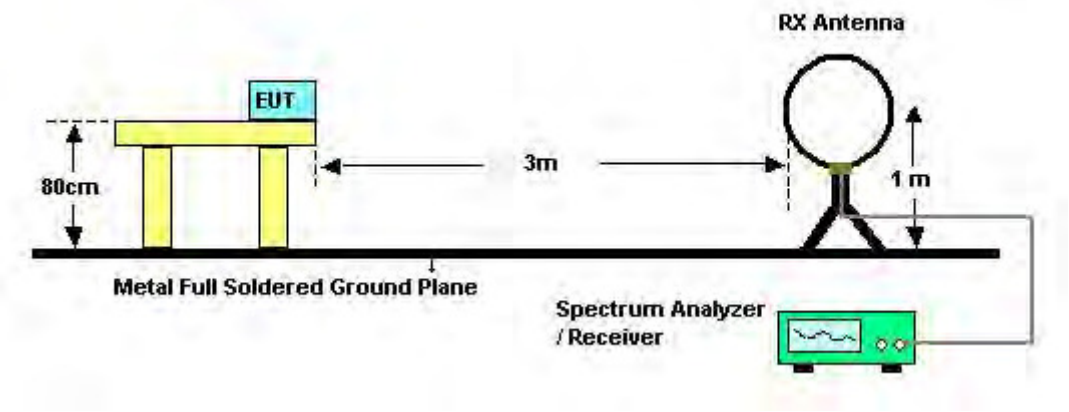
Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RBW 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RBW 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RBW 120kHz for QP

4.5.3. Test Procedures

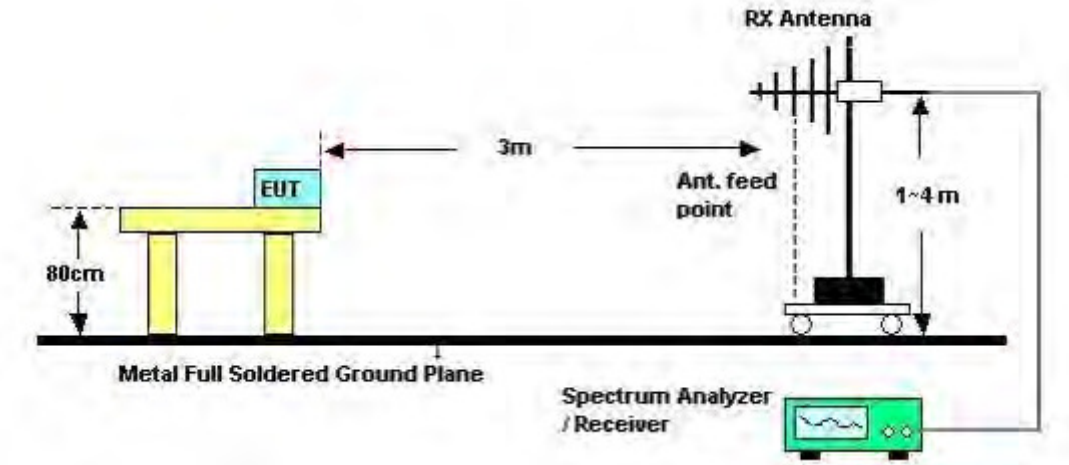
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting 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 1/T VBW for average reading in spectrum analyzer.
7. 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.
8. 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.
9. 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.

