KES Co., Ltd.
C-3701 Dongil Techno Town, 889-1, Gwanyang 2-dong,
Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450
www.kes.co.kr

TEST REPORT

Part 15 Subpart B&C 15.247

Equipment under test	Auto Blood Pressure Meter
Model name	HX-461
BT Module FCC ID	QOQWT12
FCC ID	QN8HX-461
Applicant	Seers Technology Co., Ltd.
Manufacturer	Seers Technology Co., Ltd.
Date of test(s)	2012.10.02 ~ 2012.10.12
Date of issue	2012.10.15

Issued to

Seers Technology Co., Ltd.
#1210, Tech Dong, SKn Technopark 190-1 Sangdaewon-dong, Jungwon-gu
Sungnam-si, Gyeonggi-do, 462-721, Korea

Issued by

KES Co., Ltd.
C3701 Dongil Techno Town, 889-1, Gwanyang 2-dong, Dongan-gu, Anyang-si,
Gyeonggi-do, 431-716, Korea
477-6, Hageo-ri, Yeoju-eup, Yeoju-gun, Gyeonggi-do, 469-803, Korea
Tel: +82-31-425-6200 / Fax: +82-31-424-0450

Test and report completed by :	**Report approval by :**
	
Kwang Yeol Choo Test engineer	Gyu-cheol Shin Technical manager

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Revision history

Revision	Date of issue	Test report No.	Description
-	2012.10.15	KES-RF-120072	Initial

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1.0 General product description

Equipment under test	Auto Blood Pressure Meter
BT Module FCC ID	QOQWT12
Model name	HX-461
Serial number	N/A
Frequency Range	2 412 ㎒ ~ 2 462 ㎒(802.11 b/g) // 2 402 ㎒ ~ 2 480 ㎒(Bluetooth BDR)
Modulation technique	DSSS, OFDM, GFSK
Number of channels	11(802.11 b/g) // 79(Bluetooth BDR)
Antenna type & gain	802.11b/g: Fixed type(Chip antenna) // 1.9 dBi Bluetooth: Fixed type(Chip antenna) // 1.7 dBi
Power source	AC 120 V

1.1 Test frequency

	Low channel	**Middle channel**	**High channel**
Frequency (㎒)	2 402	2 441	2 480

1.2 Information about variant model

N/A

1.3 Device modifications

N/A

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1.4 Test facility

C3701 Dongil Techno Town, 889-1, Gwanyang 2-dong, Dongan-gu, Anyang-si, Gyeonggi-do, 431-716, Korea
477-6, Hageo-ri, Yeoju-eup, Yeoju-gun, Gyeonggi-do, 469-803, Korea

The open area test site is constructed in conformance with the requirements ANSI C63.4-2003.

1.5 Laboratory accreditations and listings

Country	Agency	Scope of accreditation	Certificate No.
USA	FCC	3 & 10 meter Open Area Test Sites and one conducted site to perform FCC Part 15/18 measurements.	343818
KOREA	KC	EMI (10 meter Open Area Test Site and two conducted sites) Radio (3 & 10 meter Open Area Test Sites and one conducted site)	KR0100
CANADA	IC	3 & 10 meter Open Area Test Sites and one conducted site	4769B-1

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2.0 Summary of tests

Section in FCC Part 15	Parameter	Status
15.247(b)(1)	Peak output power	Complies
15.247(d)	Conducted spurious emission and band edge	Complies
15.205 15.209	Radiated spurious emission and band edge	Complies
15.207	AC conducted emission	Complies

Statement;

The measurement procedures described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 ㎑ to 40 ㎓ (ANSI C63.4-2003) and the guidance provided in FCC OET Public notice DA 00-705 were used in the measurement of the DUT.

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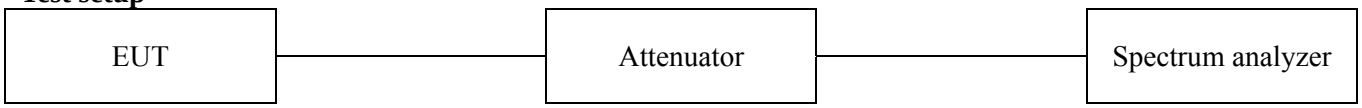
2.1 Test data

2.1.1 Peak power output power

Test setup



Test procedure

1. Use the following spectrum analyzer setting
   Center frequency: Lowest, middle and highest channels
   Span = 5 ㎒ (Approximately 5 times the 20 ㏈ bandwidth, centered on a hopping channel)
   RBW = 1 ㎒ (the 20 ㏈ bandwidth of the emission being measured)
   VBW = 1 ㎒ (≥ RBW)
   Sweep = auto
   Detector function = peak
   Trace = max hold
2. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power.

Limit

According to §15.247(b)(3), for systems using digital modulation in the 902 ~ 928 ㎒, 2 400 ~ 2 483.5 ㎒, and 5 725 ~ 5 850 ㎒ band: 1 Watt.

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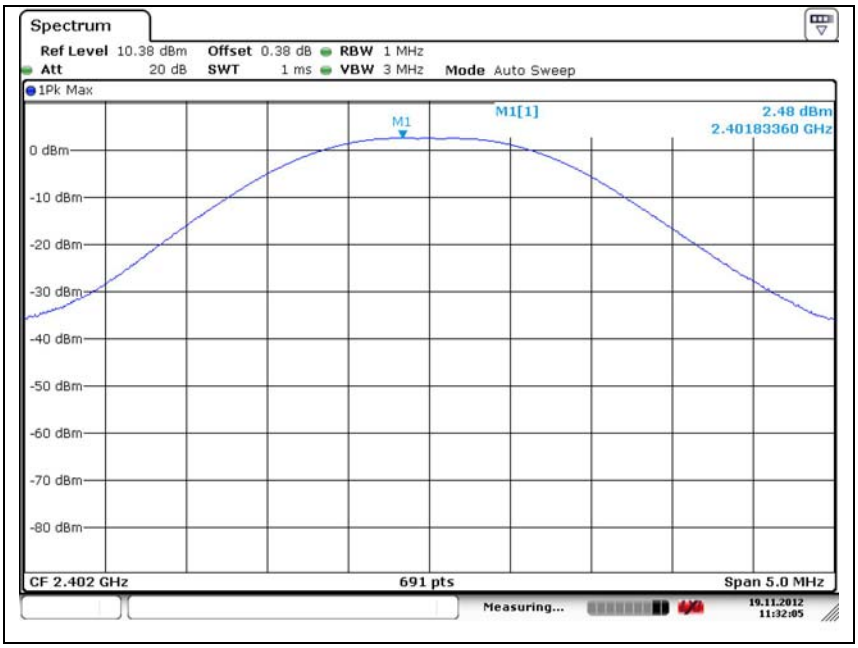
Test results

