Electromagnetic Emission

F C C M E A S U R E M E N T R E P O R T

CERTIFICATION OF COMPLIANCE

FCC Part 15 Certification Measurement

PRODUCT	:	THERMAL PRINTER
MODEL/Serial No.	:	PORTI-SM40 / Proto type
MULTIPLE MODEL	:	PORTI-SC40N, PORTI-S35N
FCC ID	:	QDDPORTI-SM40-ABC
APPLICANT	:	Woosim System Inc. #501, Daerung Technotown 3th, 448, Gasan-dong, Geumcheon-gu, Seoul, Korea
MANUFACTURER	:	Woosim System Inc. #501, Daerung Technotown 3th, 448, Gasan-dong, Geumcheon-gu, Seoul, Korea
FCC CLASSIFICATION	:	DSS: Part 15 Spread Spectrum Transmitter
TYPE OF MODULATION	:	FHSS (GFSK)
FREQUENCY CHANNEL	:	2 402 MHz to 2 480 MHz and Channel Spacing 1 MHz (79 Ch)
ANTENNA TYPE	:	Printed Monopole Antenna (Integral)
ANTENNA GAIN	:	-3.00 dBi max
RF POWER	:	5.15 mW
RULE PART(S)	:	FCC Part 15 Subpart C
FCC PROCEDURE	:	ANSI C63.4-2003
TEST REPORT No.	:	ETLE100105.04
DATES OF TEST	:	January 11, 2010 to January 13, 2010
REPORT ISSUE DATE	:	February 01, 2010
TEST LABORATORY	:	ETL Inc. (FCC Designation No. : KR0022)

The THERMAL PRINTER, Model PORTI-SM40 has been tested in accordance with the measurement procedures specified in ANSI C63.4-2003 at the ETL Test Laboratory and has been shown to be complied with the electromagnetic radiated emission limits specified in FCC Rule Part15 Subpart C section 15.247.
I attest to the accuracy of data. All measurement herein was performed by me or was made under my supervision and is correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.
The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Hyung Seok, Lee / Chief Engineer

ETL Inc.
#371-51, Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea
Tel: 82-2-858-0786 Fax: 82-2-858-0788

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FCC MEASUREMENT REPORT

Scope – *Measurement and determination of electromagnetic emission (EME) of radio frequency devices including intentional radiators and/or unintentional radiators for compliance with the technical rules and regulations of the U.S Federal Communications Commission(FCC)*

General Information

Applicant Name	**: Woosim System Inc.**
Address	**: #501, Daerung Technotown 3th, 448, Gasan-dong, Geumcheon-gu, Seoul, Korea**
Attention	**: Moo-Seung Lim / Assistant Manager**

- **EUT Type** : THERMAL PRINTER
- **Model Number** : PORTI-SM40
- **S/N** : Proto type
- **Freq. Range** : 2 402 MHz - 2 480 MHz
- **Number of Channels** : 79
- **Modulation Technique** : FHSS (GFSK)
- **Frequency Channel** : 2 402 MHz to 2 480 MHz and Channel Spacing 1 MHz (79 Ch)
- **Antenna Type** : Printed Monopole Antenna (Integral)
- **Antenna Gain** : -3.00 dBi max
- **RF Power** : 5.15 mW
- **FCC Rule Part(s)** : FCC Part 15 Subpart C
- **Test Procedure** : ANSI C63.4-2003
- **FCC Classification** : DSS: Part 15 Spread Spectrum Transmitter
- **Place of Tests** : ETL Inc. Testing Lab.
  Radiated Emission test;
  #499-1, Sagot-ri, Seosin-myeon, Hwaseong-si, Gyeonggi-do, 445-882, Korea

  Conducted Emission test;
  ETL Inc. Testing Lab.
  371-51, Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea

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1. INTRODUCTION

The measurement test for radiated and conducted emission test was conducted at the ETL Inc. The site is constructed in conformance with the requirements of the ANSI C63.4-2003 and CISPR Publication 16. The ETL has site descriptions on file with the FCC for 3 m and 10 m site configurations. Detailed description of test facility was found to be in compliance with FCC Rules according to the ANSI C63.4-2003 and registered to the Federal Communications Commission (FCC Designation Number : KR0022).

The measurement procedure described in American National Standard for Method of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2003) was used in determining radiated and conducted emissions from the Woosim System Inc. Model: PORTI-SM40

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2. PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the THERMAL PRINTER (model: PORTI-SM40).

The model PORTI-SM40 is basic that was tested.

The multi models PORTI-SC40N and PORTI-S35N are identical to basic model, except for model designation, Smart Card Module and MSR Module.

The model differences are same with below table;

Model name	Smart Card Module	MSR Module
PORTI-SM40 (Basic model)	O	O
PORTI-SC40N	X	O
PORTI-S35N	X	X

* O: Existence, X: Nonexistence

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2.2 General Specification

Item	Specifications
Print method	Direct thermal line printing
Characters per line	42cpl (MAX)
Character size	Eng. : 9×24dots, 12×24dots Kor. : 16×24dots, [24×24dots]
Optional Characters	Simplified/Traditional Chinese, Arabic, Cyrillic, Russian, Tukish, Greek, Japanese, Persian, Latin9 and Others upon request.
Resolution	203dpi, 8dots/mm
Print width	2-inch (48mm, 384dots)
Print speed	80mm / sec (MAX)
Dimension	80.5×113.5×46 mm
Weight	300g (Including battery & roll paper)
Interface	UART(RS-232C or TTL) / Bluetooth Ver 2.1 + EDR
Paper roll	Thermal roll paper (57mm wide, 40ø)
Barcodes	1-dimension : Code128, EAN 128, Code39, I2/5, Code93 UPC, EAN, KAN, JAN, CODABAR 2-dimension : PDF417, QR Code, DATA Matrix
Memory	MCU : 32bit RISC, FLASH : 4 Mbytes, RAM : 8 Mbytes
Receive buffer size	1M bytes
MSR	ISO 7810 / 7811 / 7812 1&2 or 2&3 Track Reading
Smart card reader	ISO 7816 Compliant (EMV level 1 Certified) / T=0, T=1 support / 2 SAM (Security Application Module)
LCD	128 × 32 Dots FSTN (Blue LED Backlight)
Battery	Rechargeable 7.4V DC/ 1,100mAh (Li-ion)
Battery duration	1 hour continuous printing
Battery charger	Input (100~250V AC, 50~60Hz) Output(8.4VDC/0.8A), 4hours full charge time

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Item	Specifications	
Environment conditions	Temperature	-20°C ~ 55°C (operating)
	Humidity	0% - 95% (operating)
MCBF(Mean Cycle Between Failure)	Mechanical	37,000,000 lines
	Head	Approximately 50 Km

Bluetooth

Category	Specification
Bluetooth Spec.	Bluetooth V2.1 / Class2 (10m)
Frequency Range	2.4GHz ISM BAND
Data Transmission Rate	57600bps Fixed.
Data bit	8 Data bit Fixed.
Parity bit	No parity Fixed.
Stop bit	1 Stop bit Fixed.
Output	Below 3mW/MHZ
Modulation type/rash way	GFSK SYSTEM / PLL

Frequency Channel Table (Bluetooth)

CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz
1	2402	11	2412	21	2422	31	2432	41	2442	51	2452	61	2462	71	2472
2	2403	12	2413	22	2423	32	2433	42	2443	52	2453	62	2463	72	2473
3	2404	13	2414	23	2424	33	2434	43	2444	53	2454	63	2464	73	2474
4	2405	14	2415	24	2425	34	2435	44	2445	54	2455	64	2465	74	2475
5	2406	15	2416	25	2426	35	2436	45	2446	55	2456	65	2466	75	2476
6	2407	16	2417	26	2427	36	2437	46	2447	56	2457	66	2467	76	2477
7	2408	17	2418	27	2428	37	2438	47	2448	57	2458	67	2468	77	2478
8	2409	18	2419	28	2429	38	2439	48	2449	58	2459	68	2469	78	2479
9	2410	19	2420	29	2430	39	2440	49	2450	59	2460	69	2470	79	2480
10	2411	20	2421	30	2431	40	2441	50	2451	60	2461	70	2471		

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3. DESCRIPTION OF TESTS

The tests documented in this report were performed in accordance with ANSI C63.4-2003 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, 15.207, 15.209 and 15.247.

3.1 Radiated Emission Measurement

Radiated emission measurements were made in accordance with § 13 in ANSI C63.4-2003 "Measurement of Intentional radiators" The measurements were performed over the frequency range of 30 MHz to 40 GHz using antenna as the input transducer to a Spectrum analyzer or a Field Intensity Meter. The measurements were made with the detector set for "Peak, Quasi-peak, Average" within a bandwidth of 120 kHz and above 1GHz is 1 MHz.

Preliminary measurements were made at 3 m using broadband antennas, and spectrum analyzer to determine the frequency producing the maximum emission in shielded room. Appropriate precaution was taken to ensure that all emission from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth and height with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30 MHz to 1000 MHz using Log-Bicon antenna. Above 1 GHz, linearly polarized double ridge horn antennas were used. Final measurements were made open site at 3 m. The test equipment was laced on a wooden turn-table. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. Each frequency found during pre-scan measurements was re-examined by manual. The detector function was set to CISPR Quasi-peak mode and the bandwidth of the receiver was set to 120 kHz or 1 MHz depending on the frequency of type of signal. The EUT, support equipment and interconnecting cables were re-configured to the set-up producing the maximum emission for the frequency and were placed on top of a 0,8 m high nonmetallic 1m x 1.5 m table. The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each emission. The turntable containing the system was rotated; the antenna height was varied 1 m to 4 m and stopped at the azimuth or height producing the maximum emission.

Varying the mode of operating frequencies of the EUT maximized each emission. The system was tested in all the three orthogonal planes and changing the polarity of the antenna. The worst-case emissions are recorded in the data tables. If necessary, the radiated emission measurement could be performed at a closer distance to ensure higher accuracy and the results were extrapolated to the specified distance using an inverse linear distance extrapolation factor (20 dB/decade) as per section 15.31(f).

Photographs of the worst-case emission can be seen in Photographs of the worst-case emission test setup can be seen in Appendix B.

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3.2 Conducted Emission Measurement

Conducted emissions measurements were made in accordance with section § 13 in ANSI C63.4-2003 "measurement of intentional radiators" The measurements were performed over the frequency range of 0.15 MHz to 30 MHz using a 50 Ω / 50 uH LISN as the input transducer to a Spectrum Analyzer or a Test Receiver. The measurements were made with the detector set for "Peak" amplitude within a bandwidth of 9 kHz or for "quasi-peak" within a bandwidth of 9 kHz.