4.5.4. Test Setup Layout

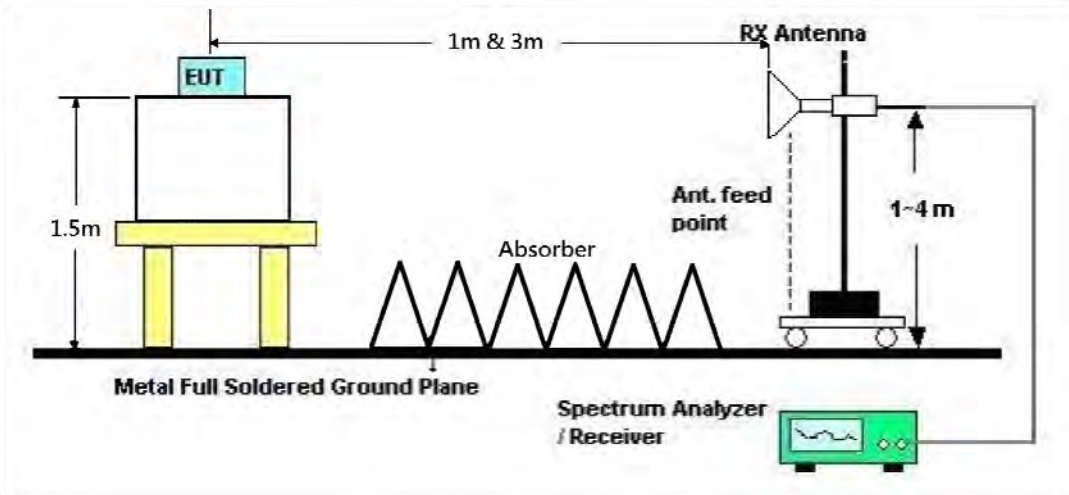
For Radiated Emissions: 9kHz ~30MHz



For Radiated Emissions: 30MHz~1GHz



For Radiated Emissions: Above 1GHz



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

Temperature	23°C	Humidity	61%
Test Engineer	YC Chen	Configurations	Normal Link
Test Date	Aug. 09, 2014	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.

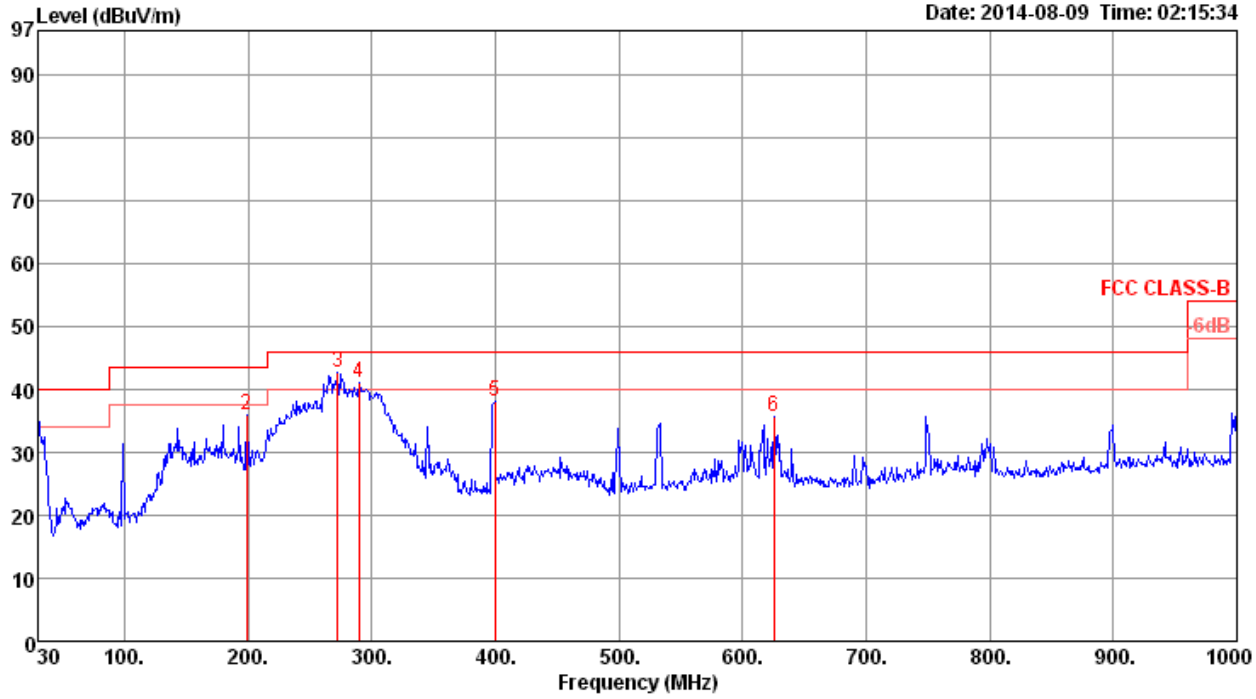
Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