Frequency(㎒)	Output power (㏈m)	Limit (㏈m)
2 402	2.48	30
2 441	2.29	
2 480	3.75	

Low channel



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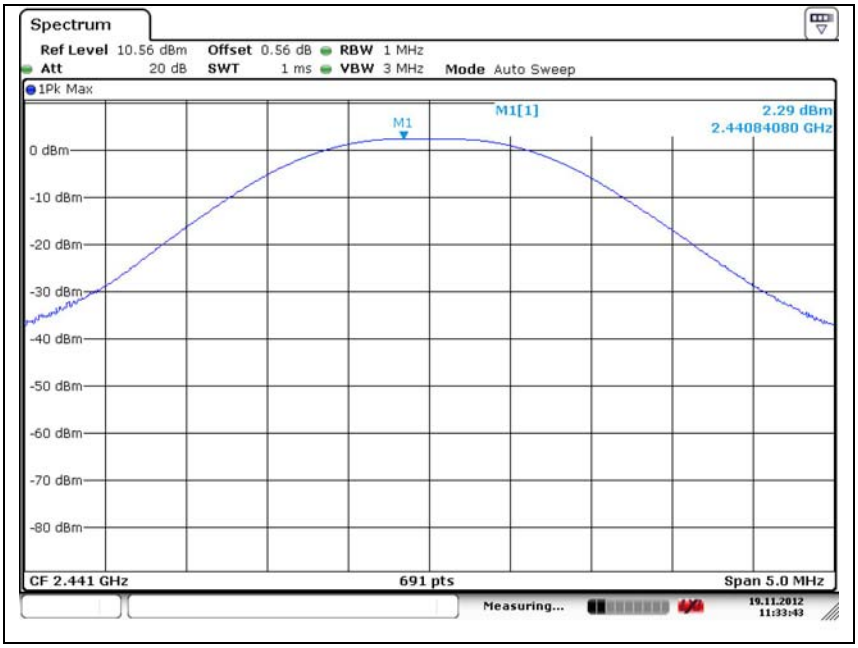
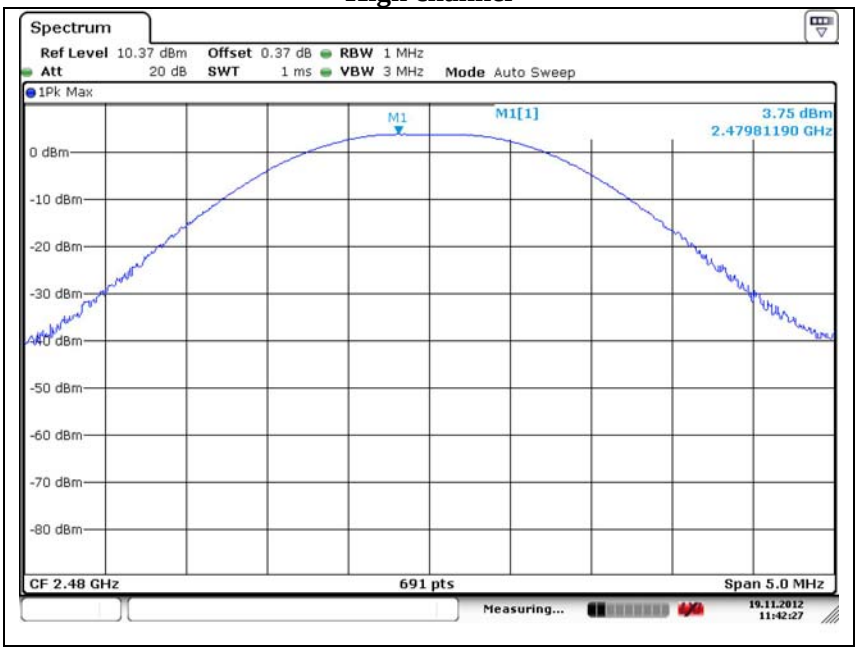
Middle channel



High channel



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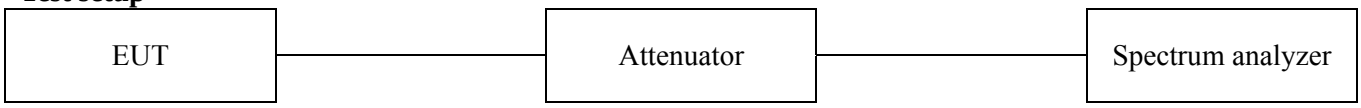
2.1.2 Conducted spurious emission & band edge

Test setup



Test procedure for band edge

1. Use the following spectrum analyzer setting
   Center frequency: Low, middle and high channel.
   Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.
   RBW = 100 ㎑
   VBW = 100 ㎑ (≥ RBW)
   Sweep = auto
   Detector function = peak
   Trace = max hold
2. Allow the trace to stabilize. Set the marker on the emission at the band edge, or on the highest modulation on product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission

Test procedure for spurious emission

1. Use the following spectrum analyzer setting
   Center frequency: Low, middle and high channel.
   Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.
   RBW = 100 ㎑
   VBW = 100 ㎑ (≥ RBW)
   Sweep = auto
   Detector function = peak
   Trace = max hold
2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.

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Limit

According to 15.247(d), in any 100 ㎑ bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 ㏈ below that in the 100 ㎑ bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval , as permitted under paragraph(b)(3) of this section , the attenuation required under this paragraph shall be 30 ㏈ instead of 20 ㏈. Attenuation below the general limits specified in section 15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section 15.205(a), must also comply the radiated emission limits specified in section 15.209(a) (see section 15.205(c))

