FCC RF Test Report

APPLICANT	:	SteelSeries Aps.
EQUIPMENT	:	2.4GHz Stereo Headset
BRAND NAME	:	SteelSeries
MODEL NAME	:	61262-02
FCC ID	:	ZHK-6126202
STANDARD	:	FCC Part 15 Subpart C §15.247
CLASSIFICATION	:	Digital Spread Spectrum (DSS)

The product was received on Apr. 18, 2011 and completely tested on Apr. 29, 2011. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.4-2003 and shown the compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by:

Jones Tsai

Jones Tsai / Manager

Testing Laboratory 1190

SPORTON INTERNATIONAL INC.
No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR141817	Rev. 01	Initial issue of report	May 10, 2011

SUMMARY OF TEST RESULT

Report Section	FCC Rule	IC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(1)	A8.4(2)	Number of Channels	≥ 15Chs	Pass	-
3.2	15.247(a)(1)	A8.1(a)	20dB Bandwidth	NA	Pass	-
3.2	-	Gen 4.4.1	99% Bandwidth	-	Pass	-
3.3	15.247(a)(1)	A8.1(b)	Channel Separation	≥ 2/3 of 20dB BW	Pass	-
3.4	15.247(a)(1)	A8.1(d)	Dwell Time of Each Channel	≤ 0.4sec in 31.6sec period	Pass	-
3.5	15.247(b)(1)	A8.1(b)	Peak Output Power	≤ 125 mW	Pass	-
3.6	15.247(d)	A8.5	Frequency Band Edges	≤ 20dBc	Pass	-
3.7	15.207	Gen 7.2.2	AC Conducted Emission	15.207(a)	Pass	Under limit 13.8 dB at 0.19 MHz
3.8	15.247(d)	A8.5	Transmitter Radiated Emission	15.209(a) & 15.247(d)	Pass	Under limit 5.49 dB at 2483.5 MHz
3.9	15.203 & 15.247(b)	A8.4	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

SteelSeries Aps.
Skovbogårds Allé 13 DK-2500 Valby Denmark

1.2 Manufacturer

SteelSeries Aps.
Skovbogårds Allé 13 DK-2500 Valby Denmark

1.3 Feature of Equipment Under Test

Product Feature & Specification	
Equipment	2.4GHz Stereo Headset
Brand Name	SteelSeries
Model Name	61262-02
FCC ID	ZHK-6126202
Tx/Rx Frequency Range	2400 MHz ~ 2483.5 MHz
Number of Channels	38
Carrier Frequency of Each Channel	2404+n*2 MHz; n=1~38
Channel Spacing	2 MHz
Maximum Output Power to Antenna	Bluetooth : -0.07 dBm (0.0010 W)
Antenna Type	PCB Antenna with gain 4.4 dBi
HW Version	V3.2
SW Version	SVN114
Type of Modulation	GFSK
EUT Stage	Production Unit

Remark:

1. For other wireless features of this EUT, test report will be issued separately.
2. This test report recorded only product characteristics and test results of Digital Spread Spectrum (DSS).
3. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Testing Site

Test Site	SPORTON INTERNATIONAL INC.		
Test Site Location	No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-3273456 / FAX: +886-3-3284978		
Test Site No.	Sporton Site No.		FCC/IC Registration No.
	CO05-HY	03CH07-HY	722060/4086B-1

1.5 Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.247
- FCC Public Notice DA 00-705
- ANSI C63.4-2003
- IC RSS-210 Issue 8

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B (DoC), recorded in a separate test report.

1.6 Ancillary Equipment List

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	XBOX	Microsoft	XBOX 360 Console	C3K-RF02	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.1 m
2.	XBOX360 Controller	Microsoft	X11-29956-02	N/A	Shielded, 2.7 m	N/A
3.	Notebook	DELL	Vostro 1510	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
4.	LCD Monitor	Lenovo	6135-AB1	FCC DoC	Shielded, 1.6 m	Unshielded, 1.8 m
5.	iPod	Apple	A1285	FCC DoC	Shielded, 1.0 m	N/A

2 Test Configuration of Equipment Under Test

2.1 RF Output Power

Preliminary tests were performed in different data rate and recorded the RF output power in the following table:

Channel	Frequency	RF Output Power
		GFSK
Ch01	2404MHz	-0.07
Ch19	2440MHz	-0.24
Ch38	2478MHz	-1.25

Remark: The EUT is programmed to transmit signals continuously for all testing.

2.2 Test Mode

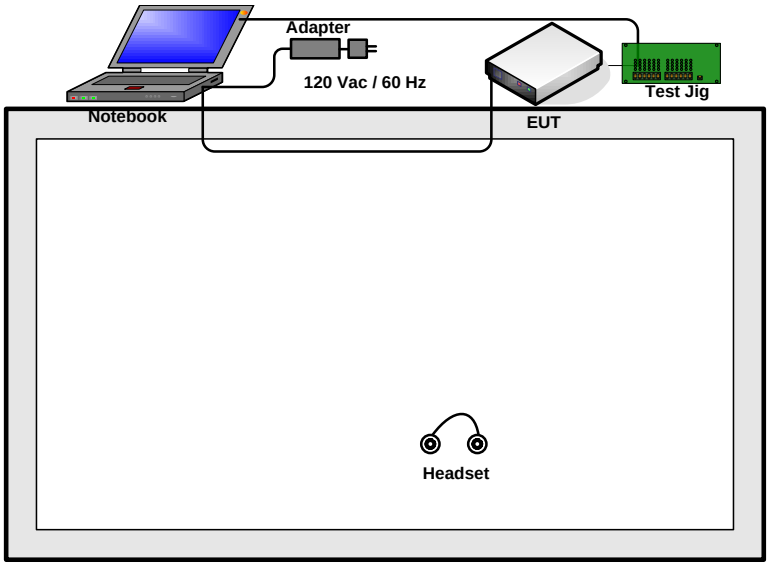
The EUT has been associated with peripherals pursuant to ANSI C63.4-2003 and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction (150 kHz to 30 MHz), radiation (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).

Pre-scanned tests were conducted to determine the final configuration from all possible combinations. The following tables are showing the test modes as the worst cases and recorded in this report.

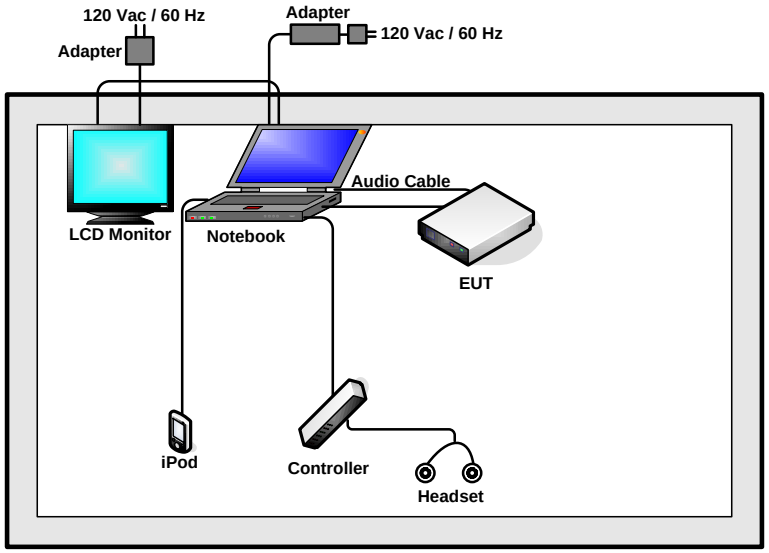
Test Cases	
	GFSK
Conducted TCs	Mode 1: Low Ch_2404 MHz Mode 2: Mid Ch_2440 MHz Mode 3: High Ch_2478 MHz
Radiated TCs	Mode 1: Low Ch_2404 MHz Mode 2: Mid Ch_2440 MHz Mode 3: High Ch_2478 MHz
AC Conducted Emission	Mode 1 :Headset Wireless Link + Station Wireless Link + Notebook with XBOX Controller + Notebook (MP3 Play) + Audio Cable (Link with Station) + Notebook (Recording) Mode 2 :Headset Wireless Link + Station Wireless Link + Notebook with XBOX Controller + XBOX (MP3 Play) + RCA with Audio Cable (Link with Station) + Notebook (Recording)
Remark: For conducted emission, the worst case is mode 1; only the test data of this mode was reported.	