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

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

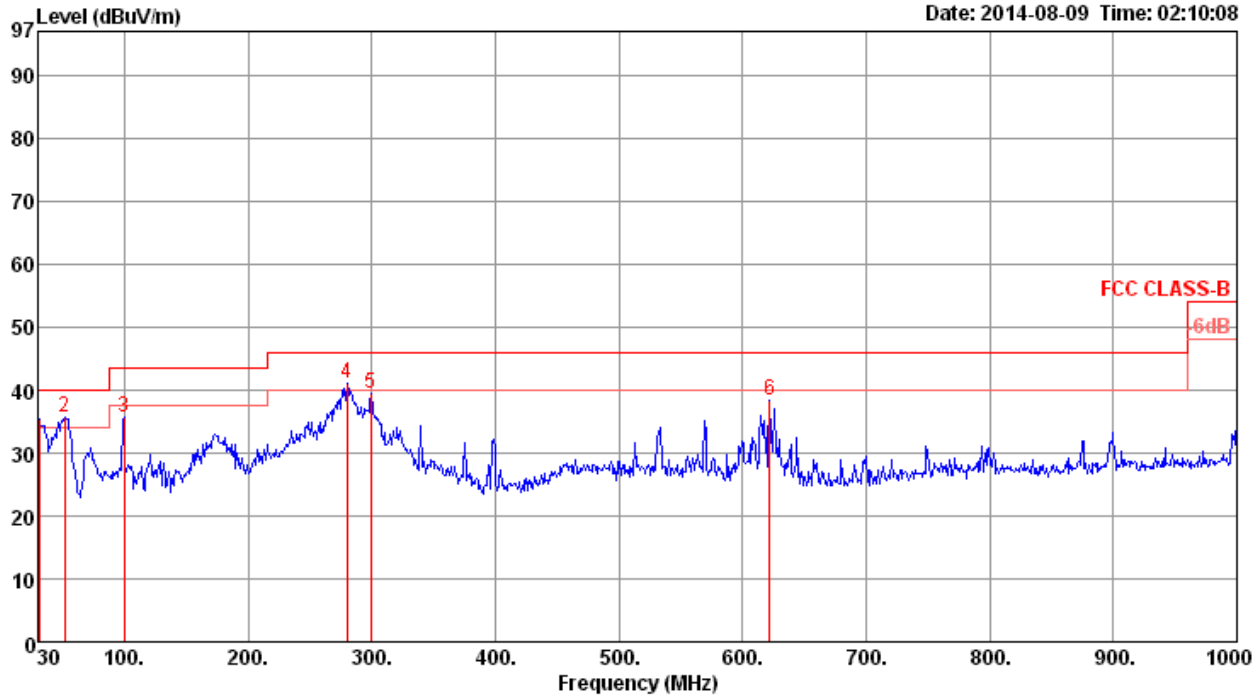
Temperature	23°C	Humidity	61%
Test Engineer	YC Chen	Configurations	Normal Link
Test Mode	Mode 1		

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	30.00	35.96	40.00	-4.04	44.39	0.61	18.76	27.80	Peak	100	0	HORIZONTAL
2	198.78	35.82	43.50	-7.68	52.02	1.66	9.25	27.11	Peak	100	0	HORIZONTAL
3	272.50	42.58	46.00	-3.42	54.61	1.89	13.04	26.96	Peak	100	0	HORIZONTAL
4	289.96	41.18	46.00	-4.82	52.88	1.98	13.24	26.92	Peak	100	0	HORIZONTAL
5	399.57	37.97	46.00	-8.03	47.21	2.30	16.06	27.60	Peak	100	0	HORIZONTAL
6	625.58	35.62	46.00	-10.38	41.94	2.90	18.85	28.07	Peak	100	0	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	30.97	35.48	40.00	-4.52	44.43	0.63	18.22	27.80	Peak	400	0	VERTICAL
2	51.34	35.71	40.00	-4.29	54.29	0.86	8.35	27.79	Peak	400	0	VERTICAL
3	99.84	35.64	43.50	-7.86	51.08	1.17	10.99	27.60	Peak	400	0	VERTICAL
4	280.26	41.16	46.00	-4.84	53.04	1.93	13.13	26.94	Peak	400	0	VERTICAL
5	299.66	39.58	46.00	-6.42	51.09	2.03	13.36	26.90	Peak	400	0	VERTICAL
6	621.70	38.34	46.00	-7.66	44.69	2.89	18.84	28.08	Peak	400	0	VERTICAL

Note:

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

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

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

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

Temperature	23°C	Humidity	61%
Test Engineer	YC Chen	Configurations	Channel 0
Test Date	Oct. 08, 2014		

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	4803.64	51.32	74.00	-22.68	47.31	5.85	33.36	35.20	Peak	123	167	HORIZONTAL
2	4804.47	43.85	54.00	-10.15	39.84	5.85	33.36	35.20	Average	123	167	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	4803.91	45.80	54.00	-8.20	41.79	5.85	33.36	35.20	Average	147	125	VERTICAL
2	4804.47	55.03	74.00	-18.97	51.02	5.85	33.36	35.20	Peak	147	125	VERTICAL

Temperature	23°C	Humidity	61%
Test Engineer	YC Chen	Configurations	Channel 20
Test Date	Oct. 08, 2014		

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	4883.62	51.10	74.00	-22.90	46.90	5.92	33.48	35.20	Peak	141	69	HORIZONTAL
2	4883.85	43.18	54.00	-10.82	38.98	5.92	33.48	35.20	Average	141	69	HORIZONTAL
3	7324.33	50.58	74.00	-23.42	42.36	7.14	36.51	35.43	Peak	129	129	HORIZONTAL
4	7326.75	36.63	54.00	-17.37	28.39	7.14	36.53	35.43	Average	129	129	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	4883.97	46.25	54.00	-7.75	42.05	5.92	33.48	35.20	Average	181	308	VERTICAL
2	4884.43	49.90	74.00	-24.10	45.70	5.92	33.48	35.20	Peak	181	308	VERTICAL
3	7324.80	50.05	74.00	-23.95	41.81	7.14	36.53	35.43	Peak	159	233	VERTICAL
4	7326.53	36.72	54.00	-17.28	28.48	7.14	36.53	35.43	Average	159	233	VERTICAL