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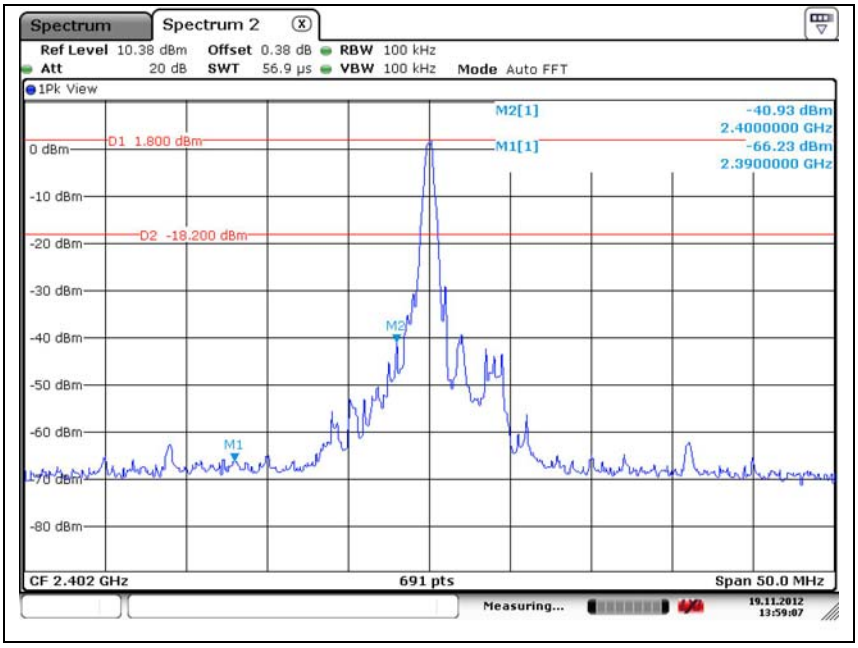
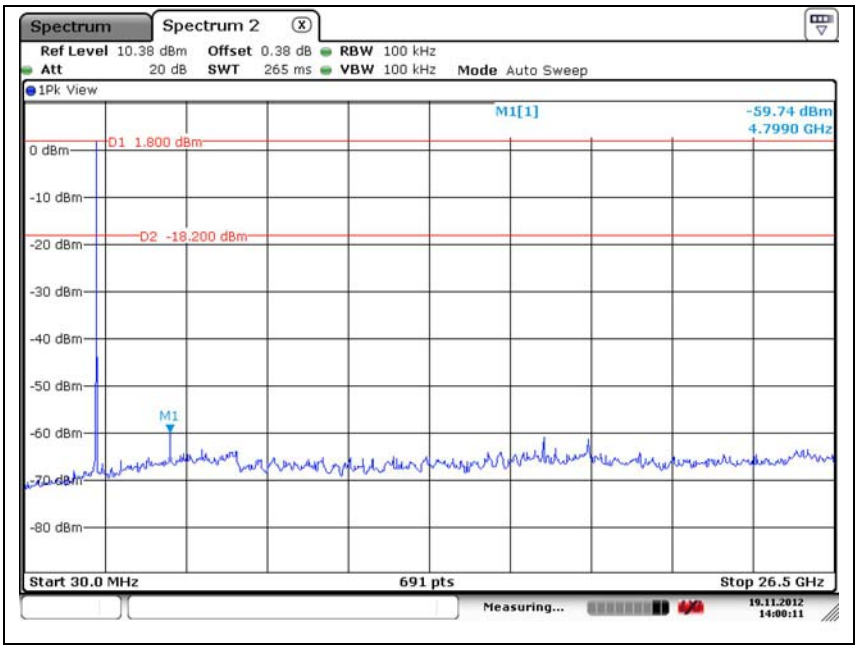
Test results

Low channel // GFSK





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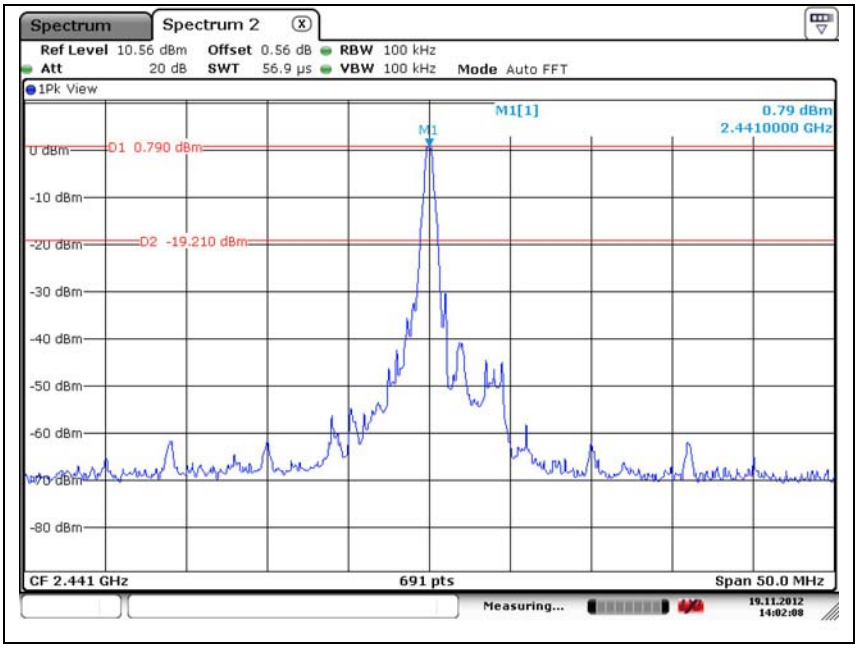
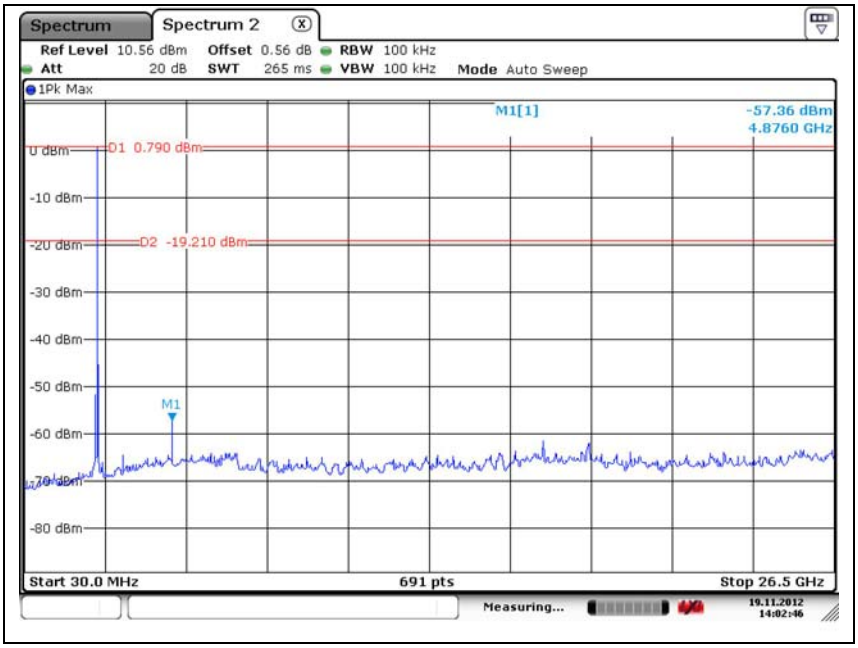
Middle channel // GFSK