2.3 Connection Diagram of Test System

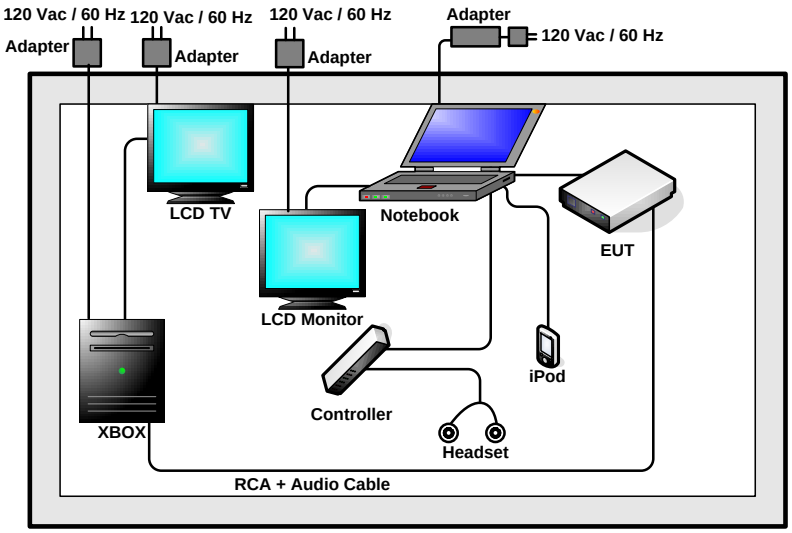
<Radiation Test>



<Conduction Test>



<Conduction Test with XBOX>



2.4 RF Utility

The RF utility, “AT Command” was installed in EUT provides functions like channel selection and power level for transmitting and receiving signals continuously

3 Test Result

3.1 Number of Channel Measurement

3.1.1 Limits of Number of Hopping Frequency

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

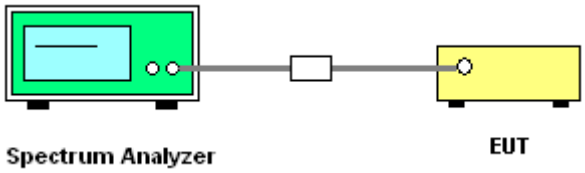
3.1.2 Measuring Instruments

See list of measuring instruments of this test report.

3.1.3 Test Procedure

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
3. The modulation types of EUT are irrelevant to number of hopping channels deviation.
4. The EUT must have its hopping function enabled. Use the following spectrum analyzer settings: Span = the frequency band of operation; RBW ≥ 1% of the span; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
5. The number of hopping frequency used is defined as the device has the numbers of total channel.

3.1.4 Test Setup

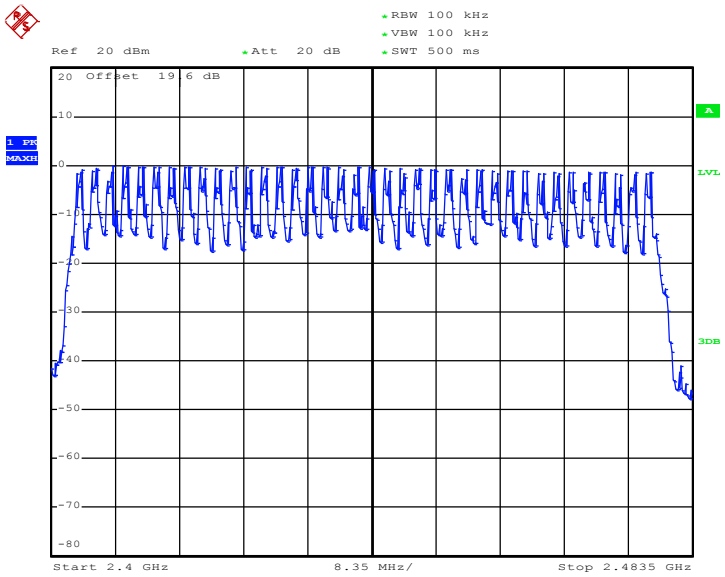


3.1.5 Test Result of Number of Hopping Frequency

Test Mode :	Mode 1~3	Temperature :	24~26℃
Test Engineer :	Phoenix Chen	Relative Humidity :	48~51%

Number of Hopping Channels (Channel)	Limits (Channel)	Pass/Fail
38	> 15	Pass

Number of Hopping Channel Plot on Channel 01 - 38



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3.2 20dB and 99% Bandwidth Measurement

3.2.1 Limit of 20dB Bandwidth

N/A

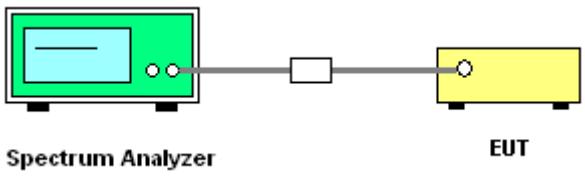
3.2.2 Measuring Instruments

See list of measuring instruments of this test report.

3.2.3 Test Procedures

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
3. The EUT should be transmitting at its maximum data rate as the worst cases.
4. Use the following spectrum analyzer settings:
   Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel;
   RBW ≥ 1% of the 20 dB bandwidth; VBW ≥ RBW; Sweep = auto; Detector function = peak;
   Trace = max hold.
5. The marker-delta reading at this point is the 20 dB bandwidth of the emission.

3.2.4 Test Setup

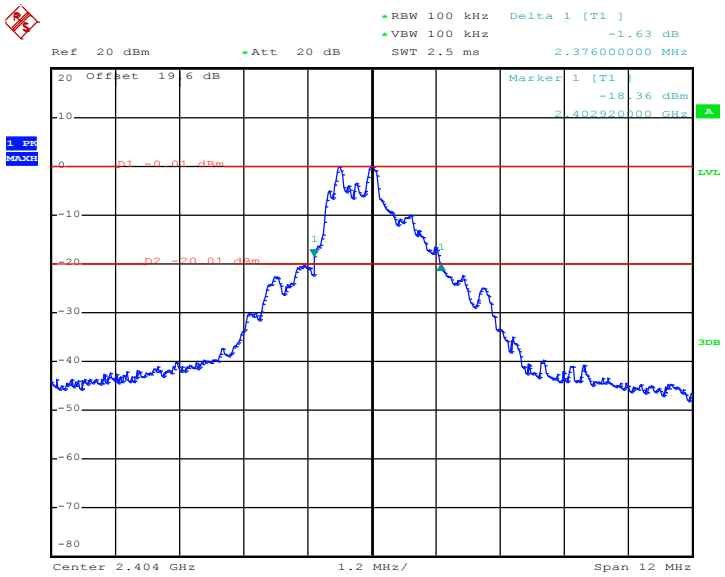


3.2.5 Test Result of 20dB Bandwidth

Test Mode :	Mode 1, 2, 3	Temperature :	24~26℃
Test Engineer :	Phoenix Chen	Relative Humidity :	48~51%

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
01	2404	2.37
19	2440	2.61
38	2478	2.68

20 dB Bandwidth Plot on Channel 01



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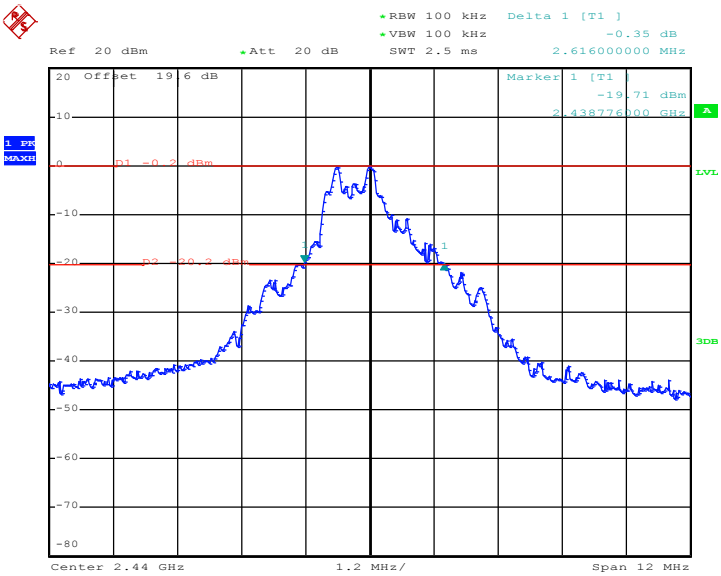
20 dB Bandwidth Plot on Channel 19



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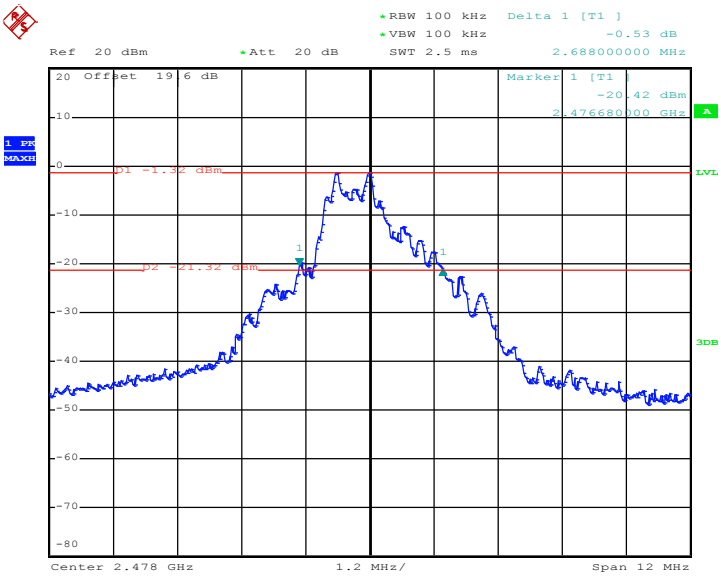
20 dB Bandwidth Plot on Channel 38