Temperature	23°C	Humidity	61%
Test Engineer	YC Chen	Configurations	Channel 39
Test Date	Oct. 08, 2014		

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	4959.97	41.70	54.00	-12.30	37.26	6.00	33.64	35.20	Average	166	147	HORIZONTAL
2	4960.33	48.49	74.00	-25.51	44.05	6.00	33.64	35.20	Peak	166	147	HORIZONTAL
3	7439.04	37.06	54.00	-16.94	28.65	7.20	36.69	35.48	Average	135	148	HORIZONTAL
4	7440.79	50.00	74.00	-24.00	41.59	7.20	36.69	35.48	Peak	135	148	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	4960.02	44.96	54.00	-9.04	40.52	6.00	33.64	35.20	Average	141	302	VERTICAL
2	4960.31	51.47	74.00	-22.53	47.03	6.00	33.64	35.20	Peak	141	302	VERTICAL
3	7437.50	36.75	54.00	-17.25	28.34	7.20	36.69	35.48	Average	160	165	VERTICAL
4	7438.37	49.98	74.00	-24.02	41.57	7.20	36.69	35.48	Peak	160	165	VERTICAL

Note:

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

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

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

4.6. Emissions Measurement

4.6.1. 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

4.6.2. Measuring Instruments and Setting

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

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	100 MHz
RBW / VBW (Emission in restricted band)	1MHz / 3MHz for Peak, 1MHz / 1/T for Average
RBW / VBW (30dBc in any 100 kHz bandwidth emission)	100 kHz / 300 kHz for Peak

4.6.3. Test Procedures

For Radiated band edges Measurement:

1. The test procedure is the same as section 4.5.3, only the frequency range investigated is limited to 100MHz around band edges.

For Radiated Out of Band Emission Measurement:

1. Test was performed in accordance with KDB 558074 D01 v03r02 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 radiated emission test is performed on each TX port of operating mode without summing or adding 10log (N) since the limit is relative emission limit.
   Only worst data of each operating mode is presented.

4.6.4. Test Setup Layout

For Radiated band edges Measurement:

This test setup layout is the same as that shown in section 4.5.4.

For Radiated Out of Band Emission Measurement:

This test setup layout is the same as that shown in section 4.5.4.

4.6.5. Test Deviation

There is no deviation with the original standard.

4.6.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.6.7. Test Result of Band Edge and Fundamental Emissions

Temperature	23°C	Humidity	61%
Test Engineer	YC Chen	Configurations	Channel 0, 20, 39
Test Date	Oct. 08, 2014		

Channel 0

	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	2386.72	59.68	74.00	-14.32	27.54	4.09	28.05	0.00	Peak	184	132	HORIZONTAL
2	2390.00	47.39	54.00	-6.61	15.25	4.09	28.05	0.00	Average	184	132	HORIZONTAL
3	2402.00	90.80			58.62	4.09	28.09	0.00	Average	184	132	HORIZONTAL
4	2402.24	92.56			60.38	4.09	28.09	0.00	Peak	184	132	HORIZONTAL

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

Channel 20

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	2388.80	58.22	74.00	-15.78	26.08	4.09	28.05	0.00	Peak	199	299	VERTICAL
2	2390.00	47.36	54.00	-6.64	15.22	4.09	28.05	0.00	Average	199	299	VERTICAL
3	2441.76	98.65			66.34	4.13	28.18	0.00	Peak	199	299	VERTICAL
4	2442.00	96.89			64.58	4.13	28.18	0.00	Average	199	299	VERTICAL
5	2483.50	47.77	54.00	-6.23	15.35	4.16	28.26	0.00	Average	199	299	VERTICAL
6	2491.19	60.30	74.00	-13.70	27.83	4.17	28.30	0.00	Peak	199	299	VERTICAL

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

Channel 39

	Freq	Level	Limit Line	Over Limit	Read Level	Cable Loss	Antenna Factor	Preamp Factor	Remark	A/Pos	T/Pos	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB		cm	deg	
1	2480.00	80.54			48.12	4.16	28.26	0.00	Average	183	315	VERTICAL
2	2480.24	97.19			64.77	4.16	28.26	0.00	Peak	183	315	VERTICAL
3	2483.50	47.88	54.00	-6.12	15.46	4.16	28.26	0.00	Average	183	315	VERTICAL
4	2483.58	58.51	74.00	-15.49	26.09	4.16	28.26	0.00	Peak	183	315	VERTICAL