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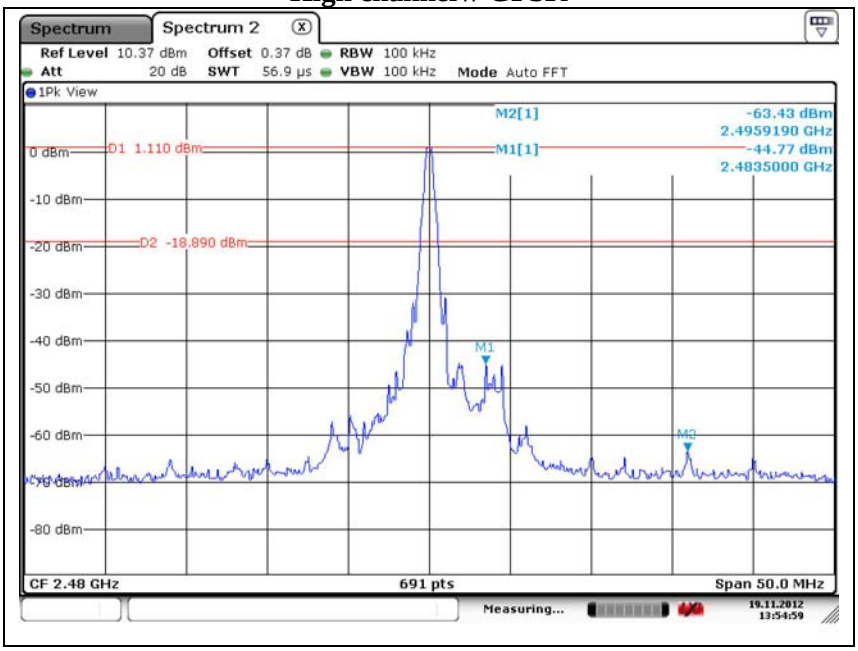
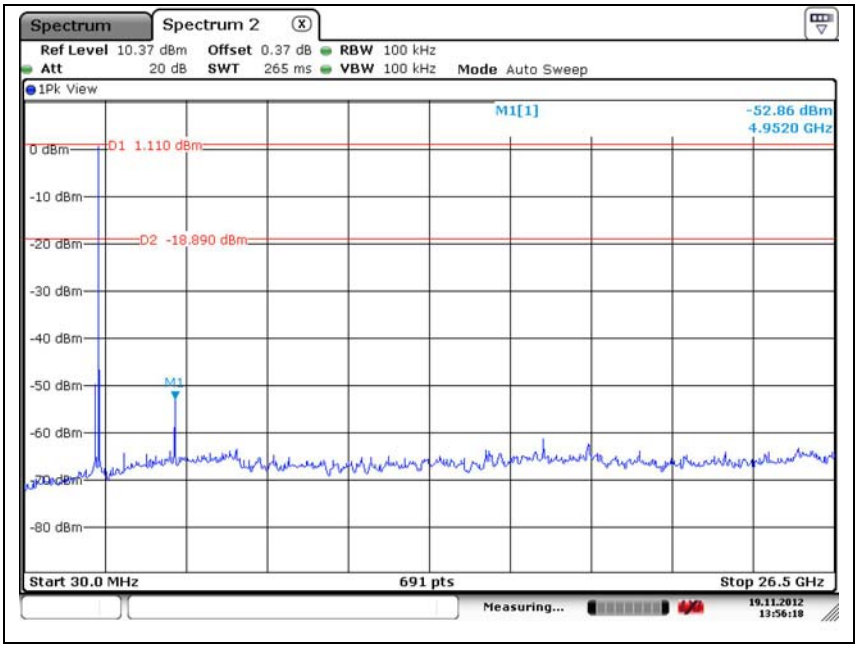
High channel // GFSK





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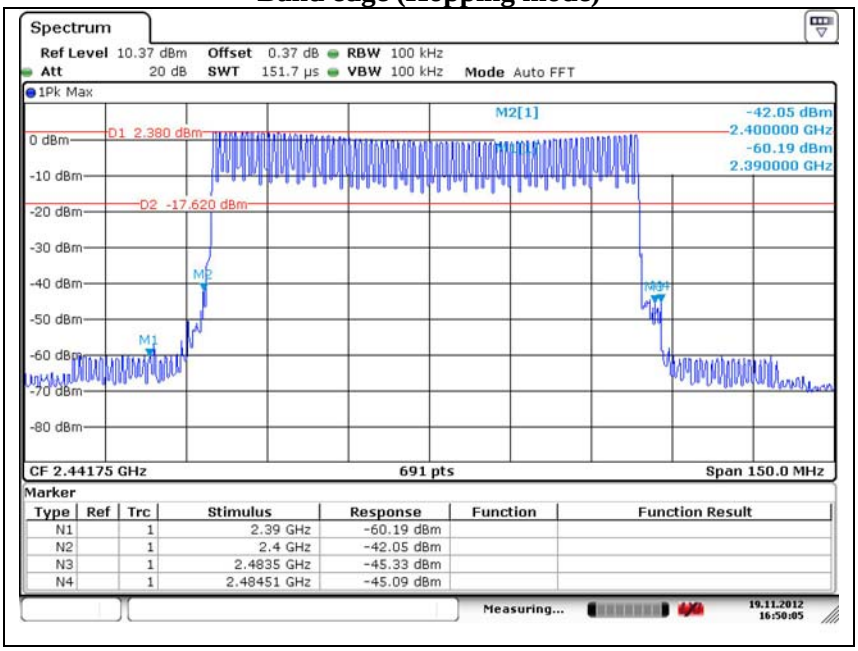
Band edge (Hopping mode)



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2.1.3 Radiated spurious emission & band edge

Test location
Testing was performed at a test distance of 3 meter Open Area Test Site

Test procedures
[9 ㎑ to 30 ㎒]
The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading. The test-receiver system was set to Quasi-peak function and specified bandwidth with maximum hold mode.

The spectrum analyzer is set to:
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer 200 ㎐ for Quasi-peak detection (QP) at frequency below 9 ㎑~ 150 ㎑.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer 9 ㎑ for Quasi-peak detection (QP) at frequency below 150 ㎑~ 30 ㎒.

[30 ㎒ to 1 ㎓ and 1 ㎓ to 24 ㎓]
The height of the measuring antenna was varied between 1 to 4 m and the table was rotated a full revolution in order to obtain maximum values of the electric field intensity.
The measurement was made in both the vertical and horizontal polarization, and the maximum value is presented in the report.

The spectrum analyzer is set to:
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer 120 ㎑ for Peak detection (PK) or Quasi-peak detection (QP) at frequency below 1 ㎓.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 ㎒ for Peak detection at frequency above 1 ㎓.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 ㎒ and the video bandwidth is 10 ㎐ for Average detection (AV) at frequency above 1 ㎓.