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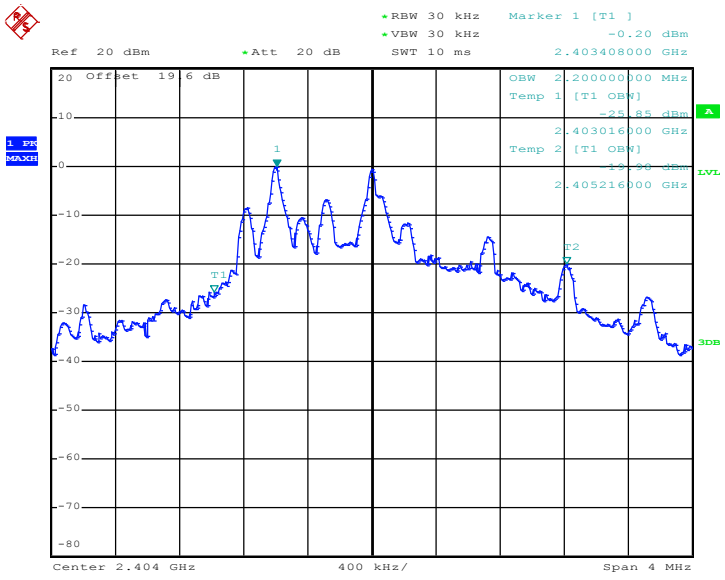
3.2.6 Test Result of 99% Occupied Bandwidth

Test Mode :	Mode 1, 2, 3	Temperature :	24~26℃
Test Engineer :	Phoenix Chen	Relative Humidity :	48~51%

Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)
01	2404	2.200
19	2440	2.168
38	2478	2.232

99% Bandwidth Plot on Channel 01



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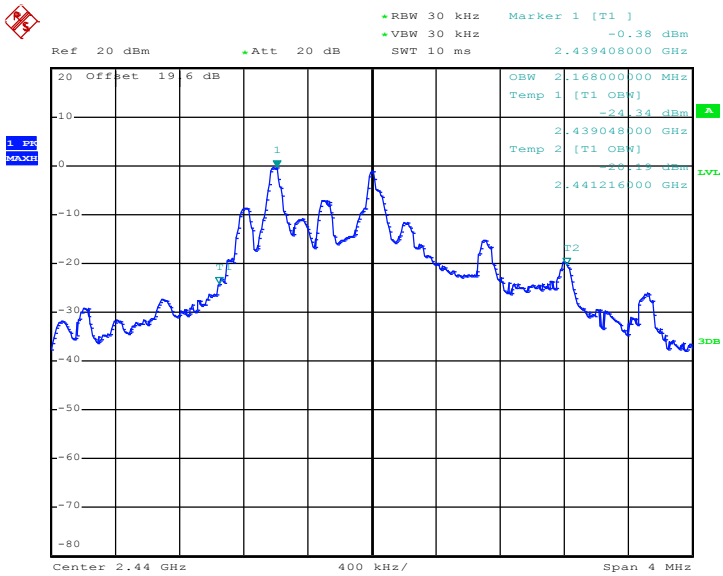
99% Occupied Bandwidth Plot on Channel 19



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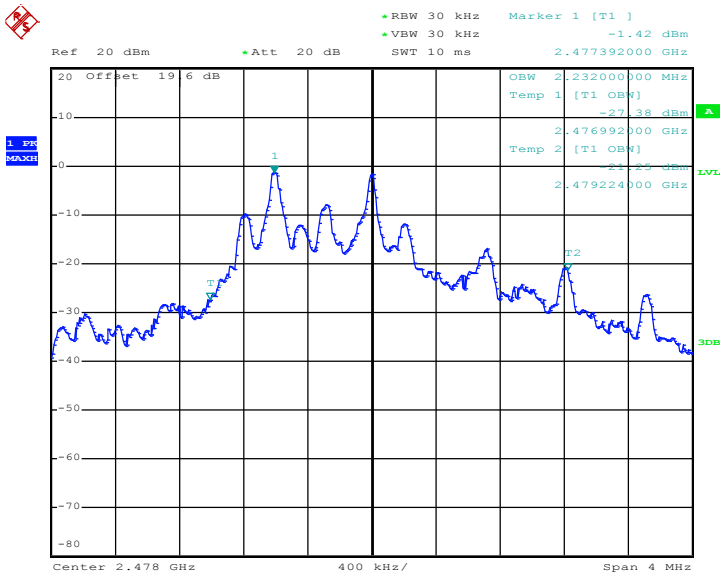
99% Occupied Bandwidth Plot on Channel 38



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3.3 Hopping Channel Separation Measurement

3.3.1 Limit of Hopping Channel Separation

Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

3.3.2 Measuring Instruments

See list of measuring instruments of this test report.

3.3.3 Test Procedures

1. Please refer FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
3. The EUT should be transmitting at its maximum data rate as the worst cases.
4. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels; RBW ≥ 1% of the span; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
5. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

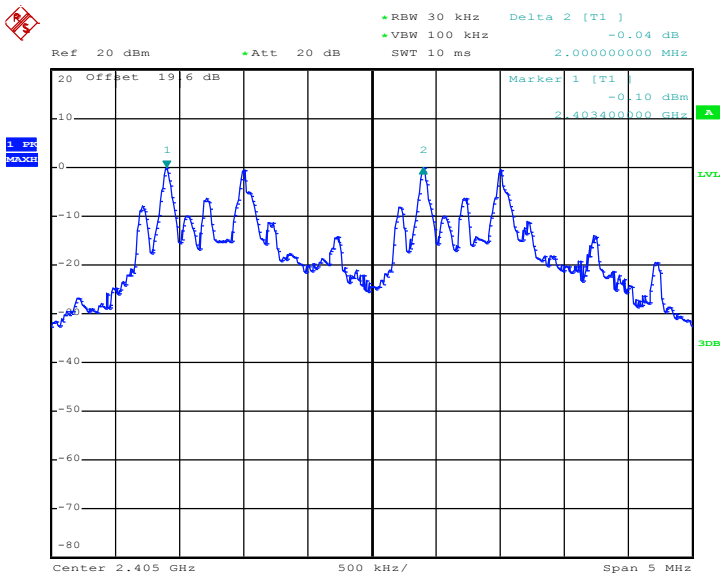
3.3.4 Test Setup

3.3.5 Test Result of Hopping Channel Separation

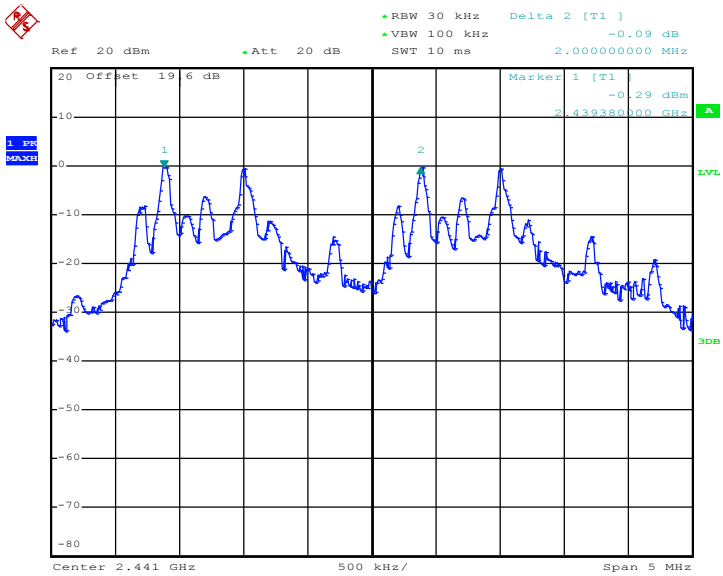
Test Mode :	Mode 1, 2, 3	Temperature :	24~26℃
Test Engineer :	Phoenix Chen	Relative Humidity :	48~51%

Channel	Frequency (MHz)	Frequency Separation (MHz)	Pass/Fail
01	2404	2.00	Pass
19	2440	2.00	Pass
38	2478	2.00	Pass

Channel Separation Plot on Channel 00 - 01



Channel Separation Plot on Channel 19 - 20



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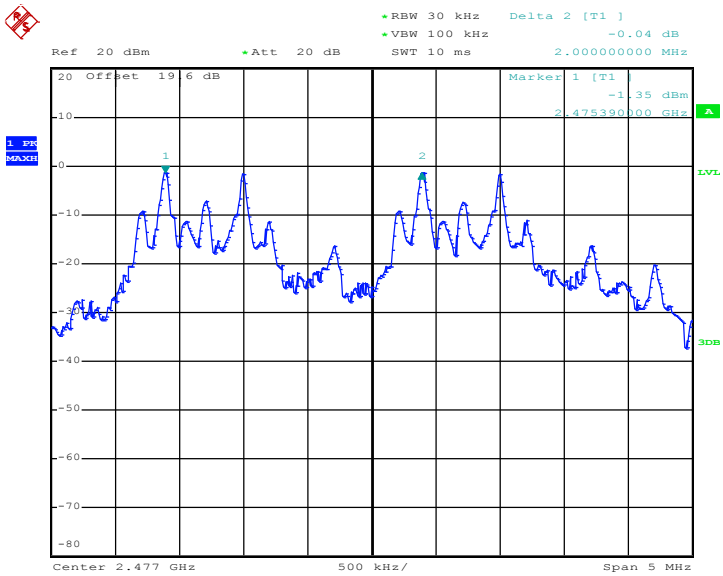
Channel Separation Plot on Channel 37 - 38



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3.4 Dwell Time Measurement

3.4.1 Limit of Dwell Time

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

3.4.2 Measuring Instruments

See list of measuring instruments of this test report.

3.4.3 Test Procedures

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
3. The EUT should be transmitting at its maximum data rate as the worst cases.
4. The EUT must have its hopping function enabled. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW = 1 MHz; VBW ≥ RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.
5. Use the marker-delta function to calculate the dwell time.