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

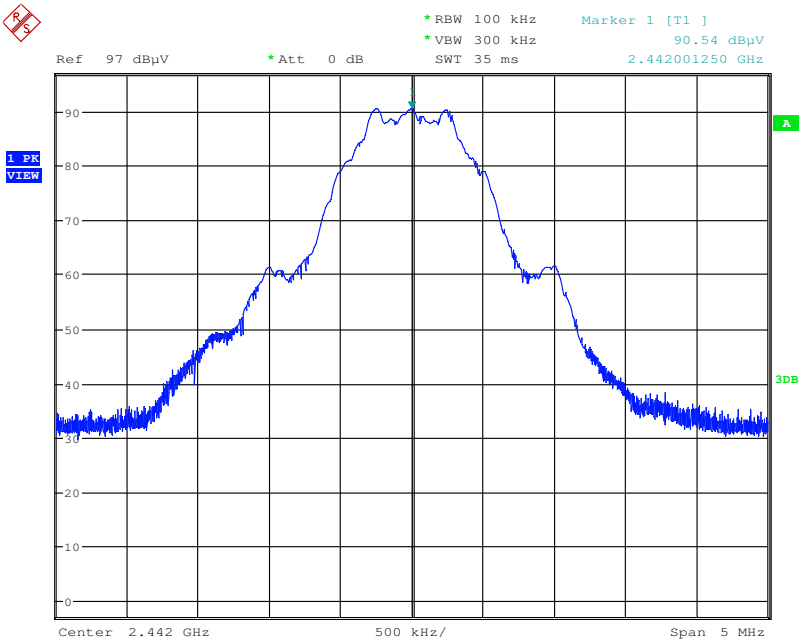
Note:

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

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

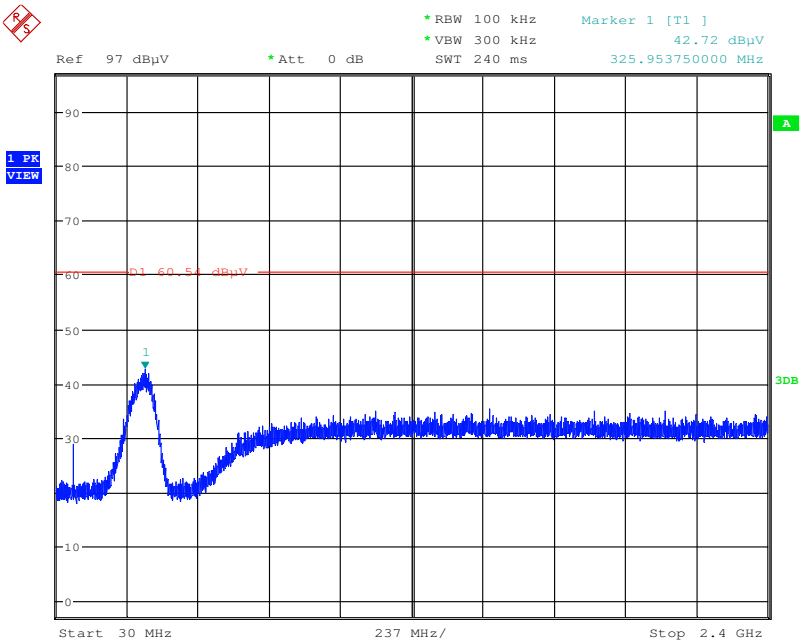
For Emission not in Restricted Band

Plot on Configuration / Reference Level (Vertical)



Date: 8.OCT.2014 05:27:19

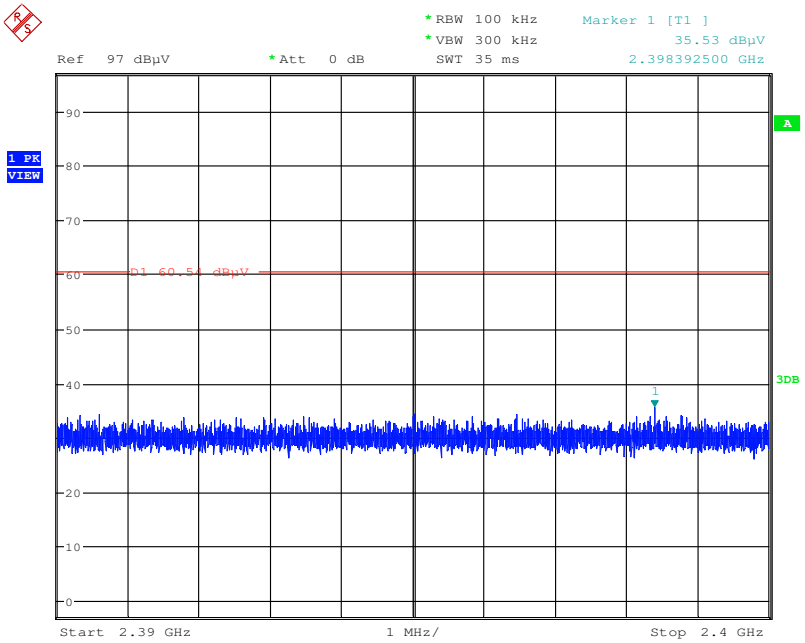
Plot on Configuration For Bluetooth 4.0 / Channel 0 / 30MHz~2400MHz (down 30dBc) (Vertical)