The line-conducted emission test is conducted inside a shielded anechoic chamber room with 1 m x 1.5 m x 0.8 m wooden table which is placed 0,4 m away from the vertical wall and 1,5 m away from the side wall of the chamber room. Two LISN are bonded to the shielded room. The EUT is powered from the LISN and the support equipment is powered from the other LISN. Power to the LISNs are filtered by a noise cut power line filters. All electrical cables are shielded by braided tinned steel tubing with inner ϕ 1.2 cm. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and these supply lines will be connected to the LISN. Non-inductive bundling to a 1 m length shortened all interconnecting cables more than 1 m. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the EMI Test Receiver to determine the frequency producing the maximum emission from the EUT. The frequency producing the maximum level was reexamined using to set Quasi-Peak mode by manual, after scanned by automatic Peak mode from 0.15 MHz to 30 MHz. The bandwidth of the spectrum analyzer was set to 9 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission.

Photographs of the worst-case emission can be seen in Photographs of the worst-case emission test setup can be seen in Appendix B.

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3.3 FCC Part 15.205 Restricted Bands of Operations

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

[1]Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2] Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

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4. TEST CONDITION

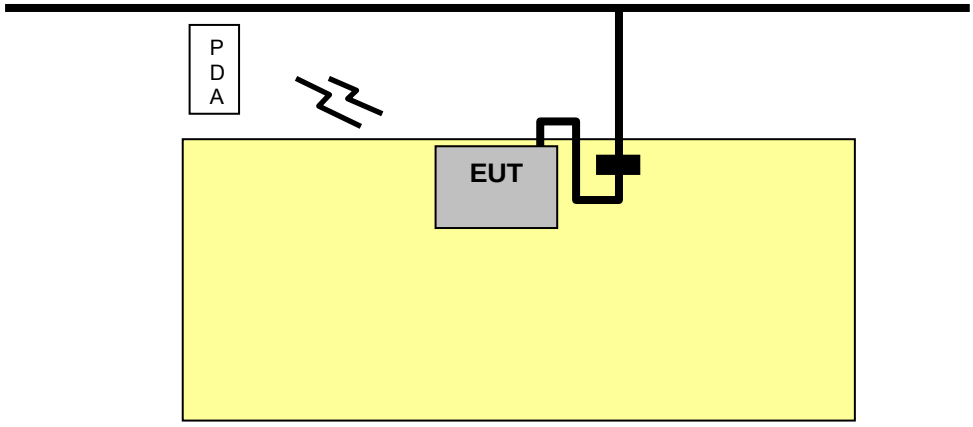
4.1 Test Configuration

The device was configured for testing in a typical fashion (as a customer would normally use it). During the tests, the following conditions and configurations were used.

4.2 Description of Test modes

THERMAL PRINTER that has the control software.

4.3 The setup drawing(s)



: Signal line

: Power line

: Adapter

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5. TEST RESULTS

5.1 Summary of Test Results

The measurement results were obtained with the EUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum emission of the EUT are reported.

47 CFR Part 15, Subpart C	Measurement Required	Result
15.247(a)(1)	Channel Bandwidth, Frequency Separation	**Pass**
15.247(b)(3)	Maximum Peak Output Power	**Pass**
15.247(d)	Bandwidth of Frequency Band Edges	**Pass**
15.247(a)(1)(iii)	Number of Hopping Channels	**Pass**
15.247(a)	Time of Occupancy(Dwell time)	**Pass**
15. 209(a)	Spurious Emissions	**Pass**
15. 207	Conducted Emissions	**Pass**
15.247(i) 1.1307(b)(1)	RF Exposure	**Pass**

The data collected shows that the **Woosim System Inc. / THERMAL PRINTER / PORTI-SM40** complied with technical requirements of above rules part 15.207, 209 and 15.247 Limits.

The equipment is not modified anything, mechanical or circuits to improve EMI status during a measurement. No EMI suppression device(s) was added and/or modified during testing.

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5.2 Channel Bandwidth and Frequency Separation

EUT	THERMAL PRINTER
Model	PORTI-SM40
Limit apply to	FCC Part 15.247(a)(1)
Test Date	January 11, 2010
Operating Condition	RF transmitting continuously during the tested.
Result	Pass

5.2.1 Channel Bandwidth

BT mode

Frequency [MHz]	20 dB Bandwidth [MHz]	Limit
2 402	0.932	< Carrier frequency separation
2 441	0.932	
2 480	0.932	

NOTES:

1. **Measure frequency separation of relevant channel using spectrum analyzer.**
2. **Please see the measured plot in next page.**

5.2.2 Frequency Separation

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

BT mode

EUT Channel Separation [MHz]	20 dB bandwidth [MHz]	Limit
1.000 (Worst)	0.932 (Worst)	> 25 kHz

NOTES:

1. **Measure frequency separation of relevant channel using spectrum analyzer.**
2. **Please see the measured plot in next page.**

Test Engineer: Hoon Pyo, Lee

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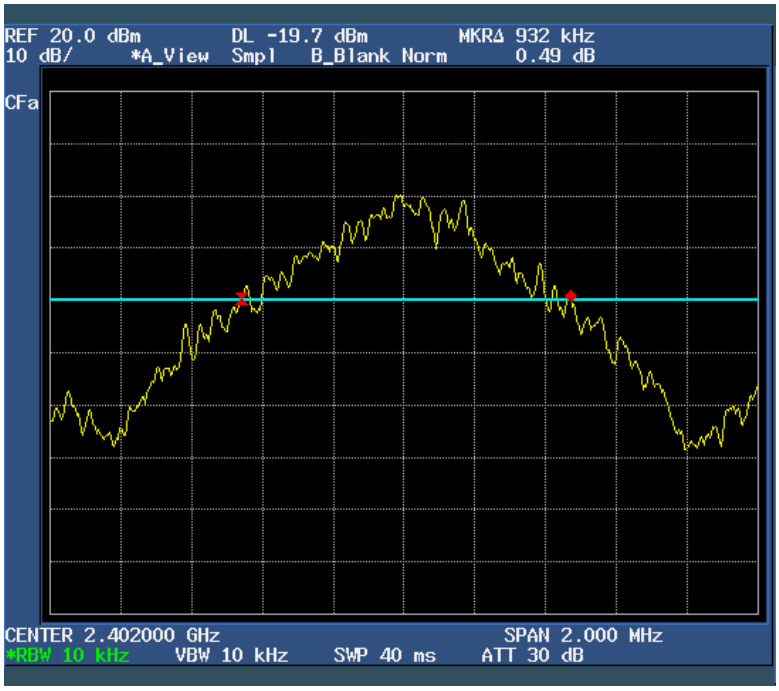
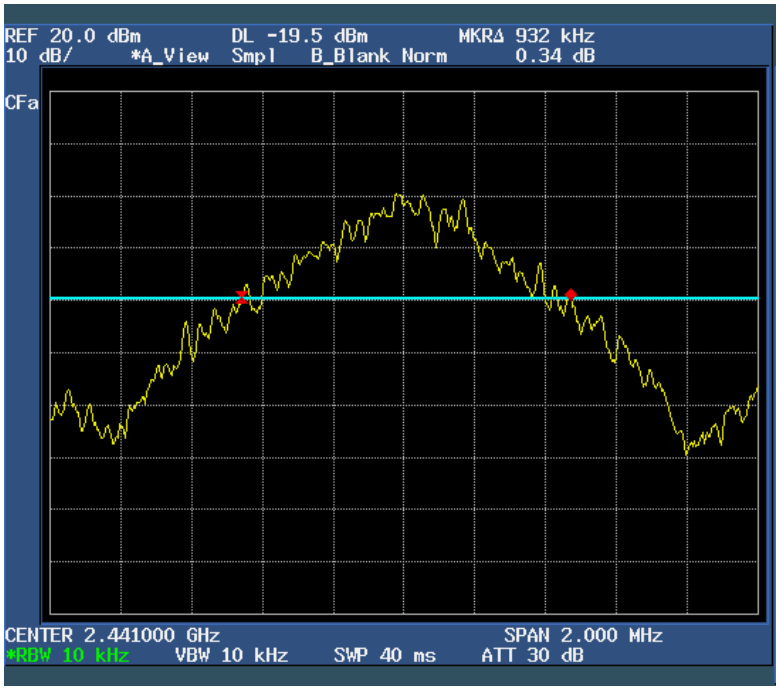
Plots of 20 dB Bandwidth

[2 402 MHz]



[2 441 MHz]



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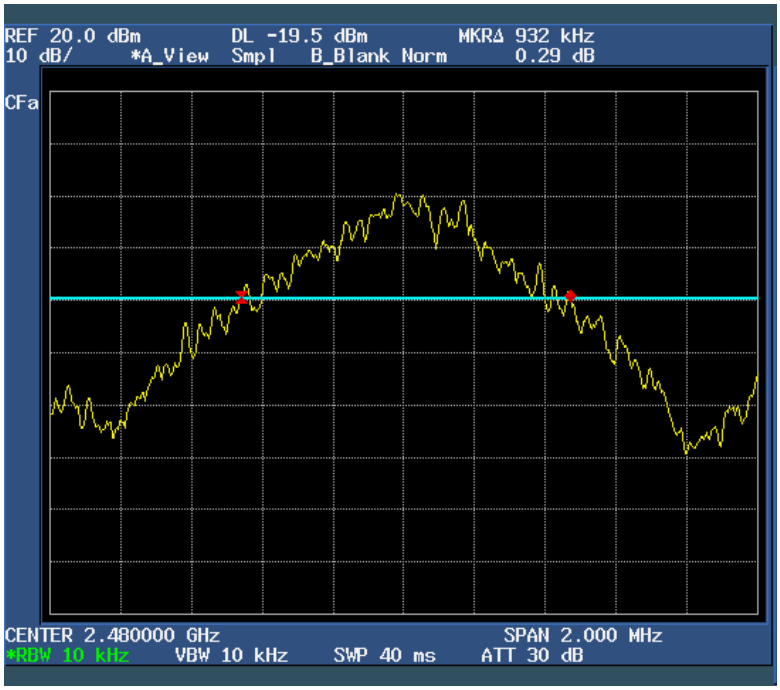
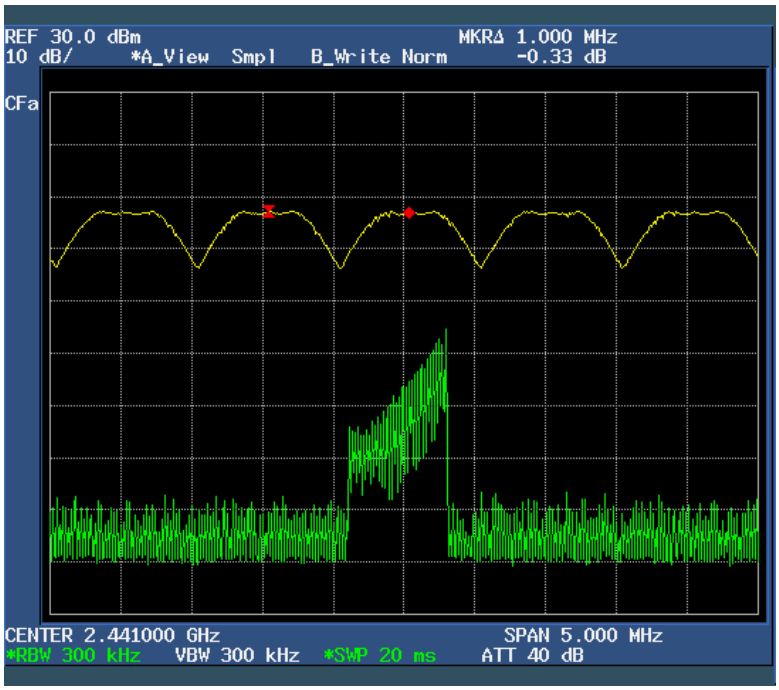
[2 480 MHz]