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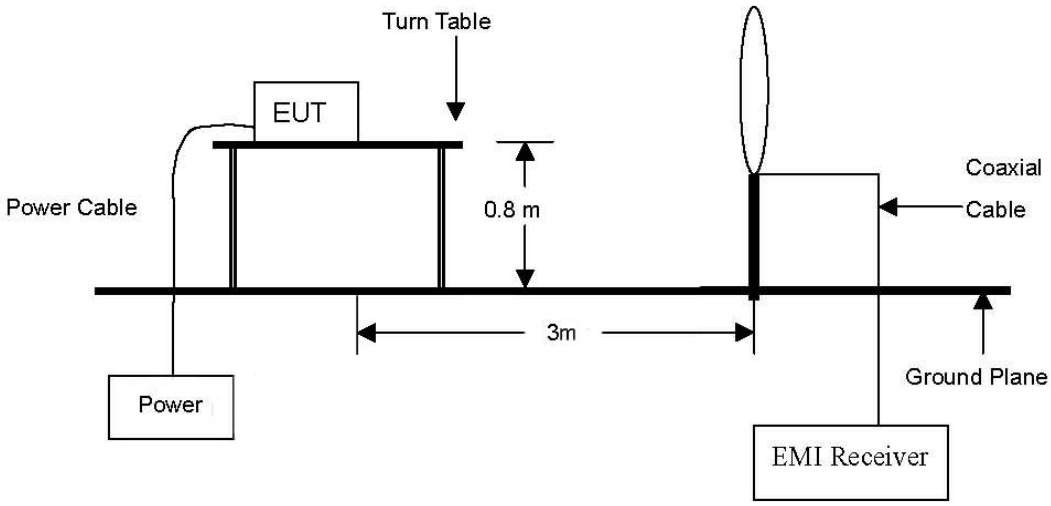
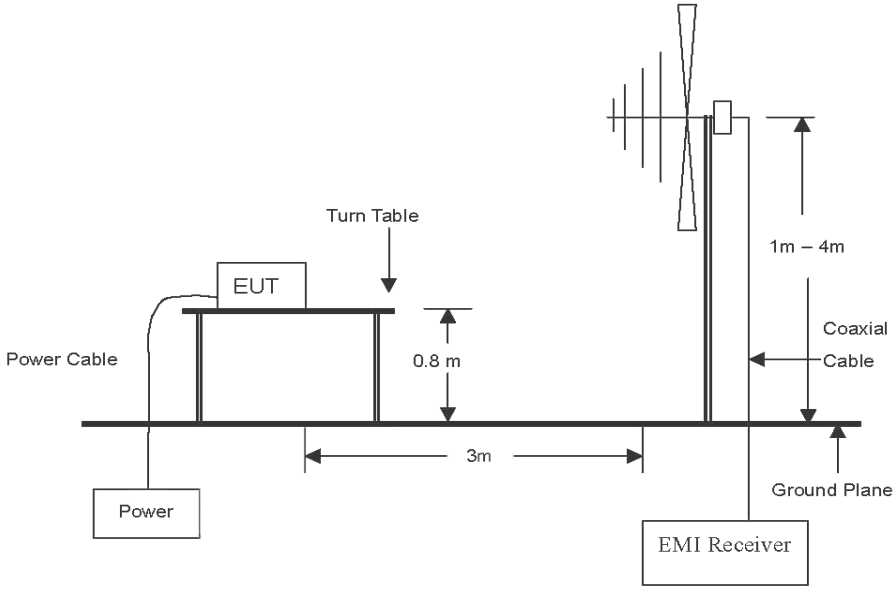
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.



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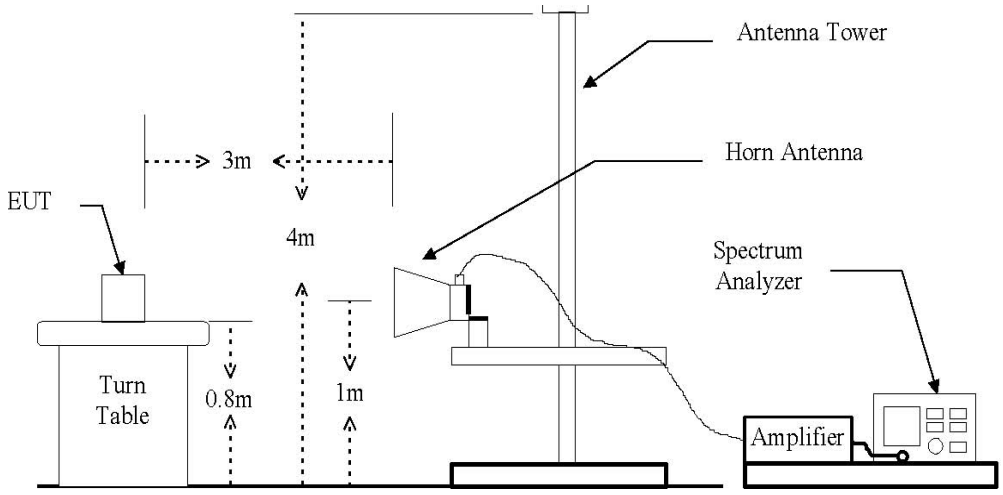
The diagram below shows the test setup that is utilized to make the measurements for emission from 1 ㎓ to 24 ㎓ emissions.



Limit

According to 15.209(a), for an intentional radiator devices, the general required of field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values：

Frequency (㎒)	Distance (Meters)	Radiated (㎶/m)
0.009 ~ 0.490	300	2400 / F(㎑)
0.490 ~ 1.705	30	24000 / F(㎑)
1.705 ~ 30.0	30	30
30 ~ 88	3	100**
88 ~ 216	3	150**
216 ~ 960	3	200**
Above 960	3	500

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 ~ 72 ㎒, 76 ~ 88 ㎒, 174 ~ 216 ㎒ or 470 ~ 806 ㎒. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

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Test results (Below 30 ㎒) – Worst case configuration: GFSK

The frequency spectrum from 9 ㎑ to 30 ㎒ was investigated. Emission levels are not reported much lower than the limits by over 20 ㏈.

Radiated emissions		Ant.	Correction factors			Total	Limit	
Frequency (㎒)	Reading (㏈㎶)	Pol.	Ant. factor (㏈/m)	Cable loss (㏈)	F_d (㏈)	Actual (㏈㎶/m)	Limit (㏈㎶/m)	Margin (㏈)
Below 30	Not detected							

※ Remark

1. All spurious emission at channels are almost the same below 30 ㎒, so that high channel was chosen at representative in final test.
2. Actual = Reading + Ant. factor + Cable loss + F_d
3. $F_d = 40\log(D_m / D_s)$
   Where:
   F_d = Distance factor in ㏈
   D_m = Measurement distance in meters
   D_s = Specification distance in meters

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Test results (Below 1 000 ㎒) – Worst case configuration: GFSK

The frequency spectrum from 30 ㎒ to 1 000 ㎒ was investigated. Emission levels are not reported much lower than the limits by over 20 ㏈.

Radiated emissions		Ant.	Correction factors		Total	Limit	
Frequency (㎒)	Reading (㏈㎶)	Pol.	Ant. factor (㏈/m)	Cable loss (㏈)	Actual (㏈㎶/m)	Limit (㏈㎶/m)	Margin (㏈)
42.1	21.16	V	13.37	1.25	35.78	40.00	4.22
144.0	18.80	H	12.81	2.31	33.92	43.50	9.58
144.0	20.75	V	12.81	2.31	35.87	43.50	7.63
177.9	15.91	H	11.82	2.58	30.31	43.50	13.19
221.6	17.50	H	10.69	3.05	31.24	46.00	14.76
221.6	27.51	V	10.69	3.05	41.25	46.00	4.75
238.6	24.91	V	11.28	3.19	39.38	46.00	6.62
267.7	20.56	V	12.27	3.40	36.23	46.00	9.77
338.0	23.16	H	14.22	3.86	41.24	46.00	4.76
364.7	18.28	H	14.82	4.02	37.12	46.00	8.88
391.3	18.96	H	15.41	4.17	38.54	46.00	7.46
532.0	18.18	V	18.37	4.99	41.54	46.00	4.46

※ Remark

1. All spurious emission at channels are almost the same below 1 ㎓, so that middle channel was chosen at representative in final test.
2. Actual = Reading + Ant. factor + Amp + CL (Cable loss)
3. Detector mode: Quasi peak
4. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.