Date: 8.OCT.2014 05:28:48

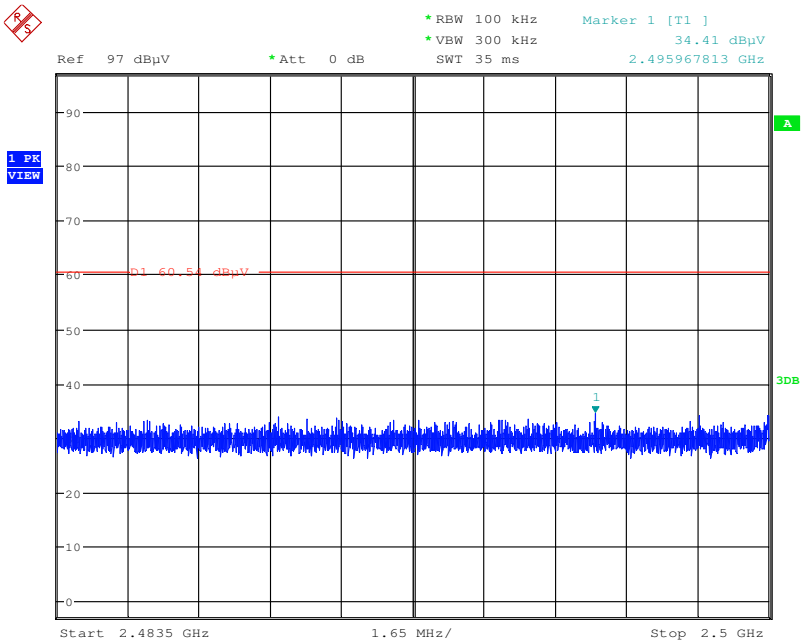
Note: Only the worse polarization (Vertical) is tested and recorded in test report.

Plot on Configuration For Bluetooth 4.0 / Channel 0 / 2390MHz~2400MHz (down 30dBc) (Vertical)



Date: 8.OCT.2014 05:29:14

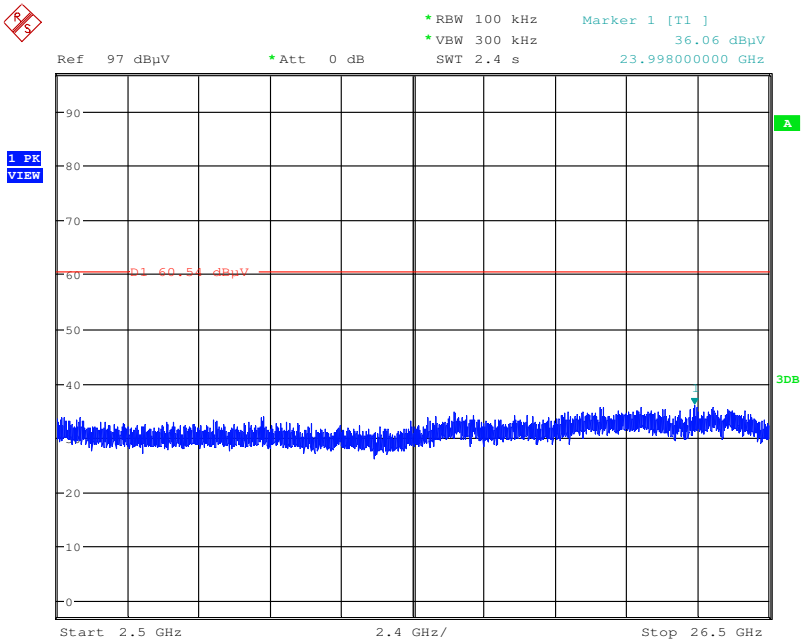
Plot on Configuration For Bluetooth 4.0 / Channel 0 / 2483.5MHz~2500MHz (down 30dBc) (Vertical)