Frequency Separation

[Channel Separation]



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5.3 Maximum peak conducted output power

EUT	THERMAL PRINTER
Model	PORTI-SM40
Limit apply to	FCC Part 15.247(b)(3)
Test Date	January 11, 2010
Operating Condition	RF transmitting continuously during the tested.
Result	Passed

Limit

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

For frequency hopping systems operating in the 2 400.0 MHz - 2 483.5 MHz band employing at least 75 non-overlapping hopping channels: 1 watt

Test Data

Channel	Frequency [MHz]	Output Power [dBm]	Limit
Low	2 402	6.91	< 30 dBm(1W)
Mid	2 441	7.10	
High	2 480	7.12	

Maximum measured transmitter power (for RF Exposure):

Output Power		Max Antenna Gain [dBi]	EIRP [mW]
[dBm]	[mW]		
7.12	5.15	-3.00	2.58

- Theory value for RF Exposure
  $P_{e.i.r.p.}(mW) = A_{cond}\ (dBm) + G_{assembly\ antenna\ gain}\ (dBi)$

NOTES:

1. **Measure conducted Channel power of relevant channel using Spectrum analyzer**
2. **RBW 1 MHz, VBW 1 MHz**
3. **Please see the measured plot in next page.**

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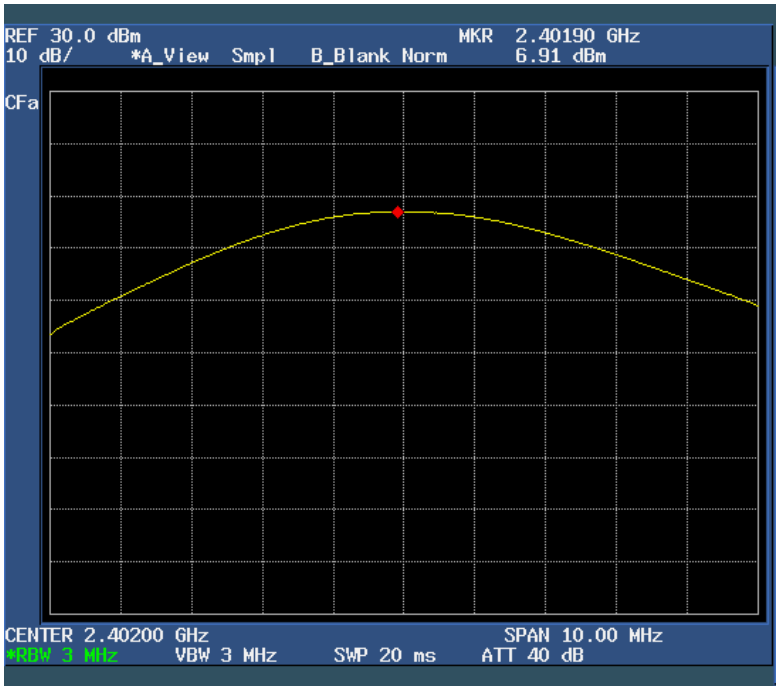
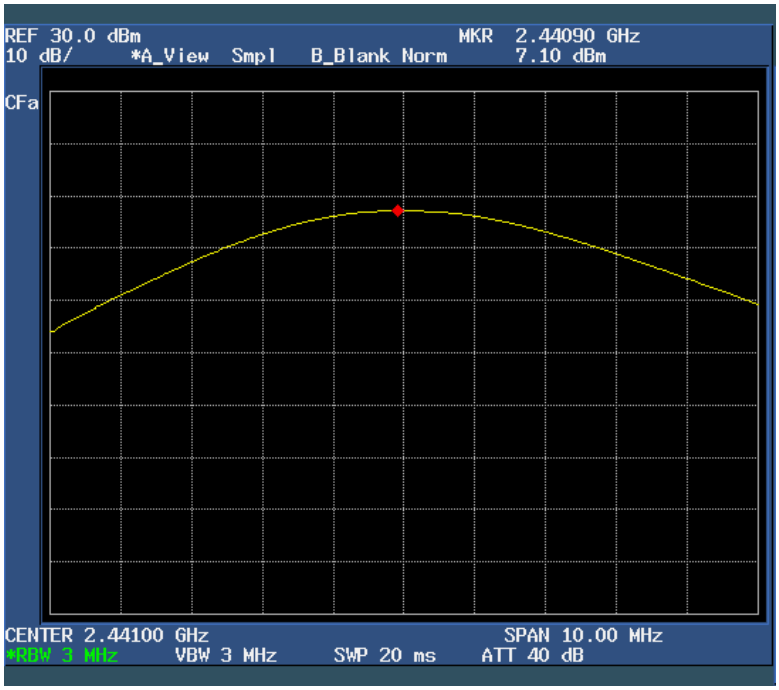
Plots of Maximum Peak Output Power

[2 402 MHz]



[2 441 MHz]



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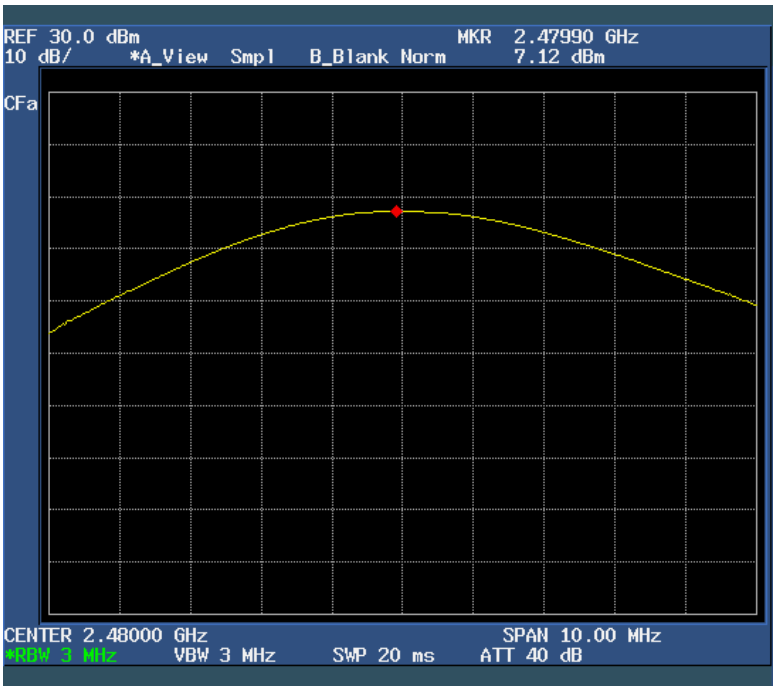
[2 480 MHz]



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5.4 Bandwidth of Frequency Band Edges

EUT	THERMAL PRINTER
Model	PORTI-SM40
Limit apply to	FCC Part 15.247(d)
Test Date	January 11, 2010 to January 12, 2010
Operating Condition	RF transmitting continuously during the tested.
Result	Passed

Limit

In any 100 kHz 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 dB below that in the 100 kHz 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 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Test Results

- Refer to see the measured plot in next page.

NOTES:

1. **The test was performed to make a direct field strength measurement at the band edge frequencies.**

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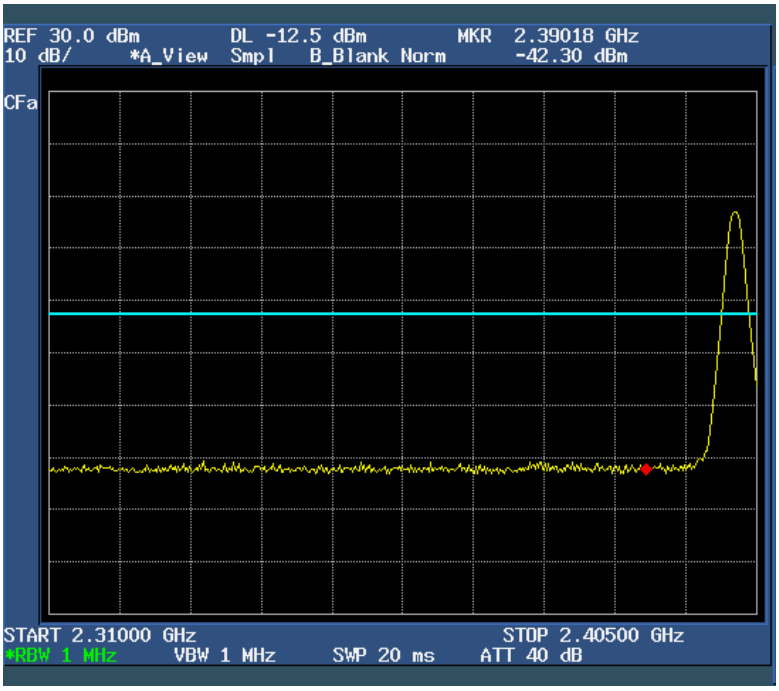
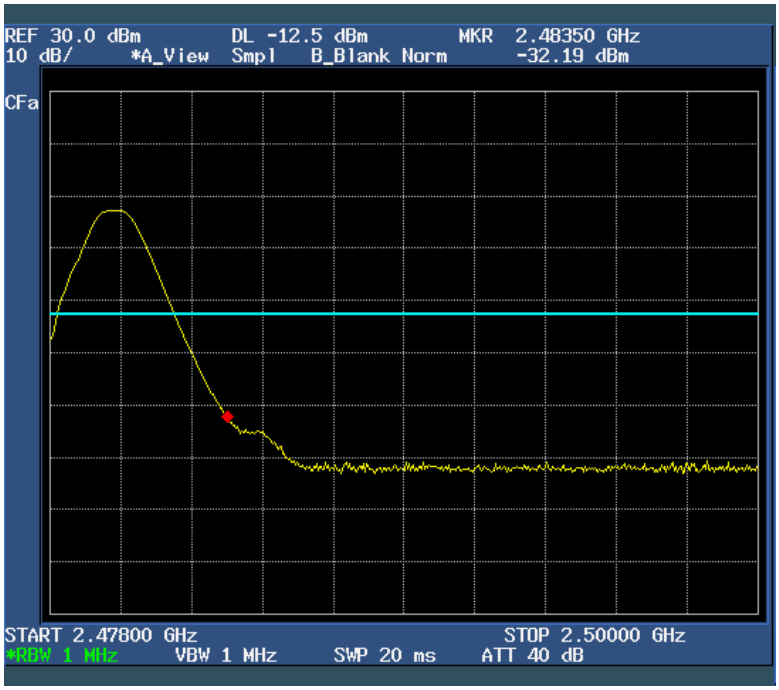
Bandwidth of Frequency Band Edges