3.4.4 Test Setup

3.4.5 Test Result of Dwell Time

Test Engineer :	Phoenix Chen	Temperature :	24~26℃
		Relative Humidity :	48~51%

Average Hopping Channel	Package Transfer Time (usec)	Dwell Time (sec)	Limits (sec)	Pass/Fail
6.60	240.00	0.02408	0.4	Pass

Remark:

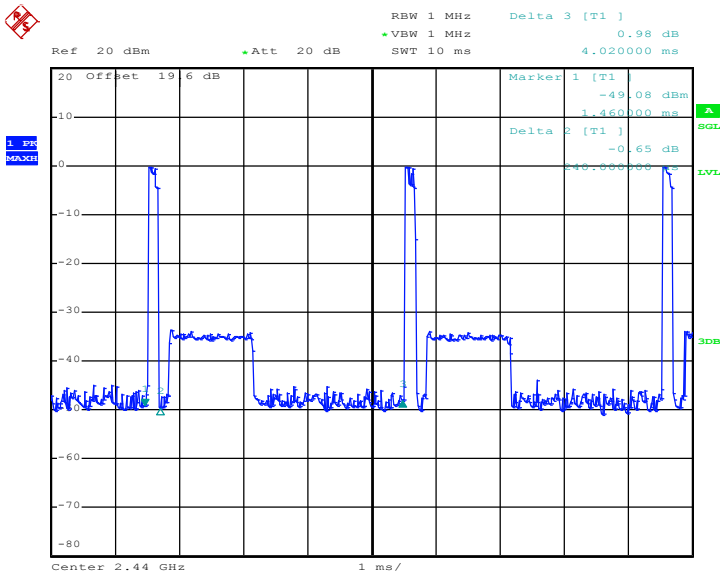
1. Dwell Time=38(channels) x 0.4(s) x average hopping channel x package transfer time

2. 38 channels come from the Hopping Channel number.

3. Average Hopping Channel = hops/sweep time

4. t: Package Transfer Time(us)

Dwell Time (One Pulse) Plot



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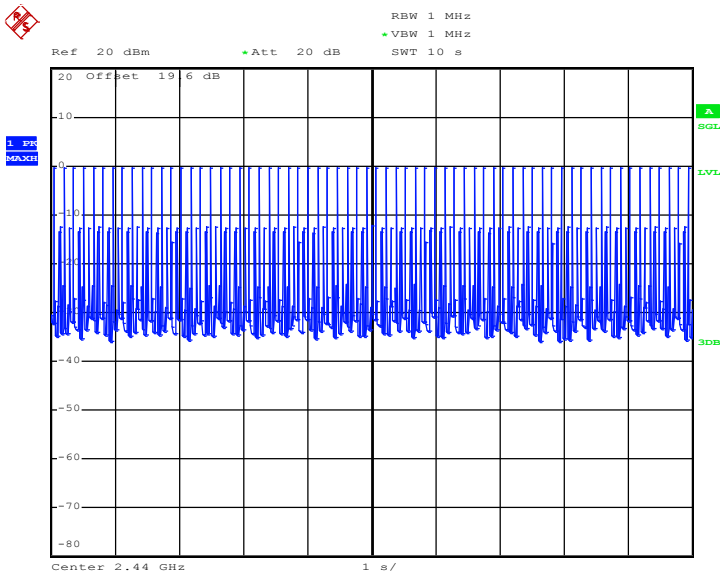
Dwell Time (Count Pulses) Plot



Date: 28.APR.2011 14:50:18

3.5 Peak Output Power Measurement

3.5.1 Limit of Peak Output Power

Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW (20.97dBm).

3.5.2 Measuring Instruments

See list of measuring instruments of this test report.

3.5.3 Test Procedures

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.

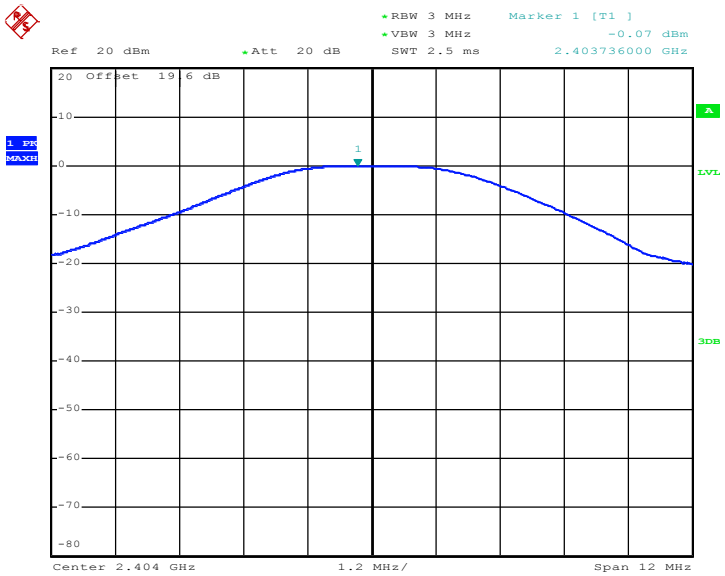
3.5.4 Test Setup

3.5.5 Test Result of Peak Output Power

Test Mode :	Mode 1, 2, 3	Temperature :	24~26℃
Test Engineer :	Phoenix Chen	Relative Humidity :	48~51%

Channel	Frequency (MHz)	RF Power (dBm)		
		GFSK	Max. Limits (dBm)	Pass/Fail
01	2404	-0.07	20.97	Pass
19	2440	-0.24	20.97	Pass
38	2478	-1.25	20.97	Pass

Peak Output Power Plot on Channel 01



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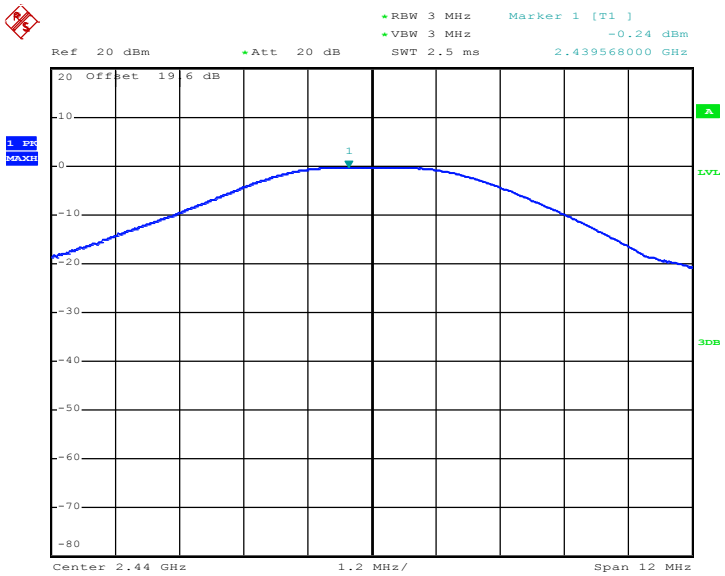
Peak Output Power Plot on Channel 19



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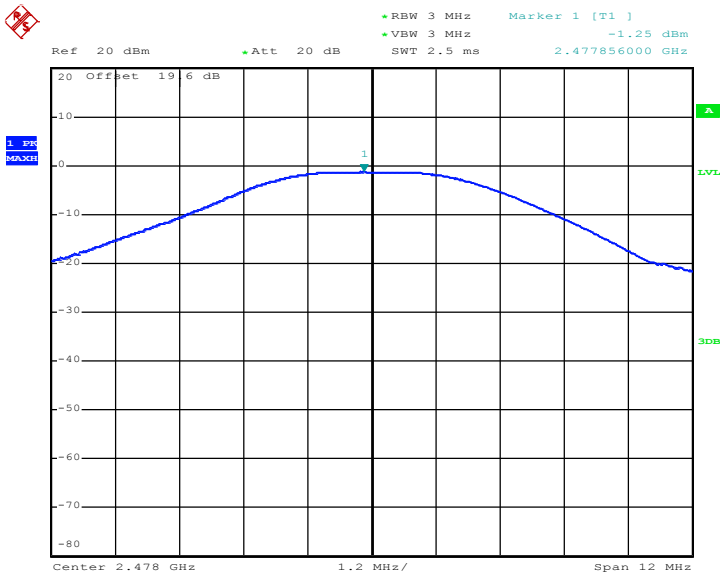
Peak Output Power Plot on Channel 38



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3.6 Band Edges Measurement

3.6.1 Limit of Band Edges

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

3.6.2 Measuring Instruments

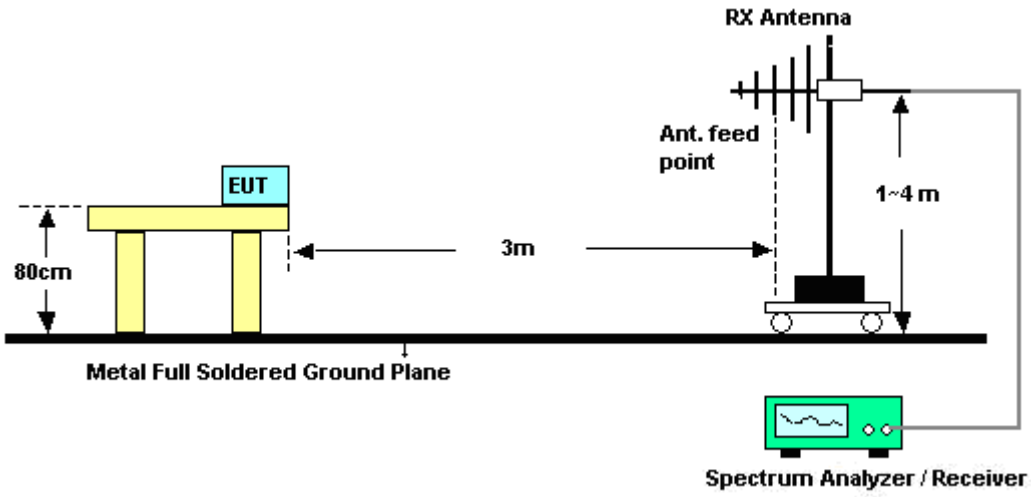
See list of measuring instruments of this test report.