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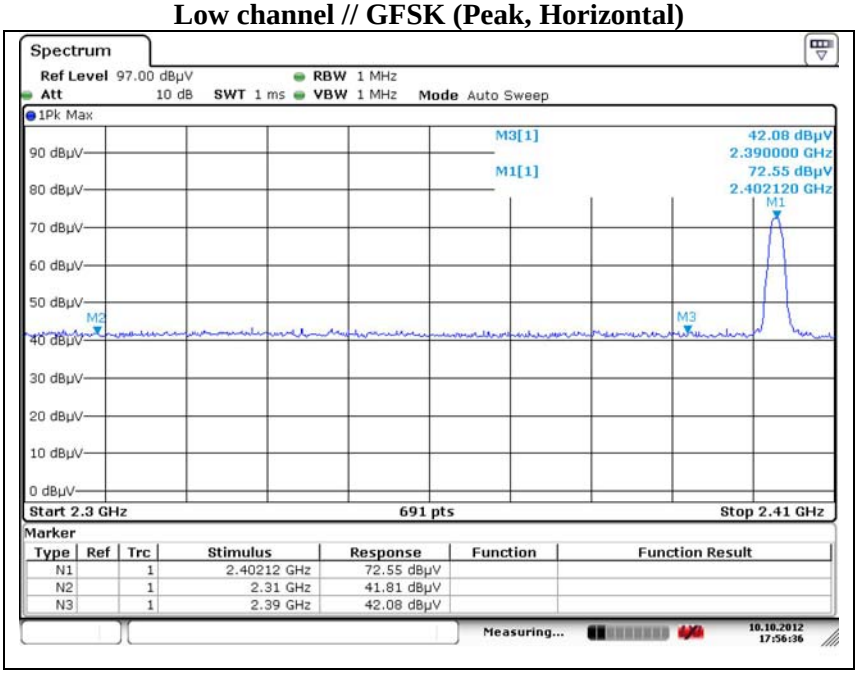
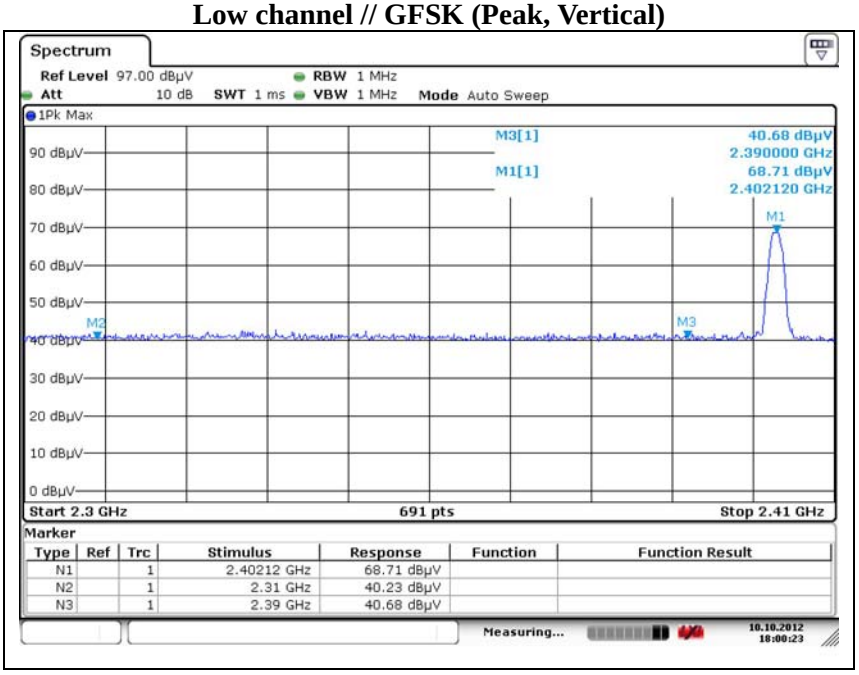
Test results (Above 1 000 ㎒)

Low channel // GFSK (Peak, Horizontal)



Low channel // GFSK (Peak, Vertical)



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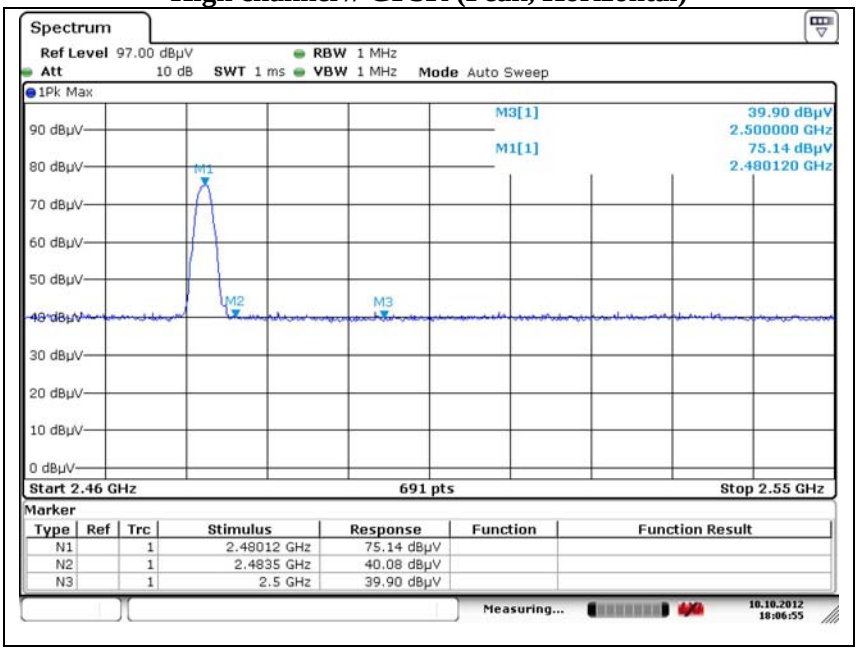
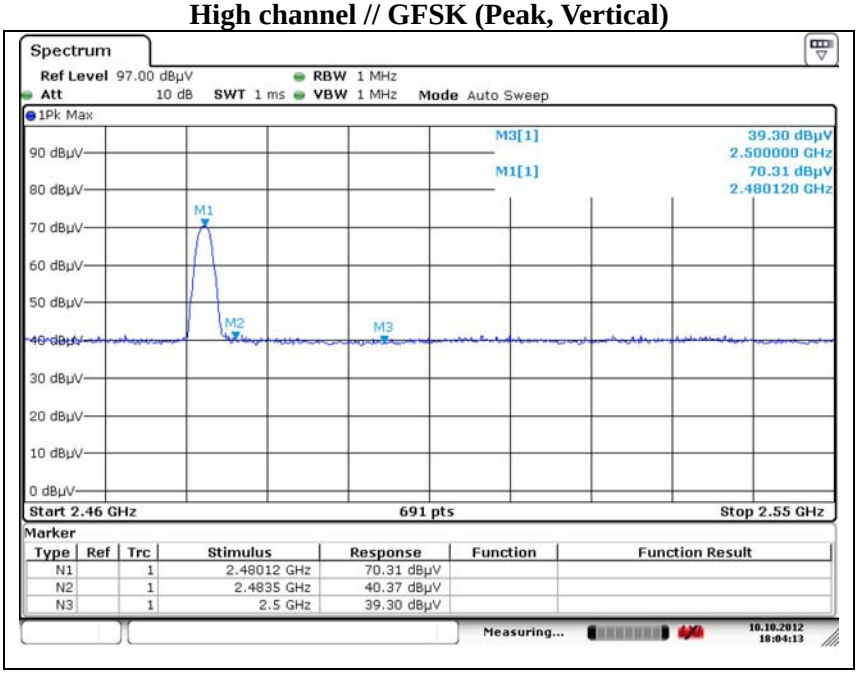
High channel // GFSK (Peak, Horizontal)