Date: 8.OCT.2014 05:29:44

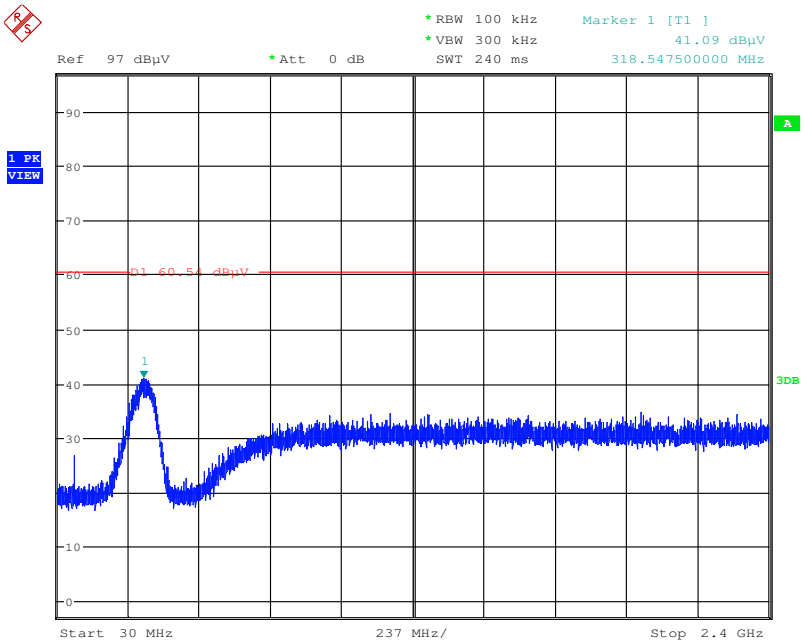
Note: Only the worse polarization (Vertical) is tested and recorded in test report.

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



Date: 8.OCT.2014 05:30:32

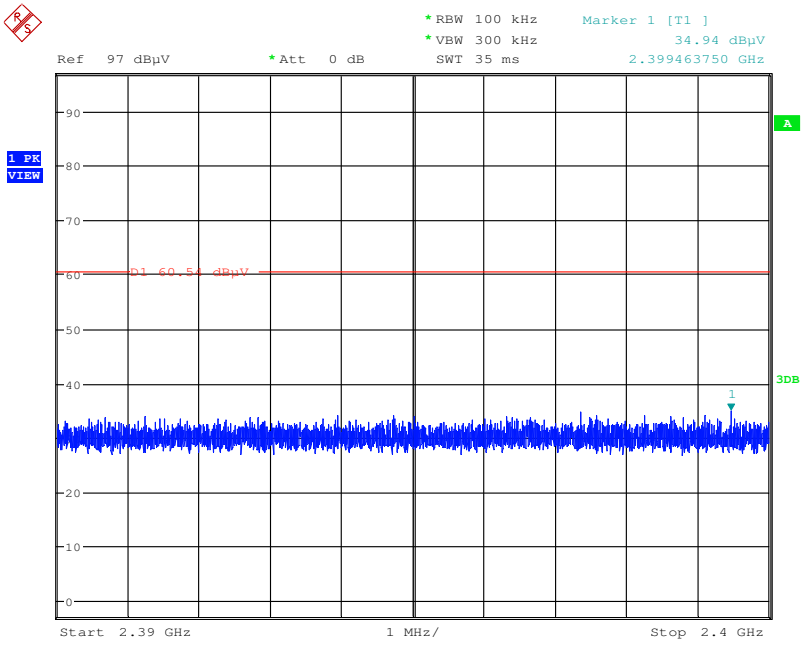
Plot on Configuration For Bluetooth 4.0 / Channel 39 / 30MHz~2400MHz (down 30dBc) (Vertical)



Date: 8.OCT.2014 05:31:06

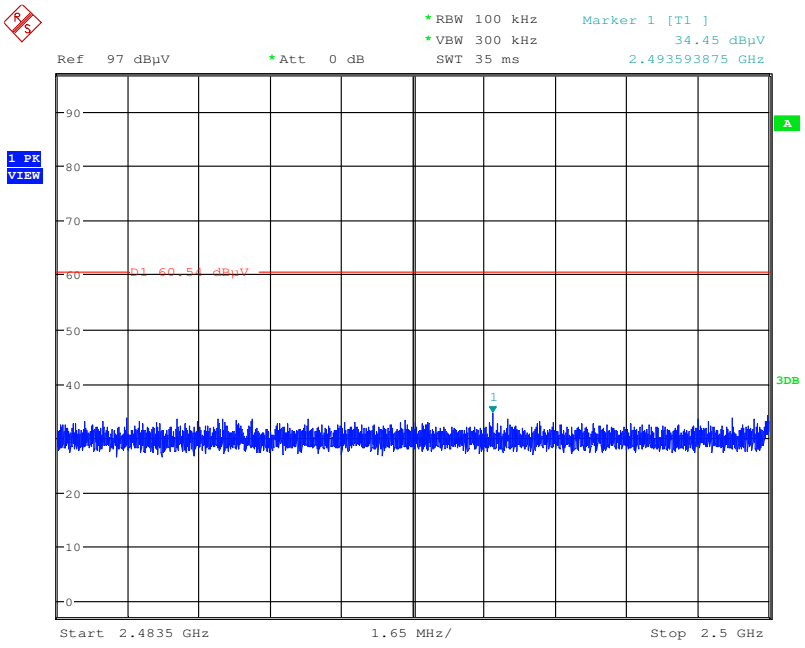
Note: Only the worse polarization (Vertical) is tested and recorded in test report.