3.6.3 Test Procedures

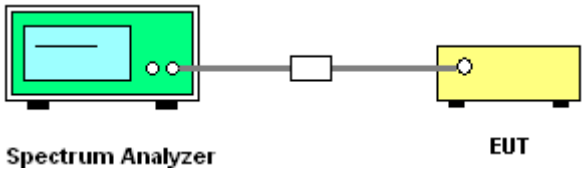
1. The testing follows the guidelines in ANSI C63.4-2003 and FCC Public Notice DA 00-705 Measurement Guidelines.
2. RF antenna conducted test: Set RBW = 1MHz, Video bandwidth (VBW) ≥ RBW. Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 1M Hz RBW. Note: If the device complies with the use of power option 2 the attenuation under this paragraph shall be 30 dB instead of 20 dB.
3. Radiated emission test: Applies to band edge emissions that fall in the restricted bands listed in FCC Section 15.205. The maximum permitted average field strength is listed in FCC Section 15.209. A pre-amp is necessary for this measurement. For measurements above 1 GHz, set RBW = 1MHz, VBW = 1MHz, Sweep: Auto for Peak; set RBW = 1MHz, VBW = 10 Hz, Sweep: Auto for Average. If the emission is pulsed, modify the unit for continuous operation; use the settings shown above, then correct the reading by subtracting the peak-average correction factor, derived from the appropriate duty cycle calculation. See FCC Section 15.35(b) and (c).
4. In case the emission is fail due to the used RBW / VBW is too wide, marker-delta method of FCC Public Notice DA 00-705 will be followed.

3.6.4 Test Setup

<Radiated Band Edges>



<Conducted Band Edges>



3.6.5 Test Result of Radiated Band Edges

Test Mode :	Mode 1	Temperature :	23~24°C
Test Channel :	01	Relative Humidity :	49~50%
		Test Engineer :	Ivan Chiang

ANTENNA POLARITY : HORIZONTAL										
Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2390	60.05	-13.95	74	55.69	32.18	6.03	33.85	100	79	Peak
2390	34.09	-19.91	54	29.73	32.18	6.03	33.85	100	79	Average

ANTENNA POLARITY : VERTICAL										
Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2390	63.6	-10.4	74	59.24	32.18	6.03	33.85	100	163	Peak
2390	34.08	-19.92	54	29.72	32.18	6.03	33.85	100	163	Average

Test Mode :	Mode 3	Temperature :	23~24°C
Test Channel :	38	Relative Humidity :	49~50%
		Test Engineer :	Ivan Chiang

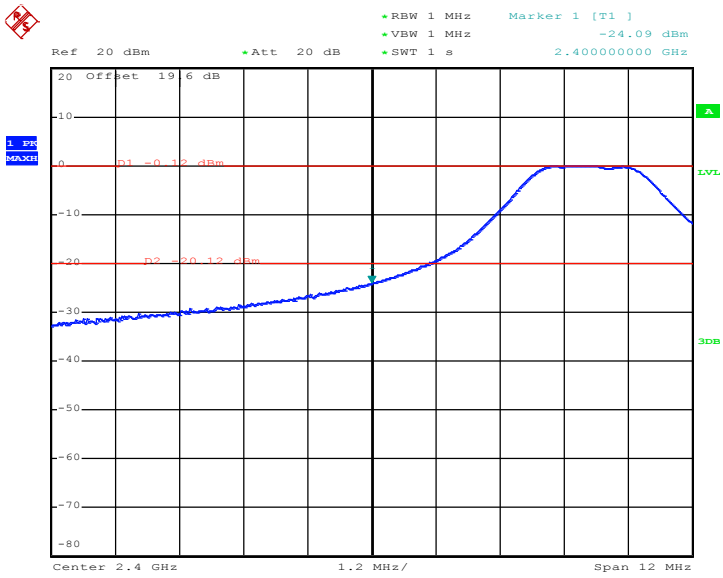
ANTENNA POLARITY : HORIZONTAL										
Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2483.5	67.45	-6.55	74	62.89	32.28	6.18	33.9	118	53	Peak
2483.5	35.08	-18.92	54	30.52	32.28	6.18	33.9	118	53	Average

ANTENNA POLARITY : VERTICAL										
Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2483.5	68.51	-5.49	74	63.95	32.28	6.18	33.9	126	200	Peak
2483.5	35.11	-18.89	54	30.55	32.28	6.18	33.9	126	200	Average

3.6.6 Test Result of Conducted Band Edges

Test Mode :	Mode 1 and 3	**Temperature :**	24~26℃
Test Channel :	01 and 38	**Relative Humidity :**	48~51%
		Test Engineer :	Phoenix Chen

Low Band Edge Plot on Channel 01



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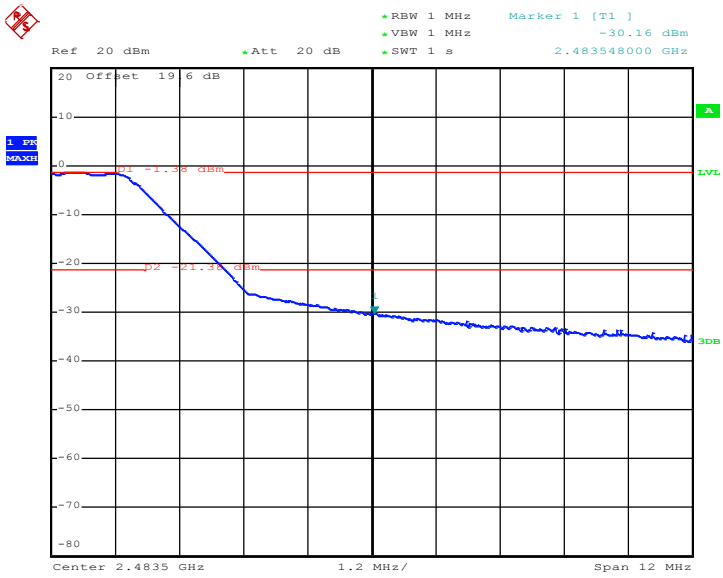
High Band Edge Plot on Channel 38



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3.7 AC Conducted Emission Measurement

3.7.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (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 the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

3.7.2 Measuring Instruments

See list of measuring instruments of this test report.

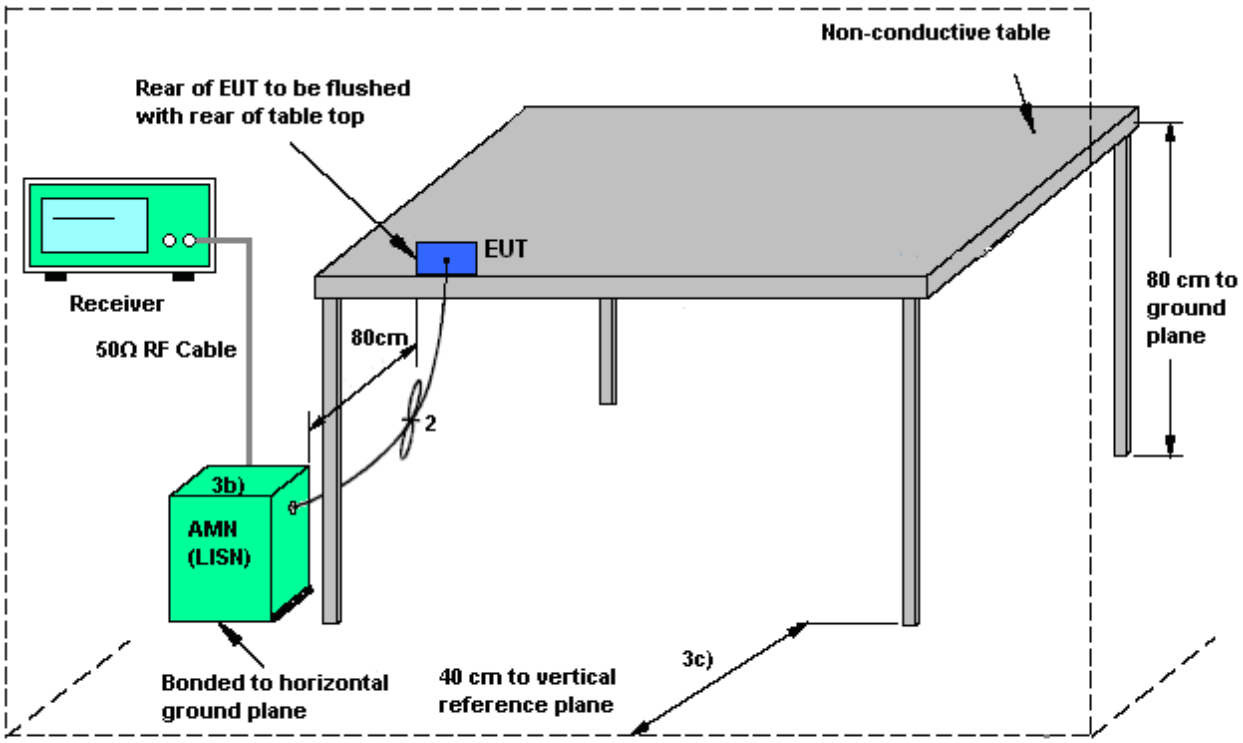
3.7.3 Test Procedures

1. Please follow the guidelines in ANSI C63.4-2003.
2. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least

80 centimeters from any other grounded conducting surface.