Conducted





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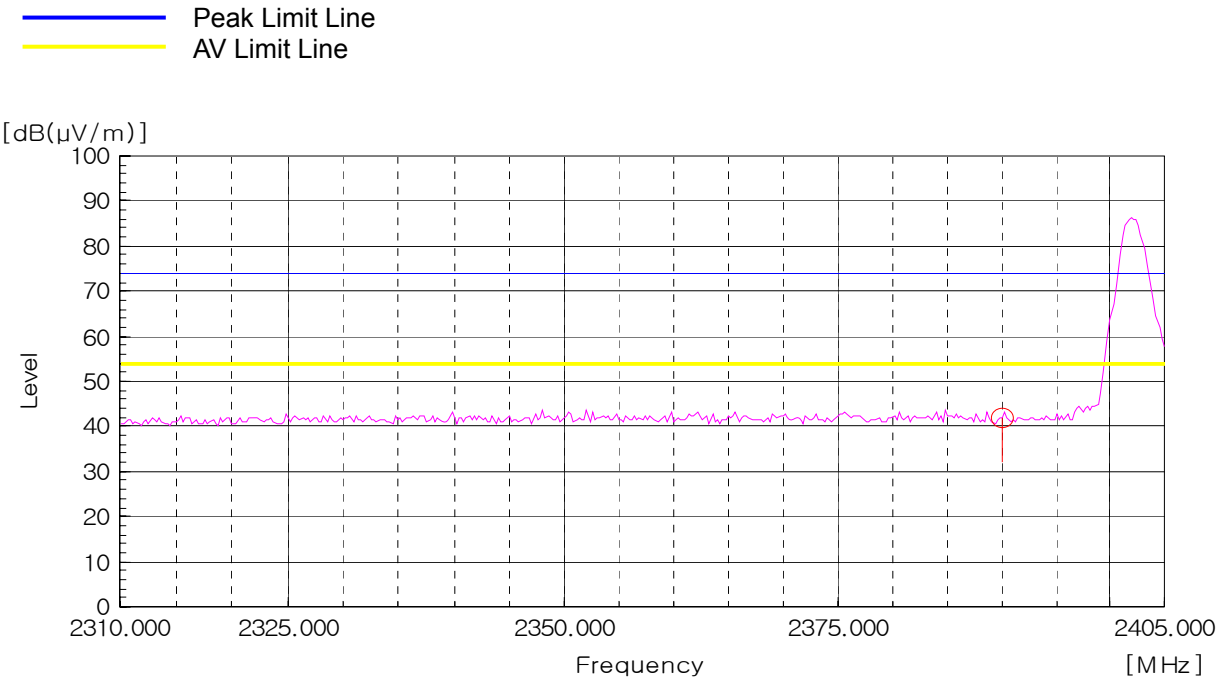
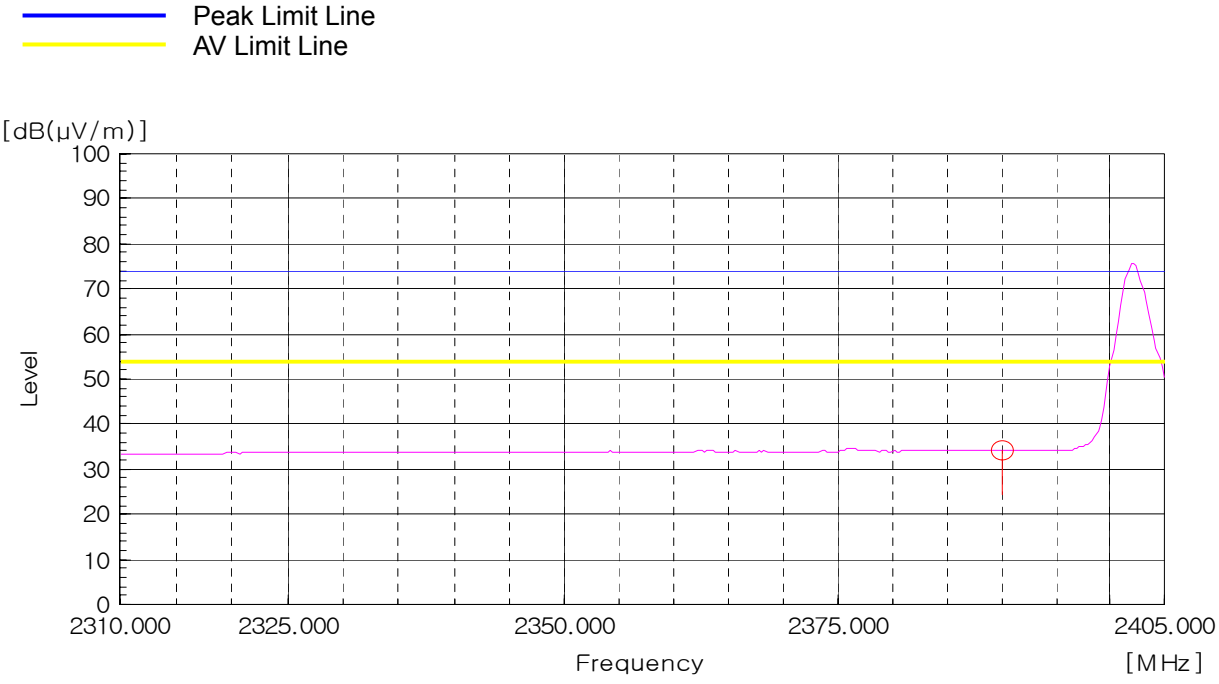
Radiated

Peak Detector: RBW: 1 MHz, VBW: 1 MHz (2310 MHz – 2390 MHz), Worst case (Low, Vertical)



AV Detector: RBW: 1 MHz, VBW: 10 Hz (2310 MHz – 2390 MHz), Worst case (Low, Vertical)



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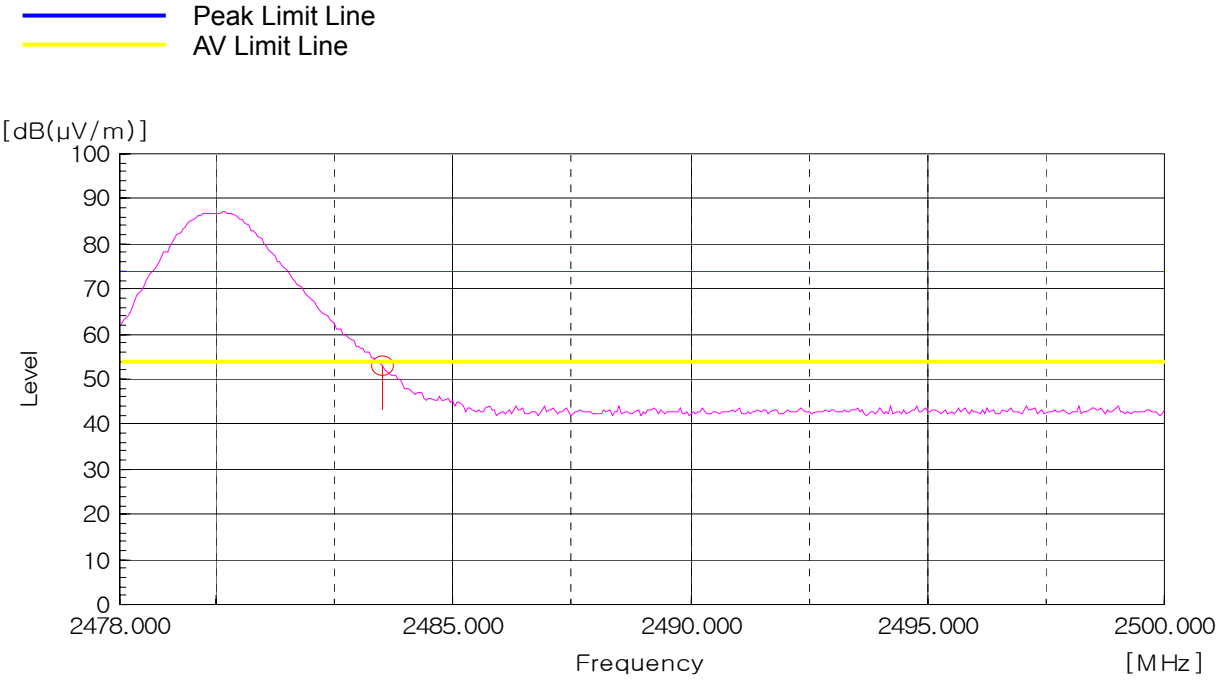
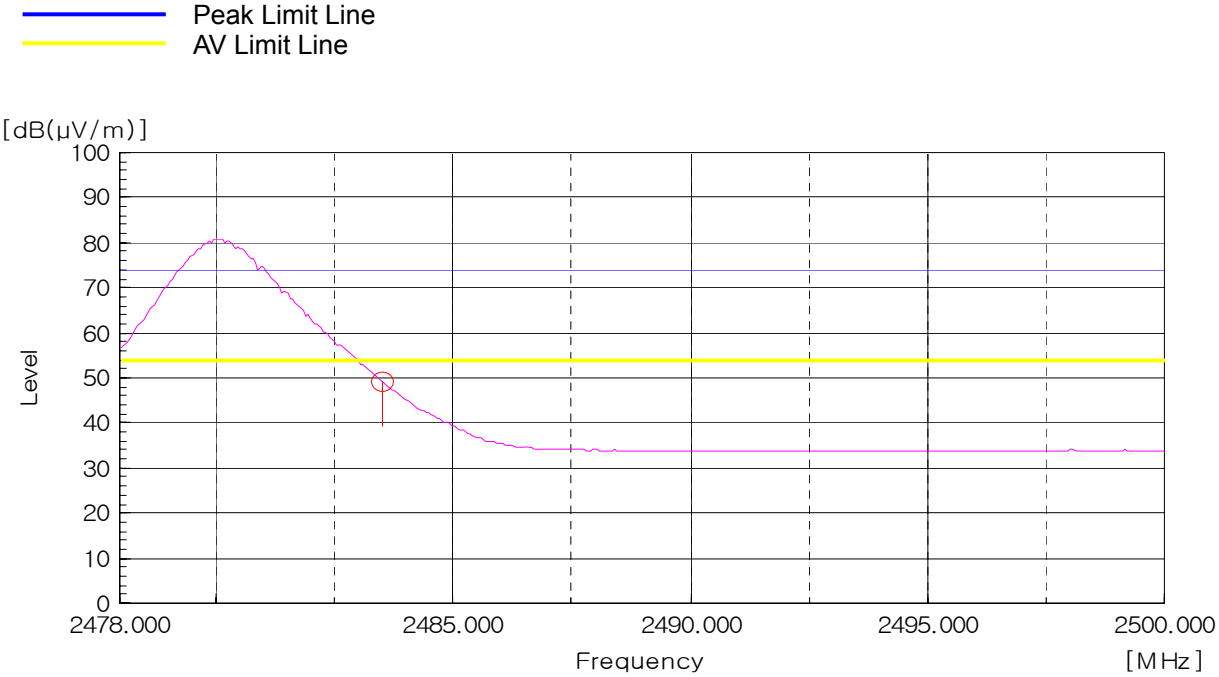
Peak Detector: RBW: 1MHz, VBW: 1MHz (2 483.5 MHz – 2 500 MHz), Worst case (High, Vertical)