High channel // GFSK (Peak, Vertical)



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The frequency spectrum from 2.5 ㎓ to 25 ㎓ was investigated. No Emissions were found above 20 dB below the limit.

Low channel

Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2 390.0	42.08	Peak	H	28.31	-38.88	31.48	74.00	42.52
2 390.0	40.68	Peak	V	28.31	-38.88	30.11	74.00	43.89

Middle channel

Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
Above 1 000	Not detected	-	-	-	-	-	74.00	-

High channel

Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2 483.5	40.08	Peak	H	28.50	-38.73	29.85	74.00	44.15
2 483.5	40.37	Peak	V	28.50	-38.73	30.14	74.00	43.86

※ Remark

1. Measuring frequencies from 1 ㎓ to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1 000 ㎒ were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit.
4. Actual = Reading + Ant. factor + Amp + CL (Cable loss)
5. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.

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2.1.4 AC conducted emissions

Frequency range of measurement
150 ㎑ to 30 ㎒

Instrument settings
IF Band Width: 9 ㎑

Test procedures
The EUT was placed on a non-metallic table 0.8m above the metallic, grounded floor and 0.4m from the reference ground plane wall. The distance to other metallic surfaces was at least 0.8m. Amplitude measurements were performed with a quasi-peak detector and an average detector.

Limit
According to 15.207(a), for an intentional radiator 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 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50uH/50 ohm line impedance stabilization network (LISN). Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequencies ranges.

Frequency of Emission (㎒)	Conducted limit (dB㎶/m)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

※ Remark
Decreases with the logarithm of the frequency.

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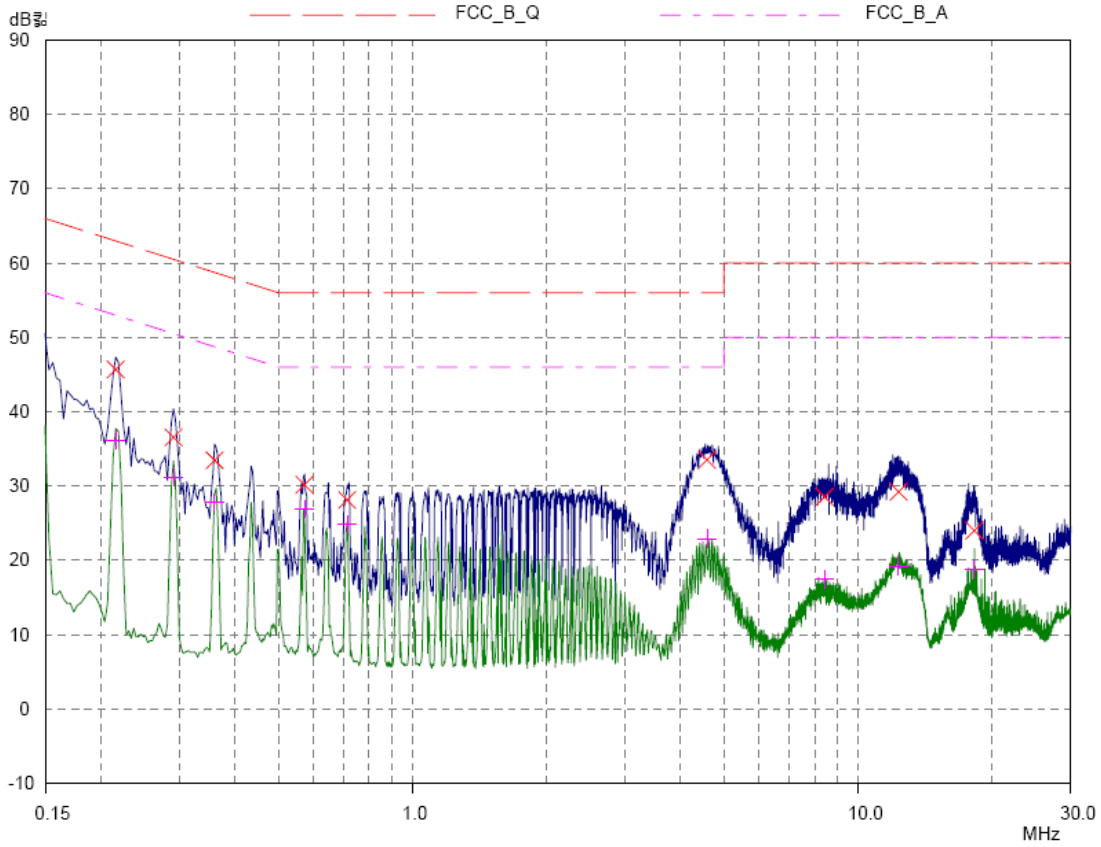
Test results



Final Measurement Results

Frequency MHz	QP Level dBµV	QP Limit dBµV	QP Delta dB
0.216	45.68	62.97	17.29
0.291	36.52	60.50	23.98
0.36	33.45	58.73	25.28
0.573	30.16	56.00	25.84
0.714	28.12	56.00	27.88
4.584	33.50	56.00	22.50
8.409	28.53	60.00	31.47
12.324	29.22	60.00	30.78
18.246	23.98	60.00	36.02

Frequency MHz	AV Level dBµV	AV Limit dBµV	AV Delta dB
0.216	36.19	52.97	16.78
0.291	31.19	50.50	19.31
0.36	27.81	48.73	20.92
0.573	26.91	46.00	19.09
0.714	24.84	46.00	21.16
4.584	22.91	46.00	23.09
8.409	17.40	50.00	32.60
12.324	19.22	50.00	30.78
18.246	18.74	50.00	31.26

Note;
Both Cable loss and LISN factor are included in measurement level(QP Level or AV Level).