3. Connect EUT to the power mains through a line impedance stabilization network (LISN).
4. All the support units are connecting to the other LISN.
5. The LISN provides 50 ohm coupling impedance for the measuring instrument.
6. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
7. Both sides of AC line were checked for maximum conducted interference.
8. The frequency range from 150 kHz to 30 MHz was searched.
9. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

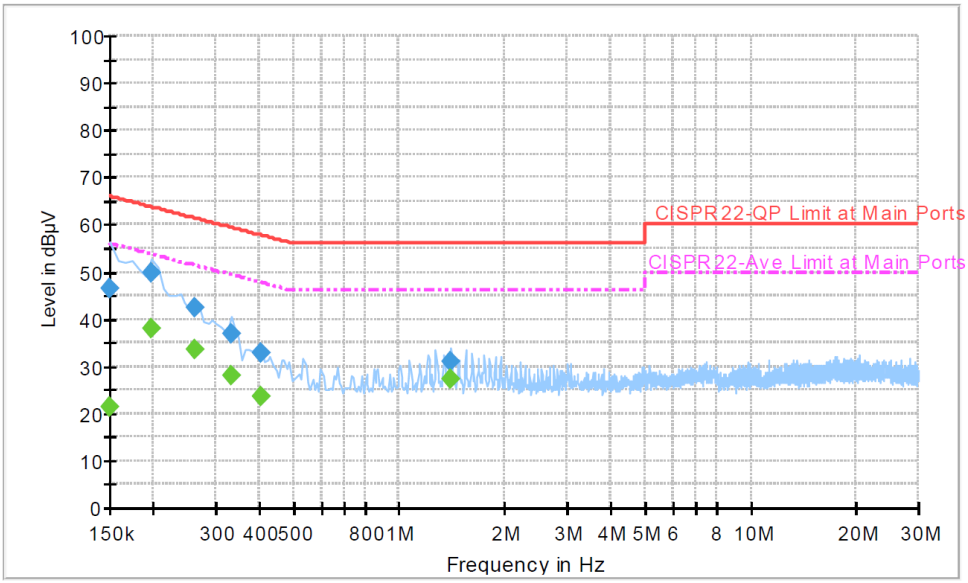
3.7.4 Test Setup



AMN = Artificial mains network (LISN)
AE = Associated equipment
EUT = Equipment under test
ISN = Impedance stabilization network

3.7.5 Test Result of AC Conducted Emission

Test Mode :	Mode 1	**Temperature :**	20~22℃
Test Engineer :	Novic Chiang	**Relative Humidity :**	40~42%
Test Voltage :	120Vac / 60Hz	**Phase :**	Line
Function Type :	Headset Wireless Link + Station Wireless Link + Notebook with XBOX Controller + Notebook (MP3 Play) + Audio Cable (Link with Station) + Notebook (Recording)		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



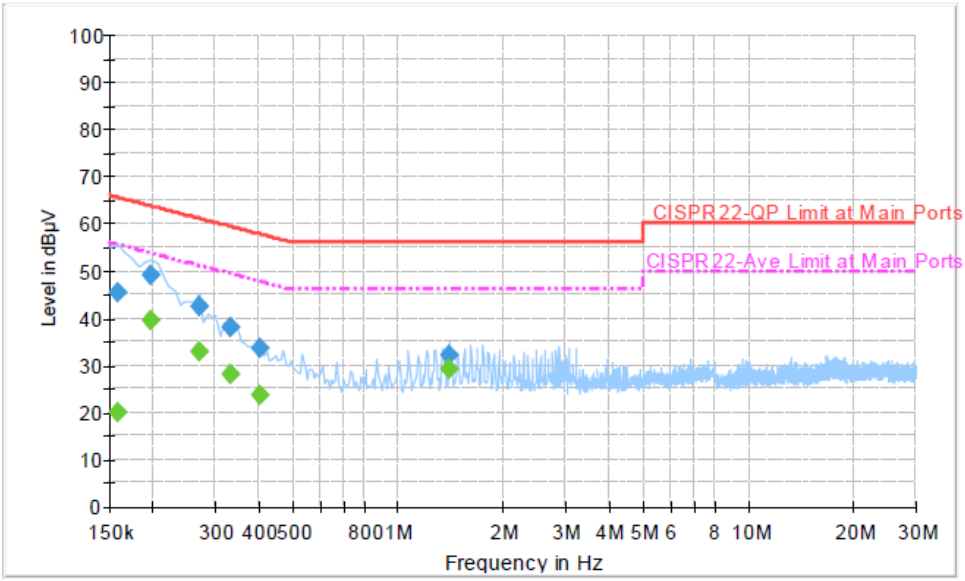
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	46.4	Off	L1	19.4	19.6	66.0
0.198000	49.9	Off	L1	19.4	13.8	63.7
0.262000	42.6	Off	L1	19.4	18.8	61.4
0.334000	36.9	Off	L1	19.4	22.5	59.4
0.406000	32.8	Off	L1	19.5	24.9	57.7
1.406000	31.1	Off	L1	19.4	24.9	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	21.2	Off	L1	19.4	34.8	56.0
0.198000	38.1	Off	L1	19.4	15.6	53.7
0.262000	33.6	Off	L1	19.4	17.8	51.4
0.334000	28.2	Off	L1	19.4	21.2	49.4
0.406000	23.7	Off	L1	19.5	24.0	47.7
1.406000	27.5	Off	L1	19.4	18.5	46.0

Test Mode :	Mode 1	**Temperature :**	20~22℃
Test Engineer :	Novic Chiang	**Relative Humidity :**	40~42%
Test Voltage :	120Vac / 60Hz	**Phase :**	Neutral
Function Type :	Headset Wireless Link + Station Wireless Link + Notebook with XBOX Controller + Notebook (MP3 Play) + Audio Cable (Link with Station) + Notebook (Recording)		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.158000	45.3	Off	N	19.4	20.3	65.6
0.198000	49.0	Off	N	19.4	14.7	63.7
0.270000	42.6	Off	N	19.4	18.5	61.1
0.334000	38.0	Off	N	19.4	21.4	59.4
0.406000	33.4	Off	N	19.5	24.3	57.7
1.406000	32.0	Off	N	19.5	24.0	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.158000	20.0	Off	N	19.4	35.6	55.6
0.198000	39.3	Off	N	19.4	14.4	53.7
0.270000	32.8	Off	N	19.4	18.3	51.1
0.334000	28.1	Off	N	19.4	21.3	49.4
0.406000	23.8	Off	N	19.5	23.9	47.7
1.406000	29.0	Off	N	19.5	17.0	46.0

3.8 Radiated Emission Measurement

3.8.1 Limit of Radiated Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

Frequency (MHz)	Field Strength (microvolts/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

3.8.2 Measuring Instruments

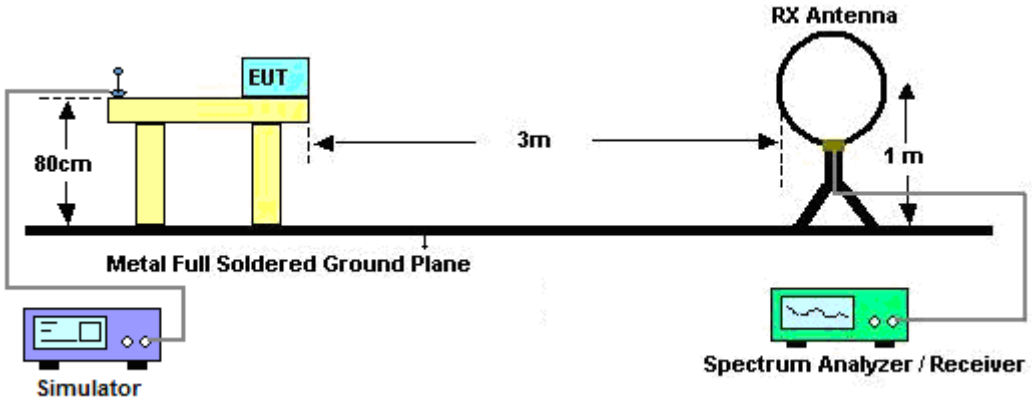
See list of measuring instruments of this test report.