AV Detector: RBW: 1MHz, VBW: 10Hz (2 483.5 MHz – 2 500 MHz), Worst case (High, Vertical)



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5.5 Number of Hopping Channels

EUT	THERMAL PRINTER
Model	PORTI-SM40
Limit apply to	FCC Part 15.247(a)(1)(iii)
Test Date	January 11, 2010
Operating Condition	RF transmitting continuously during the tested.
Result	Passed

Limit

Frequency hopping systems in the 2 400.0 MHz - 2 483.5 MHz band shall use at least 15 channels.

Test Data

BT mode

Result	Limit
79	> 15 Channel

NOTES:

1. **Measure number of hopping channel of relevant channel using spectrum analyzer.**
2. **Please see the measured plot in next page.**

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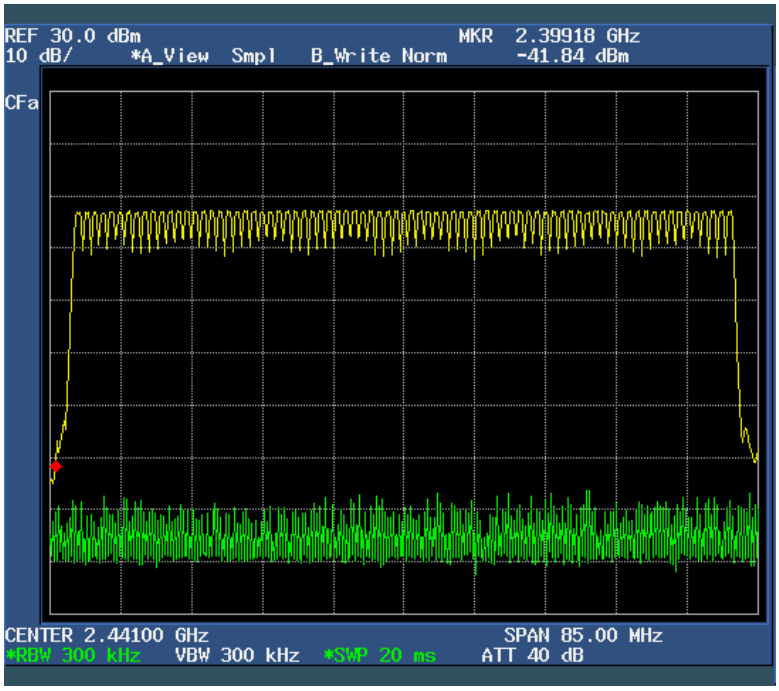
Number of Hopping Channels

[Hopping Channels]



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5.6 Time of Occupancy

EUT	THERMAL PRINTER
Model	PORTI-SM40
Limit apply to	FCC Part 15.247(a)(1)(iii)
Test Date	January 11, 2010
Operating Condition	RF transmitting continuously during the tested.
Result	Passed

Limit

Frequency hopping systems in the 2 400.0 MHz - 2 483.5 MHz band. 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.

Test Data

Pulse Time [ms]	Total of Dwell [ms]	Limit [ms]
2.904	309.760	400.000

NOTES:

1. **Measure time of occupancy of relevant channel using spectrum analyzer.**
2. **Please see the measured plot in next page.**

Test Engineer: Hoon Pyo, Lee

Time of Occupancy

Test period = 0.4 [seconds / channel] × 79 [channel]
Actual = Reading × (Hopping rate / Number of channels) × Test period
Hopping rate (DH5 Packet) = 1 600 [hopping / second] / 6 [time slot] = 266.667

0.4 s x 79(CH) = 31.6 s
2.904 ms x (266.667 / 79) x 31.6 s = 309.76 ms

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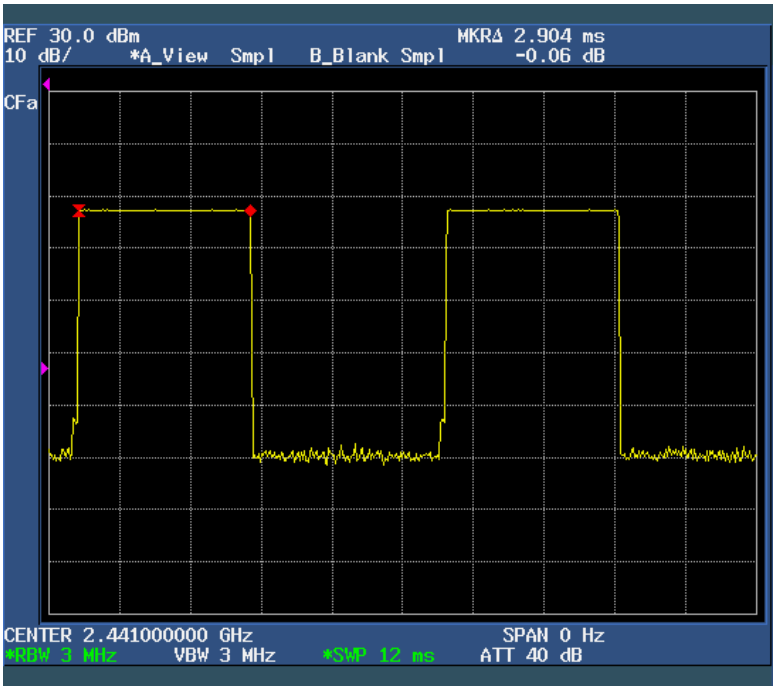
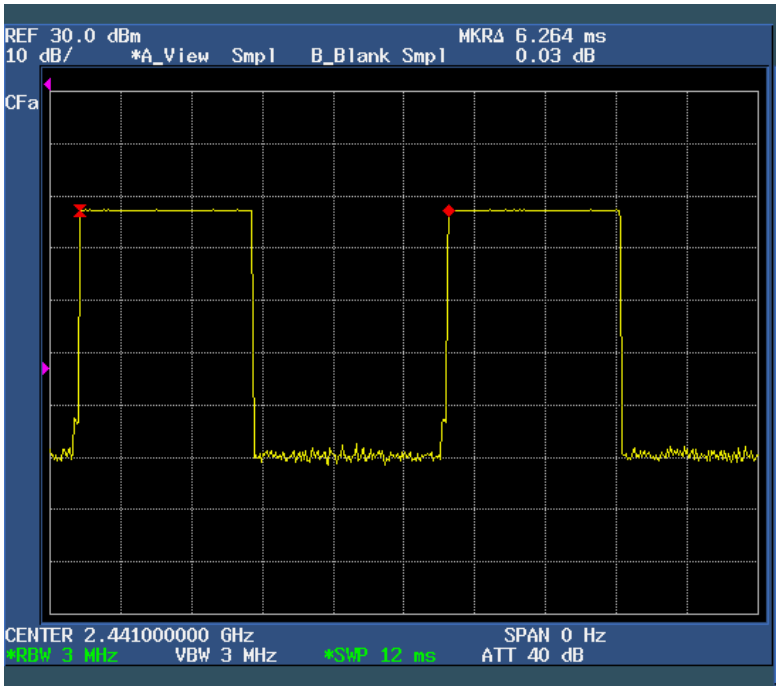
Time of Occupancy

[Continuous Time]



[Hopping Period]



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5.7 Spurious Emissions

5.7.1 Radiated Emissions (TX)

EUT	THERMAL PRINTER
Model	PORTI-SM40
Limit apply to	FCC Part 15.109, 209
Test Date	January 11, 2010 to January 12, 2010
Operating Condition	Low CH, Middle CH, High CH Transmission
Result	Passed

Limit

Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequencies [MHz]	Field Strength [μN/m]	Measurement Distance [m]
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

* 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 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

Test Results

- Refer to see the measured plot in next page.

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Radiated Emissions Test data

- 9 kHz to 30 MHz

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.
Detector mode: CISPR Quasi – Peak mode (100 Hz, 9 kHz)

BT mode

Frequency [MHz]	Reading [dB(μN)]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB]	Result [dB(μN/m)]	Limit [dB(μN/m)]	Margin [dB]
	Emission attenuated more than 20 dB below the limit are not reported.						