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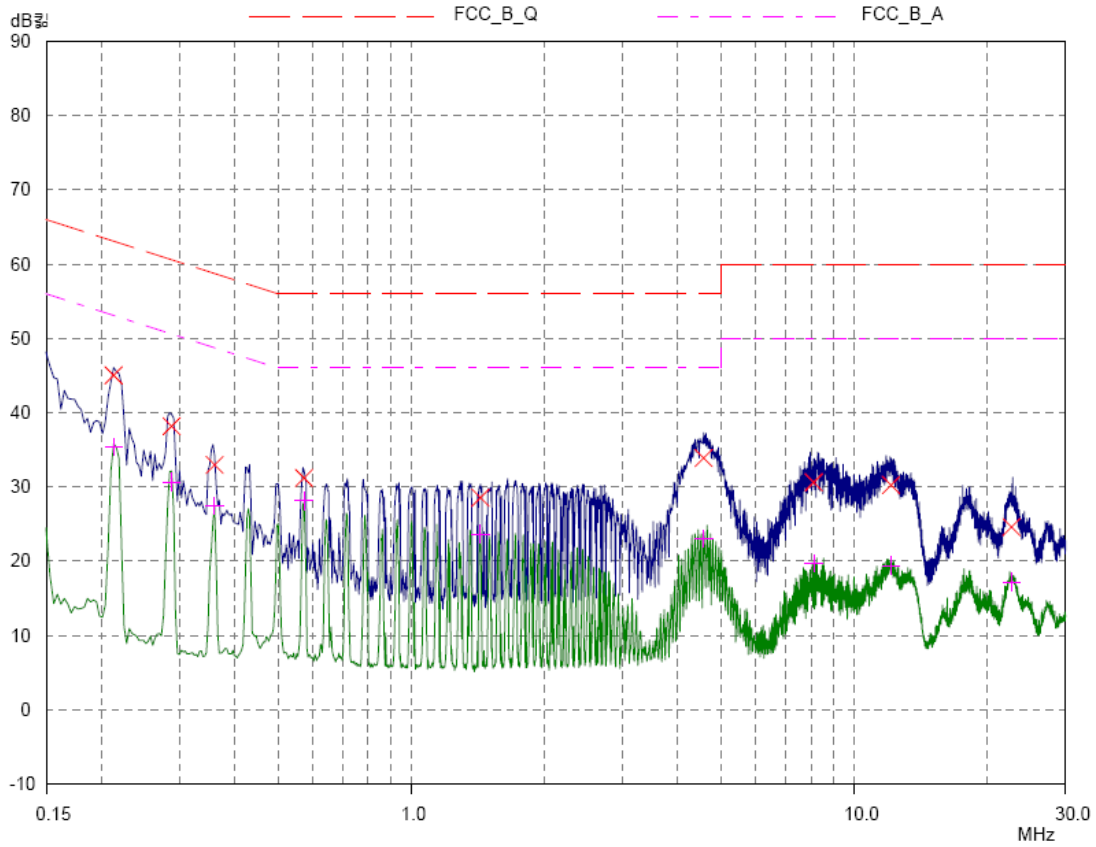

Final Measurement Results

Frequency MHz	QP Level dBμV	QP Limit dBμV	QP Delta dB
0.213	45.02	63.09	18.07
0.288	38.15	60.58	22.43
0.36	32.94	58.73	25.79
0.573	31.19	56.00	24.81
1.434	28.54	56.00	27.46
4.575	33.88	56.00	22.12
8.103	30.60	60.00	29.40
12.108	30.24	60.00	29.76
22.656	24.56	60.00	35.44

Frequency MHz	AV Level dBμV	AV Limit dBμV	AV Delta dB
0.213	35.41	53.09	17.68
0.288	30.64	50.58	19.94
0.36	27.48	48.73	21.25
0.573	28.13	46.00	17.87
1.434	23.64	46.00	22.36
4.575	23.06	46.00	22.94
8.103	19.74	50.00	30.26
12.108	19.40	50.00	30.60
22.656	17.20	50.00	32.80

Note;
Both Cable loss and LISN factor are included in measurement level(QP Level or AV Level).

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Appendix A. Test equipment used for test

Equipment	Manufacturer	Model	Calibration due.
Spectrum Analyzer	R&S	FSV30	2013.01.10
8360B Series Swept Signal Generator	HP	83630B	2013.06.06
Attenuator	HP	8495B	2013.05.04
Attenuator	HP	8494B	2013.05.04
AC POWER SOURCE ANALYZER	HP	6813A	2013.07.06
Loop Antenna	R&S	HFH2-Z2.335.4711.52	2013.03.10
Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	2013.10.25
Horn Antenna	A.H. System	SAS-571	2013.03.22
Horn Antenna	A.H. System	SAS-572	2013.09.07
High Pass Filter	Wainwright Instrument	WHJS3000-10TT	2013.01.10
Preamplifier	A.H. System	PAM-0118	2013.05.04
Power Amplifier	MITEQ	AFS43-01002600	2013.10.07
EMC Analyzer	Agilent	E7405A	2013.05.04
EMI TEST Receiver	R & S	ESHS10	2013.05.04
LISN	R & S	ENV216	2013.02.27
LISN	EMCO	3810/2	2013.04.18

Peripheral devices

Device	Manufacturer	Model No.	Serial No.
Notebook	Samsung electronics	NT-R410Y	Z9YJ93CS300631H

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Appendix B. Test setup photo

Radiated field emissions

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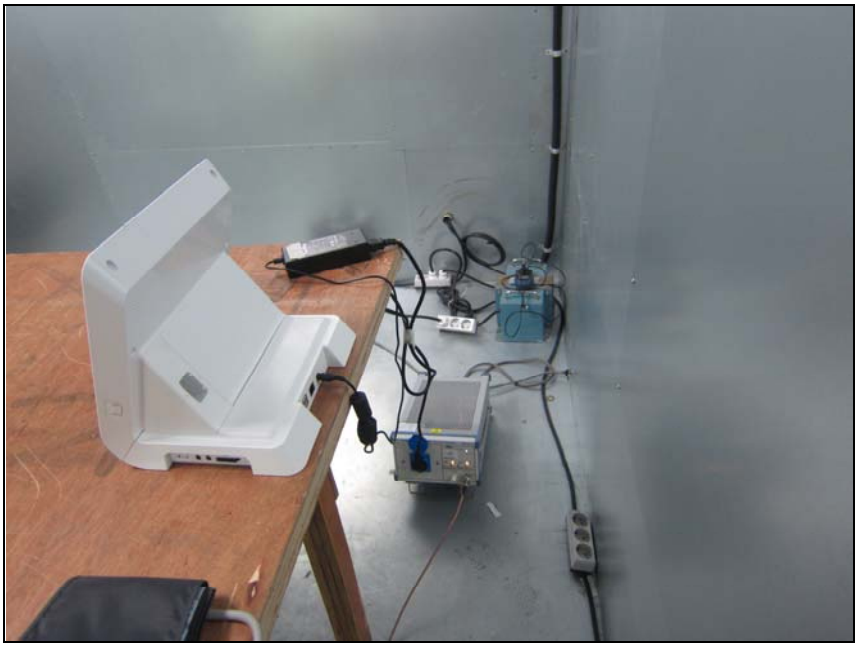
AC conducted emission



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