Plot on Configuration For Bluetooth 4.0 / Channel 39 / 2390MHz~2400MHz (down 30dBc) (Vertical)



Date: 8.OCT.2014 05:31:38

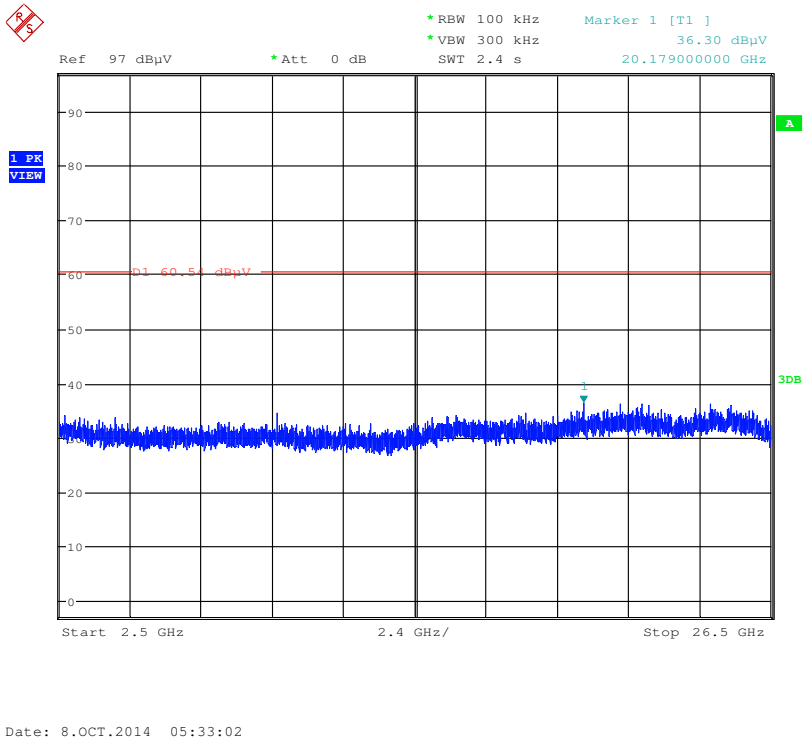
Plot on Configuration For Bluetooth 4.0 / Channel 39 / 2483.5MHz~2500MHz (down 30dBc) (Vertical)



Date: 8.OCT.2014 05:32:15

Note: Only the worse polarization (Vertical) is tested and recorded in test report.

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



Note: Only the worse polarization (Vertical) is tested and recorded in test report.

4.7. Antenna Requirements

4.7.1. 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.

4.7.2. Antenna Connector Construction

Please refer to section 3.3 in this test report; antenna connector complied with the requirements.

5. LIST OF MEASURING EQUIPMENTS

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
EMI Test Receiver	R&S	ESCS 30	100355	9 kHz ~ 2.75 GHz	Apr. 23, 2014	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150 kHz ~ 100 MHz	Nov. 23, 2013	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127478	9kHz ~ 30MHz	Nov. 11, 2013	Conduction (CO01-CB)
COND Cable	Woken	Cable	01	150 kHz ~ 30 MHz	Dec. 04, 2013	Conduction (CO01-CB)
Software	Audix	E3	5.410e	-	N.C.R.	Conduction (CO01-CB)
Signal analyzer	R&S	FSV40	100979	9kHz~40GHz	Nov. 29, 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)
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	Agilent	E9327A	US40442088	50MHz~18GHz	Dec. 02, 2013	Conducted (TH01-CB)
Power Meter	Agilent	E4416A	GB41291199	50MHz~18GHz	Dec. 02, 2013	Conducted (TH01-CB)
BILOG ANTENNA	Schaffner	CBL6112D	22021	20MHz ~ 2GHz	May 26, 2014	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	15GHz ~ 40GHz	Feb. 13, 2014	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10991	0.1MHz ~ 1.3GHz	Nov. 12, 2013	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Dec. 16, 2013	Radiation (03CH01-CB)
Pre-Amplifier	WM	TF-130N-R1	923365	26GHz ~ 40GHz	Oct. 23, 2013	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSP40	100019	9kHz~40GHz	Dec. 02, 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)

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

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%