Result: All emissions below noise floor of 20 dBμN/m

NOTES:

1. *** H : Horizontal polarization , ** V : Vertical polarization**
2. **Result = Reading + Antenna factor + Cable loss**
3. **Margin = Limit - Result**
4. **The measurement was performed for the frequency range 9 kHz to 30 MHz according to FCC Part 15.209.**

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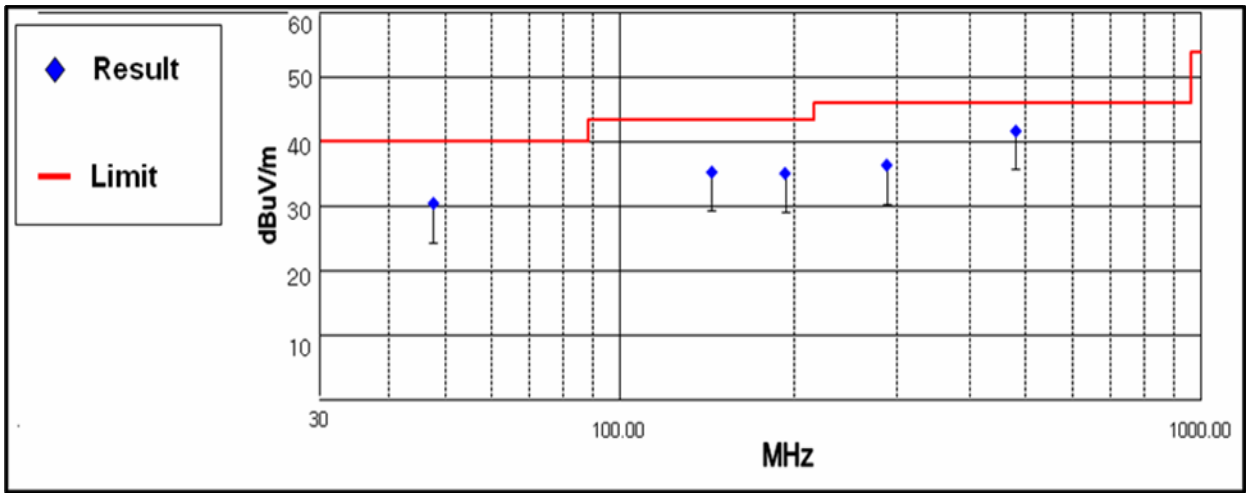
Below 1 GHz (30 MHz to 1 GHz)

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.
Detector mode: CISPR Quasi – Peak mode (6 dB Bandwidth: 120 kHz)

Frequency [MHz]	Reading [dB(μV)]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
47.72	16.62	V	12.17	1.61	30.40	40.00	9.60
143.85	19.85	V	12.54	2.91	35.30	43.50	8.20
192.25	21.75	V	9.73	3.62	35.10	43.50	8.40
287.70	19.91	H	12.08	4.41	36.40	46.00	9.60
480.28	19.33	H	16.44	5.93	41.70	46.00	4.30

NOTES:

1. *** H : Horizontal polarization , ** V : Vertical polarization**
2. **Result = Reading + Antenna factor + Cable loss**
3. **Margin = Limit - Result**
4. **The measurement was performed for the frequency range above 30 MHz according to FCC Part 15.209.**



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Above 1 GHz

1. Low CH

Detector mode: Peak mode

Frequency [MHz]	Reading [dB(μV)]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB(μV)]	Preamp [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
4804.00	21.75	V	31.25	14.12	-34.80	32.32	74.00	41.68

Detector mode: Average mode

Frequency [MHz]	Reading [dB(μV)]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB(μV)]	Preamp [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
4804.00	10.80	V	31.25	14.12	-34.80	21.37	54.00	32.63

2. Middle CH

Detector mode: Peak mode

Frequency [MHz]	Reading [dB(μV)]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB(μV)]	Preamp [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
4882.00	20.51	V	31.40	14.22	-34.80	31.33	74.00	42.67

Detector mode: Average mode

Frequency [MHz]	Reading [dB(μV)]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB(μV)]	Preamp [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
4882.00	10.66	V	31.40	14.22	-34.80	21.48	54.00	32.52

3. High CH

Detector mode: Peak mode

Frequency [MHz]	Reading [dB(μV)]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB(μV)]	Preamp [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
4960.00	21.41	V	31.55	14.29	-34.80	32.45	74.00	41.55

Detector mode: Average mode

Frequency [MHz]	Reading [dB(μV)]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB(μV)]	Preamp [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
4960.00	10.32	V	31.55	14.29	-34.80	21.36	54.00	32.64

Result: All emissions below noise floor of 20 dBμV/m

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NOTES:

1. *** H : Horizontal polarization , ** V : Vertical polarization**
2. **Result = Reading + Antenna factor + Cable loss + Preamp**
3. **Margin = Limit - Result**
4. **Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.**
5. **Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded(ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.**
6. **Spectrum setting:**
   a. Peak Setting 1 GHz to 10th harmonics of fundamental, RBW = 1 MHz, VBW = 1 MHz, Sweep = Auto
   ***b*. AV Setting 1 GHz to 10th harmonics of fundamental, RBW = 1 MHz, VBW = 10 Hz, Sweep = Auto**

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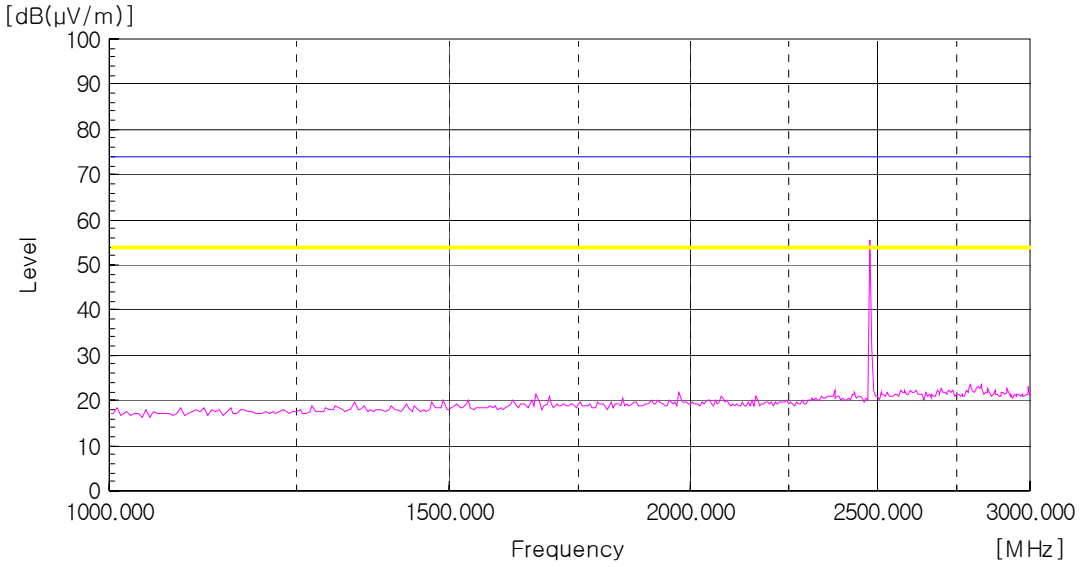
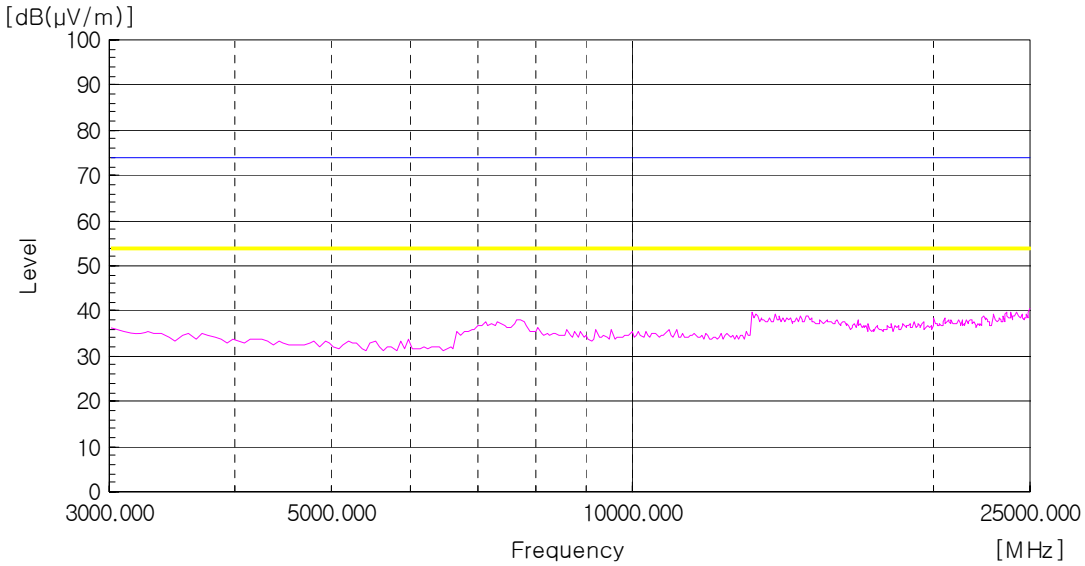
- Operating mode: TX / CH: Low, Mid, High

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Peak Limit Line
AV Limit Line

Final data Peak





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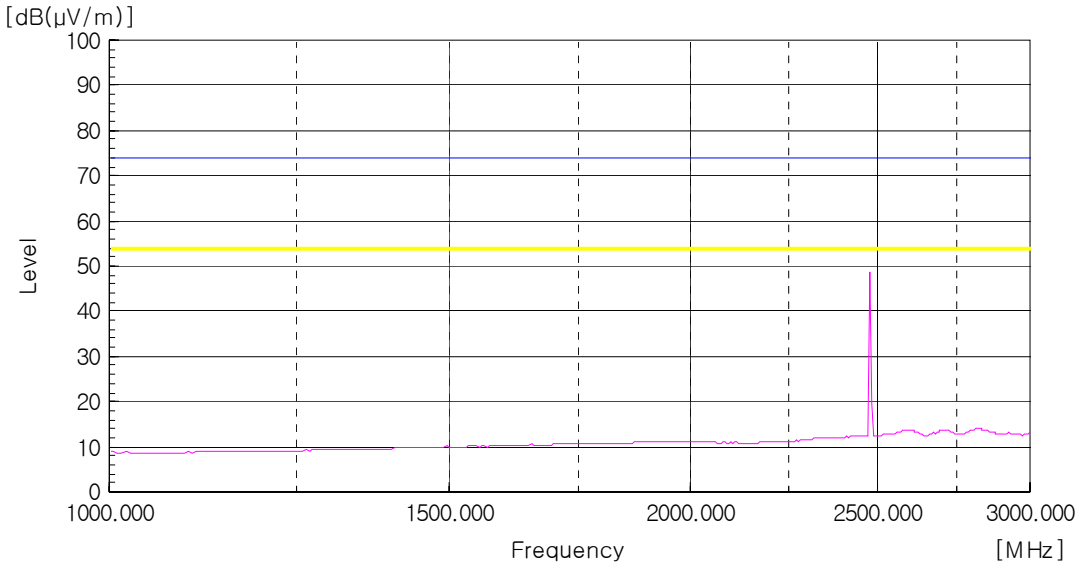
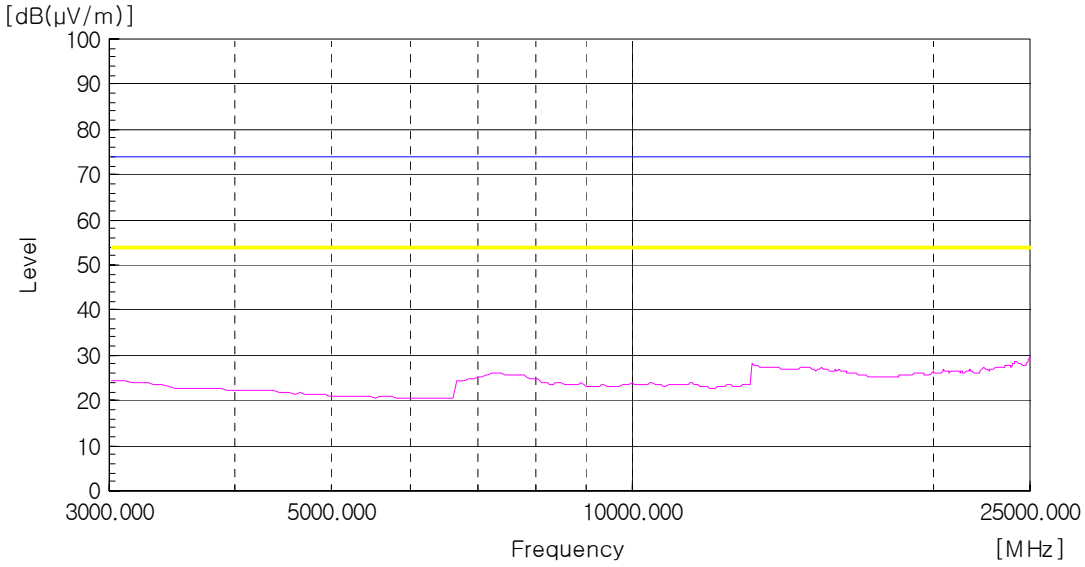
Final data AV