3.8.3 Test Procedures

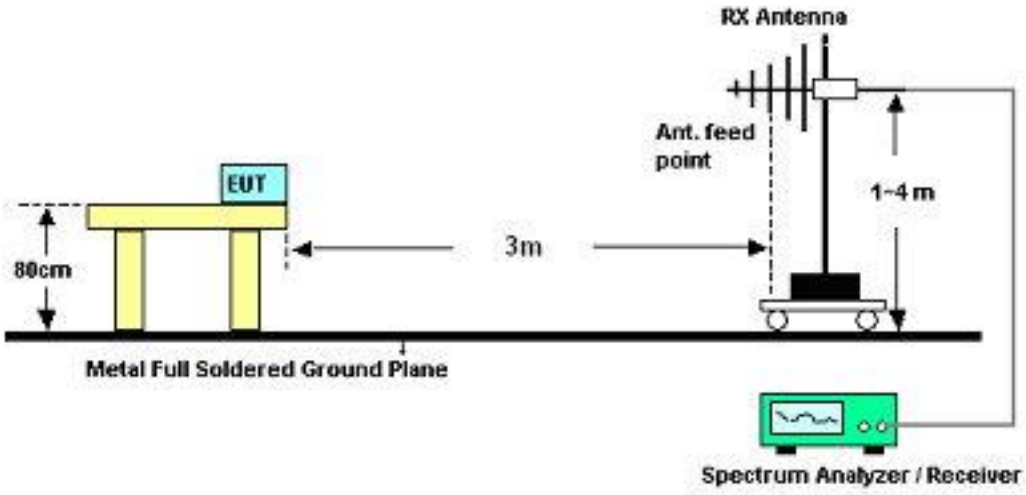
1. The testing follows the guidelines in FCC Public Notice DA 00-705 Measurement Guidelines.
2. Use the following spectrum analyzer settings:
   (1) Span = wide enough to fully capture the emission being measured; RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
   (2) Above 18 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade from 3m to 1m.
   Distance extrapolation factor = 20 log (specific distance [3m] / test distance [1m]) (dB)
3. Follow the guidelines in ANSI C63.4-2003 with respect to maximizing the emission by rotating the EUT, measuring the emission for three EUT orthogonal planes, and adjusting the measurement antenna height and polarization. A pre-amp and a high pass filter are used for this test in order to get the good signal level.
4. Measured average value for the peak value is greater than 54 dBuv/m

3.8.4 Test Setup

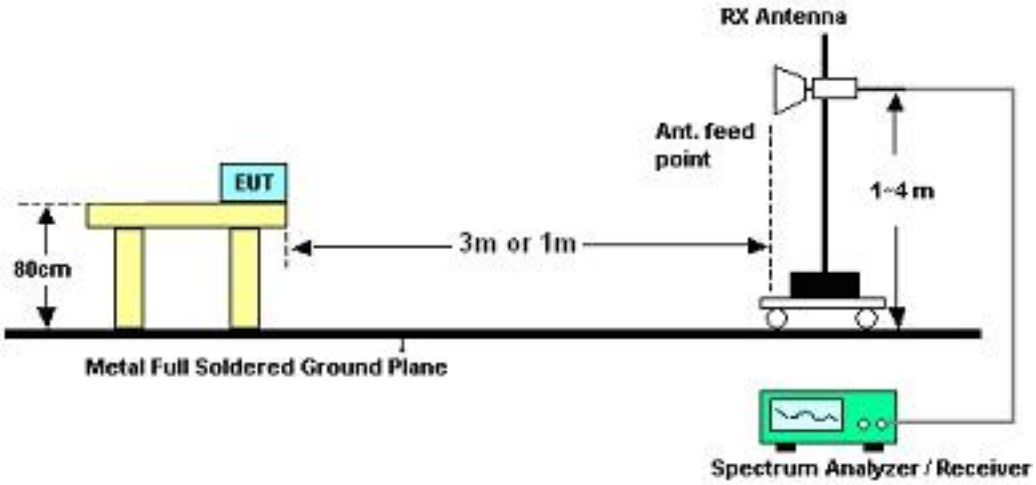
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.8.5 Test Results of Radiated Emissions (9 kHz ~ 30 MHz)

Test Engineer :	Ivan Chiang	Temperature :	23~24°C
		Relative Humidity :	49~50%

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

Note:

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

3.8.6 Test Result of Radiated Emission (30 MHz ~ 10th Harmonic)

Test Mode :	Mode 1	Temperature :	23~24°C
Test Channel :	01	Relative Humidity :	49~50%
Test Engineer :	Ivan Chiang	Polarization :	Horizontal
Remark :	2404 MHz is Fundamental Signals which can be ignored.		

Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
42.69	27.87	-12.13	40	47.15	11.59	0.64	31.51	101	85	Peak
91.02	22.64	-20.86	43.5	44.42	8.79	0.95	31.52	-	-	Peak
286.77	22.26	-23.74	46	38.65	13.26	1.68	31.33	-	-	Peak
360.2	26.78	-19.22	46	40.66	15.33	2.06	31.27	-	-	Peak
455.4	26.98	-19.02	46	38.27	17.49	2.31	31.09	-	-	Peak
816.6	25.1	-20.9	46	29.96	22.66	3.18	30.7	-	-	Peak
2390	60.05	-13.95	74	55.69	32.18	6.03	33.85	100	79	Peak
2390	34.09	-19.91	54	29.73	32.18	6.03	33.85	100	79	Average
2404	98.35	-	-	93.97	32.2	6.03	33.85	100	79	Peak
2404	54.55	-	-	50.17	32.2	6.03	33.85	100	79	Average
2484	33.57	-20.43	54	29.01	32.28	6.18	33.9	100	79	Average
2484	46.92	-27.08	74	42.36	32.28	6.18	33.9	100	79	Peak
4808	60.23	-13.77	74	76.19	34.06	9.12	59.14	100	154	Peak
4808	26.43	-27.57	54	42.39	34.06	9.12	59.14	100	154	Average
7212	49.71	-24.29	74	62.25	35.53	10.02	58.09	100	0	Peak

Test Mode :	Mode 1	Temperature :	23~24°C
Test Channel :	01	Relative Humidity :	49~50%
Test Engineer :	Ivan Chiang	Polarization :	Vertical
Remark :	2404 MHz is Fundamental Signals which can be ignored.		

Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
91.02	30.44	-13.06	43.5	52.22	8.79	0.95	31.52	-	-	Peak
142.86	31.15	-12.35	43.5	50.04	11.46	1.2	31.55	-	-	Peak
227.37	30.69	-15.31	46	49.65	11.02	1.46	31.44	-	-	Peak
335	32.35	-13.65	46	47.25	14.54	1.87	31.31	-	-	Peak
438.6	32.17	-13.83	46	43.82	17.2	2.27	31.12	-	-	Peak
808.9	34.37	-11.63	46	39.33	22.57	3.16	30.69	128	100	Peak
2390	63.6	-10.4	74	59.24	32.18	6.03	33.85	100	163	Peak
2390	34.08	-19.92	54	29.72	32.18	6.03	33.85	100	163	Average
2404	99.89	-	-	95.51	32.2	6.03	33.85	100	163	Peak
2404	55.71	-	-	51.33	32.2	6.03	33.85	100	163	Average
2492	33.61	-20.39	54	29.03	32.3	6.18	33.9	100	163	Average
2492	46.92	-27.08	74	42.34	32.3	6.18	33.9	100	163	Peak
4808	65.55	-8.45	74	81.51	34.06	9.12	59.14	100	261	Peak
4808	31.3	-22.7	54	47.26	34.06	9.12	59.14	100	261	Average
7212	48.05	-25.95	74	60.59	35.53	10.02	58.09	100	0	Peak

Test Mode :	Mode 2	Temperature :	23~24°C
Test Channel :	19	Relative Humidity :	49~50%
Test Engineer :	Ivan Chiang	Polarization :	Horizontal
Remark :	2440 MHz is Fundamental Signals which can be ignored.		

Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
42.69	27.69	-12.31	40	46.97	11.59	0.64	31.51	-	-	Peak
119.37	25.43	-18.07	43.5	44.44	11.45	1.1	31.56	-	-	Peak
127.74	35.5	-8	43.5	54.36	11.57	1.14	31.57	100	147	Peak
360.2	26.64	-19.36	46	40.52	15.33	2.06	31.27	-	-	Peak
455.4	26.22	-19.78	46	37.51	17.49	2.31	31.09	-	-	Peak
934.9	26.5	-19.5	46	29.62	24.07	3.42	30.61	-	-	Peak
2390	51.83	-22.17	74	47.47	32.18	6.03	33.85	155	56	Peak
2390	33.99	-20.01	54	29.63	32.18	6.03	33.85	155	56	Average
2440	96.5	-	-	92.03	32.24	6.11	33.88	155	56	Peak
2440	51.47	-	-	47	32.24	6.11	33.88	155	56	Average
2492	49.98	-24.02	74	45.4	32.3	6.18	33.9	155	56	Peak
2492	33.53	-20.47	54	28.95	32.3	6.18	33.9	155	56	Average
4880	61.94	-12.06	74	77.76	34.08	9.14	59.04	100	302	Peak
4880	29.69	-24.31	54	45.51	34.08	9.14	59.04	100	302	Average
7320	47.88	-26.12	74	60.52	35.44	10.06	58.14	100	0	Peak

Test Mode :	Mode 2	Temperature :	23~24°C
Test Channel :	19	Relative Humidity :	49~50%
Test Engineer :	Ivan Chiang	Polarization :	Vertical
Remark :	2440 MHz is Fundamental Signals which can be ignored.		

Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
91.02	30.81	-12.69	43.5	52.59	8.79	0.95	31.52	-	-	Peak
142.86	31.52	-11.98	43.5	50.41	11.46	1.2	31.55	110	258	Peak
219.81	31.7	-14.3	46	51.2	10.54	1.42	31.46	-	-	Peak
335	32.6	-13.4	46	47.5	14.54	1.87	31.31	-	-	Peak
455.4	29.91	-16.09	46	41.2	17.49	2.31	31.09	-	-	Peak
666.1	28.58	-17.42	46	36.05	20.51	2.87	30.85	-	-	Peak
2380	51.82	-22.18	74	47.48	32.16	6.03	33.85	124	157	Peak
2380	33.61	-20.39	54	29.27	32.16	6.03	33.85	124	157	Average
2440	98.14	-	-	93.67	32.24	6.11	33.88	124	157	Peak
2440	53.82	-	-	49.35	32.24	6.11	33.88	124	157	Average
2484	51.94	-22.06	74	47.38	32.28	6.18	33.9	124	157	Peak
2484	33.55	-20.45	54	28.99	32.28	6.18	33.9	124	157	Average
4880	68	-6	74	83.82	34.08	9.14	59.04	100	251	Peak
4880	31.26	-22.74	54	47.08	34.08	9.14	59.04	100	251	Average
7320	49.77	-24.23	74	62.41	35.44	10.06	58.14	100	0	Peak

Test Mode :	Mode 3	Temperature :	23~24°C
Test Channel :	38	Relative Humidity :	49~50%
Test Engineer :	Ivan Chiang	Polarization :	Horizontal
Remark :	2478 MHz is Fundamental Signals which can be ignored.		

Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
42.69	28.44	-11.56	40	47.72	11.59	0.64	31.51	100	223	Peak
91.02	21.12	-22.38	43.5	42.9	8.79	0.95	31.52	-	-	Peak
286.77	22.92	-23.08	46	39.31	13.26	1.68	31.33	-	-	Peak
343.4	26.24	-19.76	46	40.8	14.81	1.92	31.29	-	-	Peak
360.2	27.23	-18.77	46	41.11	15.33	2.06	31.27	-	-	Peak
455.4	27.6	-18.4	46	38.89	17.49	2.31	31.09	-	-	Peak
2372	46.29	-27.71	74	41.98	32.16	5.99	33.84	118	53	Peak
2372	33.77	-20.23	54	29.46	32.16	5.99	33.84	118	53	Average
2478	97.26	-	-	92.7	32.28	6.18	33.9	118	53	Peak
2478	53.85	-	-	49.29	32.28	6.18	33.9	118	53	Average
2483.5	67.45	-6.55	74	62.89	32.28	6.18	33.9	118	53	Peak
2483.5	35.08	-18.92	54	30.52	32.28	6.18	33.9	118	53	Average
4956	67.11	-6.89	74	82.77	34.09	9.16	58.91	100	116	Peak
4956	33.34	-20.66	54	49	34.09	9.16	58.91	100	116	Average
7434	50.62	-23.38	74	63.32	35.36	10.12	58.18	100	0	Peak

Test Mode :	Mode 3	Temperature :	23~24°C
Test Channel :	38	Relative Humidity :	49~50%
Test Engineer :	Ivan Chiang	Polarization :	Vertical
Remark :	2478 MHz is Fundamental Signals which can be ignored.		

Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
91.02	30.39	-13.11	43.5	52.17	8.79	0.95	31.52	-	-	Peak
120.18	29.99	-13.51	43.5	48.92	11.53	1.1	31.56	-	-	Peak
227.37	30.81	-15.19	46	49.77	11.02	1.46	31.44	-	-	Peak
335	33.21	-12.79	46	48.11	14.54	1.87	31.31	133	184	Peak
455.4	29.24	-16.76	46	40.53	17.49	2.31	31.09	-	-	Peak
853.7	32.57	-13.43	46	36.93	23.09	3.28	30.73	-	-	Peak
2390	48.65	-25.35	74	44.29	32.18	6.03	33.85	126	200	Peak
2390	34.03	-19.97	54	29.67	32.18	6.03	33.85	126	200	Average
2478	98.59	-	-	94.03	32.28	6.18	33.9	126	200	Peak
2478	53.99	-	-	49.43	32.28	6.18	33.9	126	200	Average
2483.5	68.51	-5.49	74	63.95	32.28	6.18	33.9	126	200	Peak
2483.5	35.11	-18.89	54	30.55	32.28	6.18	33.9	126	200	Average
4956	66.97	-7.03	74	82.63	34.09	9.16	58.91	100	247	Peak
4956	32.53	-21.47	54	48.19	34.09	9.16	58.91	100	247	Average
7434	52	-22	74	64.7	35.36	10.12	58.18	119	200	Peak

3.9 Antenna Requirements

3.9.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. 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 FCC rule.

3.9.2 Antenna Connected Construction

The antennas type used in this product is PCB Antenna without connector and it is considered to meet antenna requirement.

3.9.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Due Date	Remark
System Simulator	R&S	CMU200	117995	N/A	Jun. 08, 2009	Jun. 07, 2011	Conducted (TH02-HY)
Spectrum Analyzer	R&S	FSP40	100055	9kHz~40GHz	Jun. 11, 2010	Jun. 10, 2011	Conducted (TH02-HY)
Power Meter	Anritsu	ML2495A	0932001	N/A	Sep. 13, 2010	Sep. 12, 2011	Conducted (TH02-HY)
Power Sensor	Anritsu	MA2411B	0846202	N/A	Sep. 14, 2010	Sep. 13, 2011	Conducted (TH02-HY)
Power Meter	Agilent	E4416A	GB41292344	N/A	Feb. 18, 2011	Feb. 17, 2012	Conducted (TH02-HY)
Power Sensor	Agilent	E9327A	US40441548	N/A	Feb. 18, 2011	Feb. 17, 2012	Conducted (TH02-HY)
Bilog Antenna	SCHAFFNER	CBL6111C	2726	30MHz ~ 1GHz	Oct. 31, 2010	Oct. 30, 2011	Radiation (03CH07-HY)
Spectrum Analyzer	R&S	FSP	101067	9KHz ~ 30GHz	Dec. 03, 2010	Dec. 02, 2011	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Aug. 19, 2010	Aug. 18, 2011	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	15GHz- 40GHz	Oct. 18, 2010	Oct. 17, 2011	Radiation (03CH07-HY)
Pre Amplifier	Agilent	8449B	3008A02362	1GHz~ 26.5GHz	Dec. 06, 2010	Dec. 05, 2011	Radiation (03CH07-HY)
Pre Amplifier	COM-POWER	PA-103A	161241	10-1000MHz.32 dB.GAIN	Mar. 29, 2011	Mar. 28, 2012	Radiation (03CH07-HY)
Loop Antenna	R&S	HFH2-Z2	860004/001	9 kHz~30 MHz	Jul. 29, 2010	Jul. 28, 2011	Radiation (03CH07-HY)
EMI Test Receive	R&S	ESCS 30	100356	9KHz – 2.75GHz	Aug. 16, 2010	Aug. 15, 2011	Conduction (CO05-HY)
Two-LISN	R&S	ENV216	11-100081	9KHz – 30MHz	Dec. 03, 2010	Dec. 02, 2011	Conduction (CO05-HY)
Two-LISN	R&S	ENV216	11-100080	9KHz – 30MHz	Dec. 01, 2010	Nov. 30, 2011	Conduction (CO05-HY)
AC Power Source	APC	APC-1000W	N/A	N/A	N/A	N/A	Conduction (CO05-HY)

5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Contribution	Uncertainty of X_i		$u(X_i)$
	dB	Probability Distribution	
Receiver Reading	0.10	Normal (k=2)	0.05
Cable Loss	0.10	Normal (k=2)	0.05
AMN Insertion Loss	2.50	Rectangular	0.63
Receiver Specification	1.50	Rectangular	0.43
Site Imperfection	1.39	Rectangular	0.80
Mismatch	+0.34 / -0.35	U-Shape	0.24
Combined Standard Uncertainty Uc(y)	**1.13**		
Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.26**		

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Contribution	Uncertainty of X_i		$u(X_i)$
	dB	Probability Distribution	
Receiver Reading	0.41	Normal (k=2)	0.21
Antenna Factor Calibration	0.83	Normal (k=2)	0.42
Cable Loss Calibration	0.25	Normal (k=2)	0.13
Pre-Amplifier Gain Calibration	0.27	Normal (k=2)	0.14
RCV/SPA Specification	2.50	Rectangular	0.72
Antenna Factor Interpolation for Frequency	1.00	Rectangular	0.29
Site Imperfection	1.43	Rectangular	0.83
Mismatch	+0.39 / -0.41	U-Shape	0.28
Combined Standard Uncertainty Uc(y)	**1.27**		
Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.54**		

Uncertainty of Radiated Emission Measurement (1 GHz ~ 40 GHz)

Contribution	Uncertainty of X_i		$u(X_i)$	C_i	$C_i * u(X_i)$
	dB	Probability Distribution			
Receiver Reading	±0.10	Normal (k=2)	0.10	1	0.10
Antenna Factor Calibration	±1.70	Normal (k=2)	0.85	1	0.85
Cable Loss Calibration	±0.50	Normal (k=2)	0.25	1	0.25
Receiver Correction	±2.00	Rectangular	1.15	1	1.15
Antenna Factor Directional	±1.50	Rectangular	0.87	1	0.87
Site Imperfection	±2.80	Triangular	1.14	1	1.14
Mismatch Receiver VSWR Γ1 = 0.197 Antenna VSWR Γ2 = 0.194 Uncertainty = 20Log(1-Γ1*Γ2)	+0.34 / -0.35	U-Shape	0.244	1	0.244
Combined Standard Uncertainty Uc(y)	**2.36**				
Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.72**				

Appendix A. Photographs of EUT

Please refer to Sporton report number EP141817 as below.