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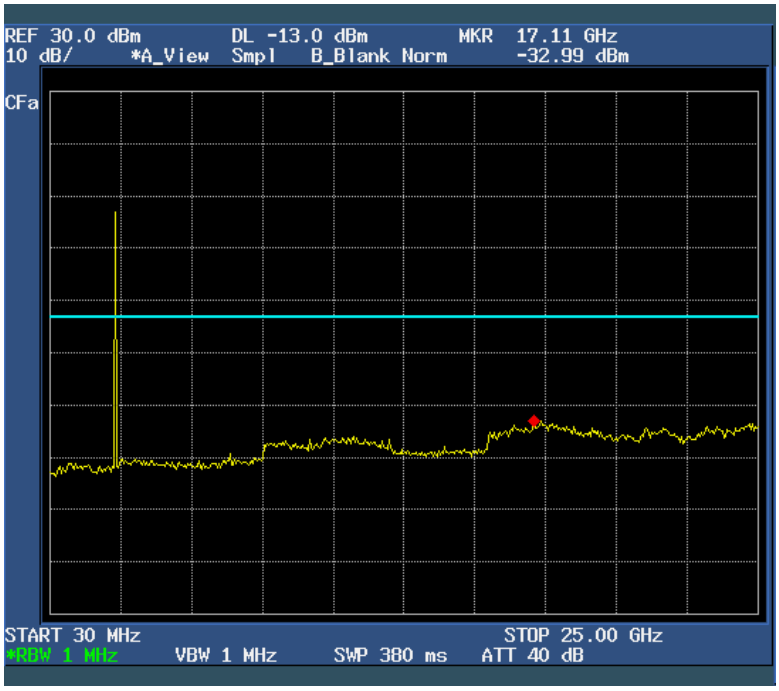
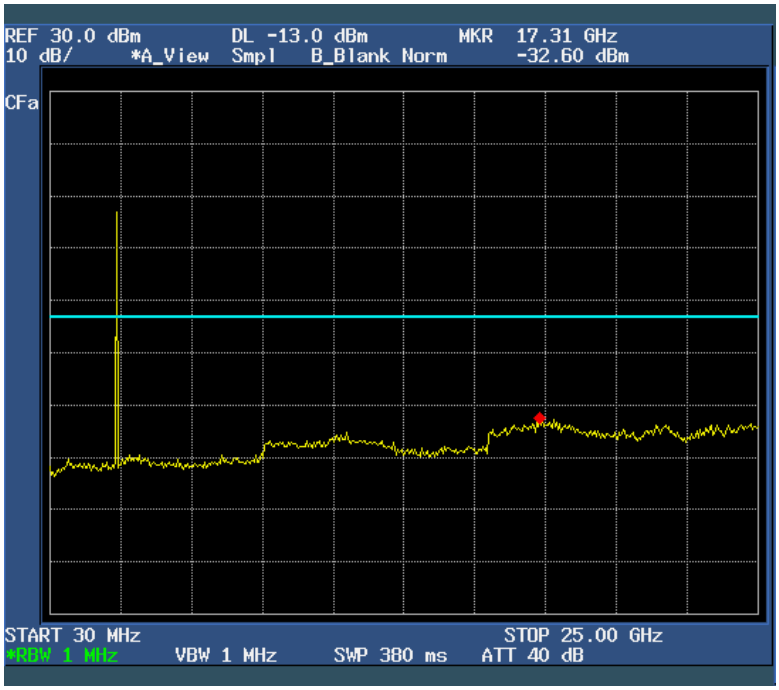
Spurious Emissions (Conducted Measurement)

[CH Low]



[CH Mid]



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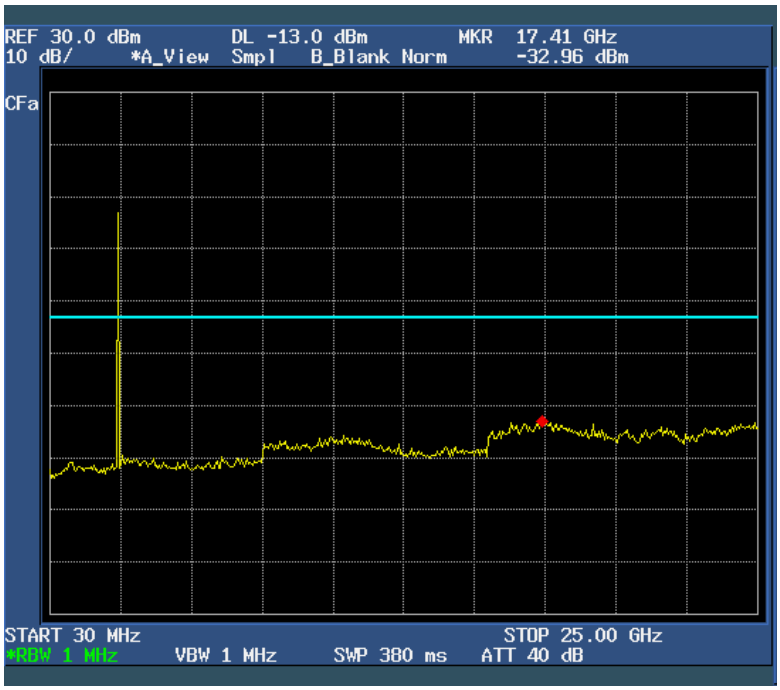
[CH High]



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5.7.2 Radiated Emissions (RX)

EUT	THERMAL PRINTER
Model	PORTI-SM40
Limit apply to	FCC Part 15.109, 209
Test Date	January 11 ~12, 2010
Operating Condition	Low CH, Middle CH, High CH RX Mode
Result	Passed

Limit

Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequencies [MHz]	Field Strength [uV/m]	Field Strength [dB(uV/m)]	Measurement Distance [m]
30 - 88	100*	40.0	3
88 - 216	150*	43.5	3
216 - 960	200*	46.0	3
Above 960	500	54.0	3

* 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 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

Test Results

- Refer to see the measured plot in next page.

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Radiated Emissions Test data

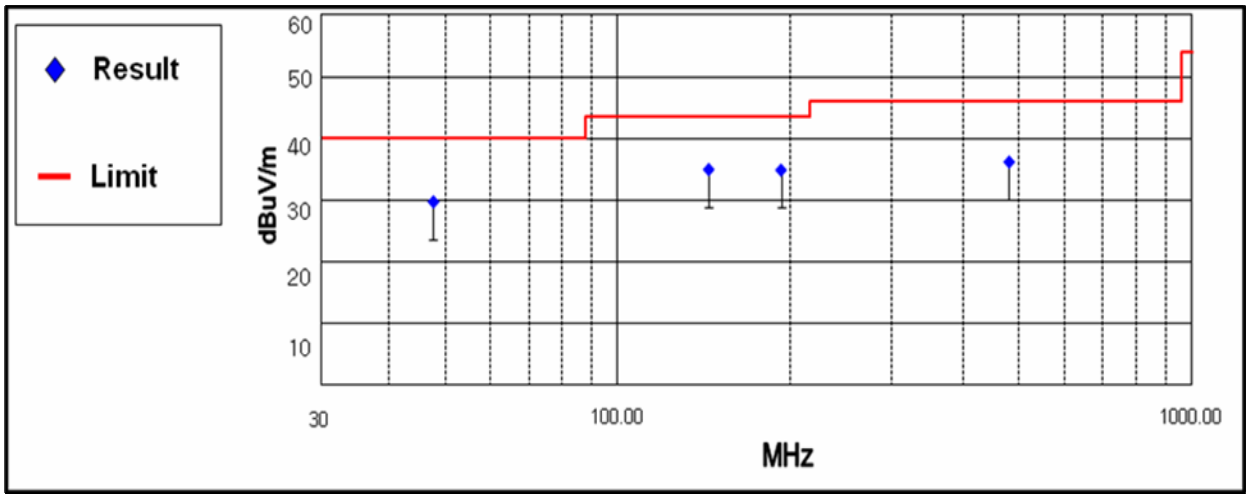
Below 1 GHz

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.
Detector mode: CISPR Quasi – Peak mode (6 dB Bandwidth: 120 kHz)

Frequency [MHz]	Reading [dB(μV)]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
47.72	15.92	V	12.17	1.61	29.70	40.00	10.30
143.85	19.45	V	12.54	2.91	34.90	43.50	8.60
192.26	21.45	V	9.73	3.62	34.80	43.50	8.70
480.28	13.73	H	16.44	5.93	36.10	46.00	9.90

NOTES:

1. *** H : Horizontal polarization , ** V : Vertical polarization**
2. **Result = Reading + Antenna factor + Cable loss**
3. **Margin = Limit - Result**
4. **The measurement was performed for the frequency range above 30 MHz according to FCC Part 15.209.**



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Above 1 GHz

1. Low CH

Detector mode: Peak mode

Frequency [MHz]	Reading [dB(μV)]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB(μV)]	Preamp [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
4804.00	20.61	V	31.25	14.12	-34.80	31.18	74.00	42.82

Detector mode: Average mode

Frequency [MHz]	Reading [dB(μV)]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB(μV)]	Preamp [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
4804.00	10.60	V	31.25	14.12	-34.80	21.17	54.00	32.83

2. Middle CH

Detector mode: Peak mode

Frequency [MHz]	Reading [dB(μV)]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB(μV)]	Preamp [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
4882.00	20.65	V	31.40	14.22	-34.80	31.47	74.00	42.53

Detector mode: Average mode

Frequency [MHz]	Reading [dB(μV)]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB(μV)]	Preamp [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
4882.00	10.58	V	31.40	14.22	-34.80	21.40	54.00	32.60

3. High CH

Detector mode: Peak mode

Frequency [MHz]	Reading [dB(μV)]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB(μV)]	Preamp [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
4960.00	20.54	V	31.55	14.29	-34.80	31.58	74.00	42.42

Detector mode: Average mode

Frequency [MHz]	Reading [dB(μV)]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB(μV)]	Preamp [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
4960.00	10.33	V	31.55	14.29	-34.80	21.37	54.00	32.63

Result: All emissions below noise floor of 20 dBμV/m

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NOTES:

1. *** H : Horizontal polarization , ** V : Vertical polarization**
2. **Result = Reading + Antenna factor + Cable loss + Preamp**
3. **Margin = Limit - Result**
4. **Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.**
5. **Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded(ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.**
6. **Spectrum setting:**
   a. Peak Setting 1 GHz to 10th harmonics of fundamental, RBW = 1 MHz, VBW = 1 MHz, Sweep = Auto
   ***b*. AV Setting 1 GHz to 10th harmonics of fundamental, RBW = 1 MHz, VBW = 10 Hz, Sweep = Auto**

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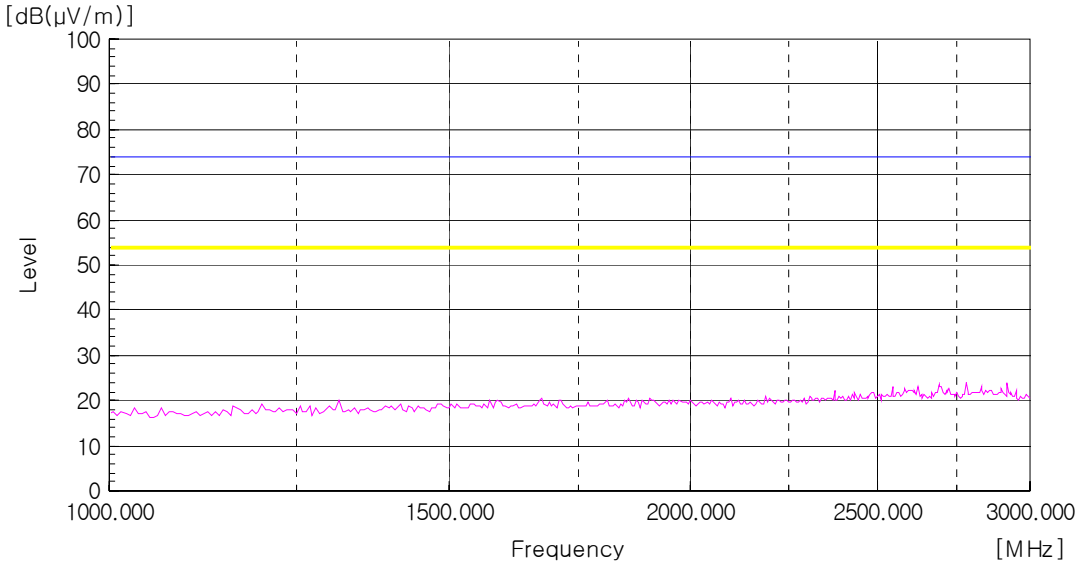
Above 1 GHz

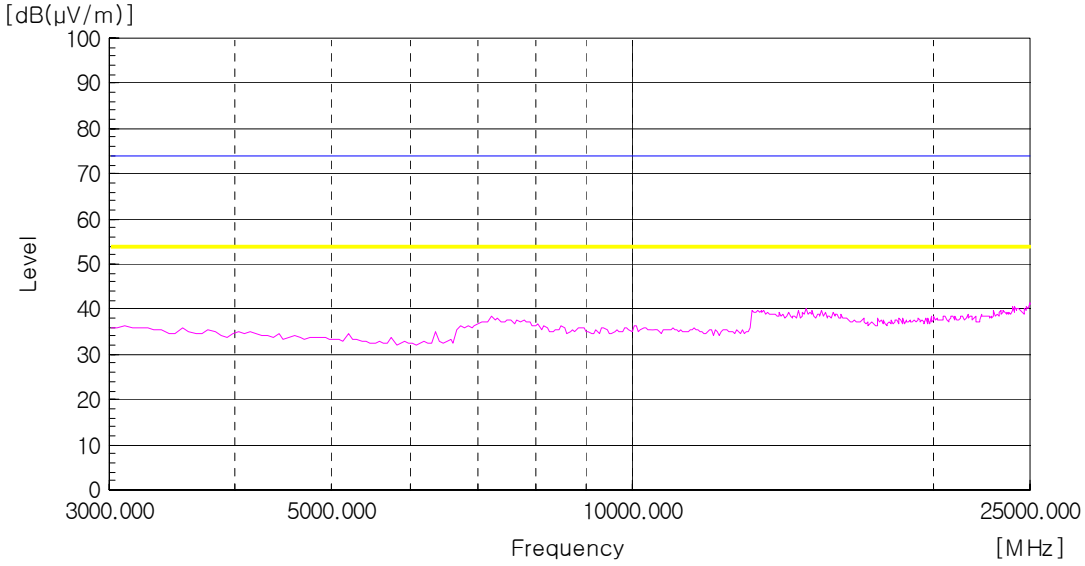
- Operating mode: TX / CH: Low, Mid, High

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Peak Limit Line
AV Limit Line

Final data Peak





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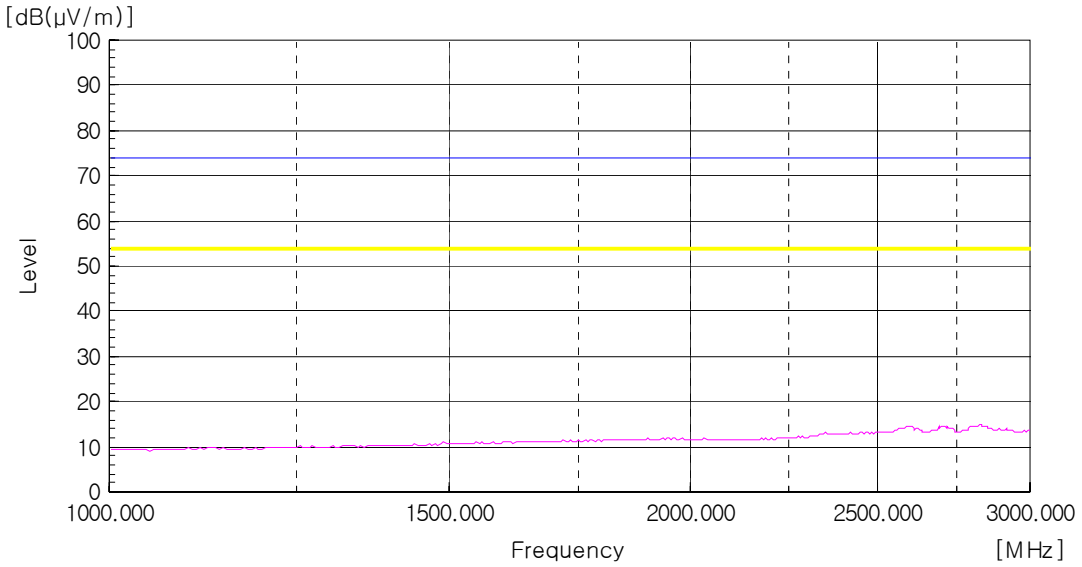
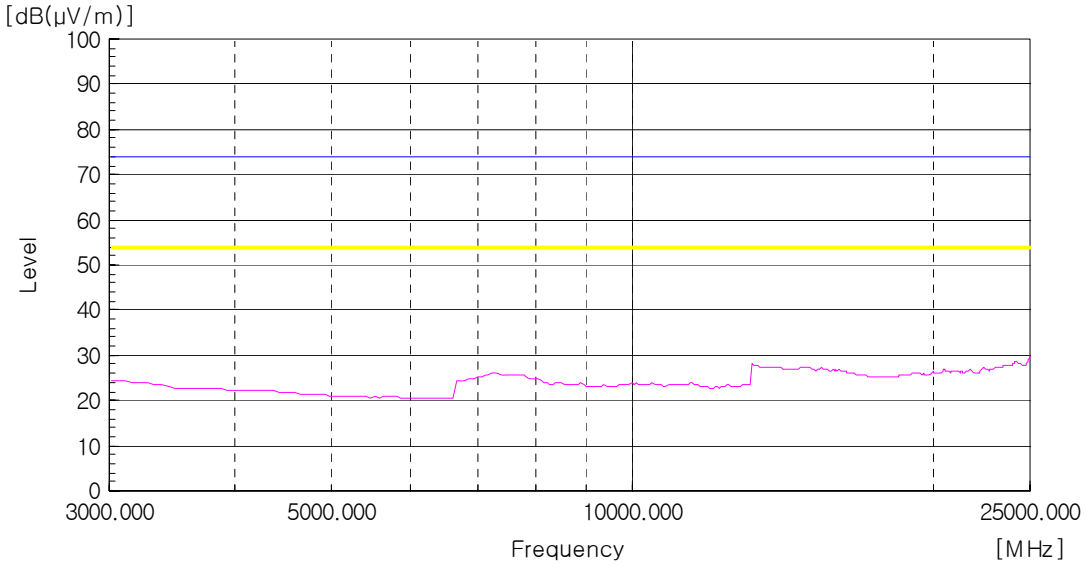
Final data AV





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5.8 Conducted Emissions Measurement

EUT	THERMAL PRINTER
Model	PORTI-SM40
Limit apply to	FCC Part 15.107, 207
Test Date	January 13, 2010
Operating Condition	RF transmitting continuously during the tested.
Result	Passed

Conducted Emission Test Data

The following table shows the highest levels of conducted emissions on both polarizations of hot and neutral line.
Detector mode: CISPR Quasi-Peak mode (6 dB Bandwidth: 9 kHz)

Frequency [MHz]	Result [dB(μV)]		Phase (*L/**N)	Limit [dB(μV)]		Margin [dB]	
	Quasi-peak	Average		Quasi-peak	Average	Quasi-peak	Average
0.205	50.30	-	H	63.40	53.40	13.10	3.10
0.305	42.90	-	H	60.10	50.10	17.20	7.20
0.411	43.10	-	H	57.60	47.60	14.50	4.50
0.578	39.90	-	H	56.00	46.00	16.10	6.10
0.660	40.20	-	H	56.00	46.00	15.80	5.80
0.787	42.00	-	H	56.00	46.00	14.00	4.00
1.309	37.20	-	H	60.00	50.00	18.80	8.80

NOTES:

1. *** H : HOT Line , **N : Neutral Line**
2. **Margin = Limit – Result**
3. **Measurement were performed at the AC Power Inlet in the frequency band of 150 kHz ~ 30 MHz according to the FCC Part 15 Class B.**

Test Engineer: Hoon Pyo, Lee

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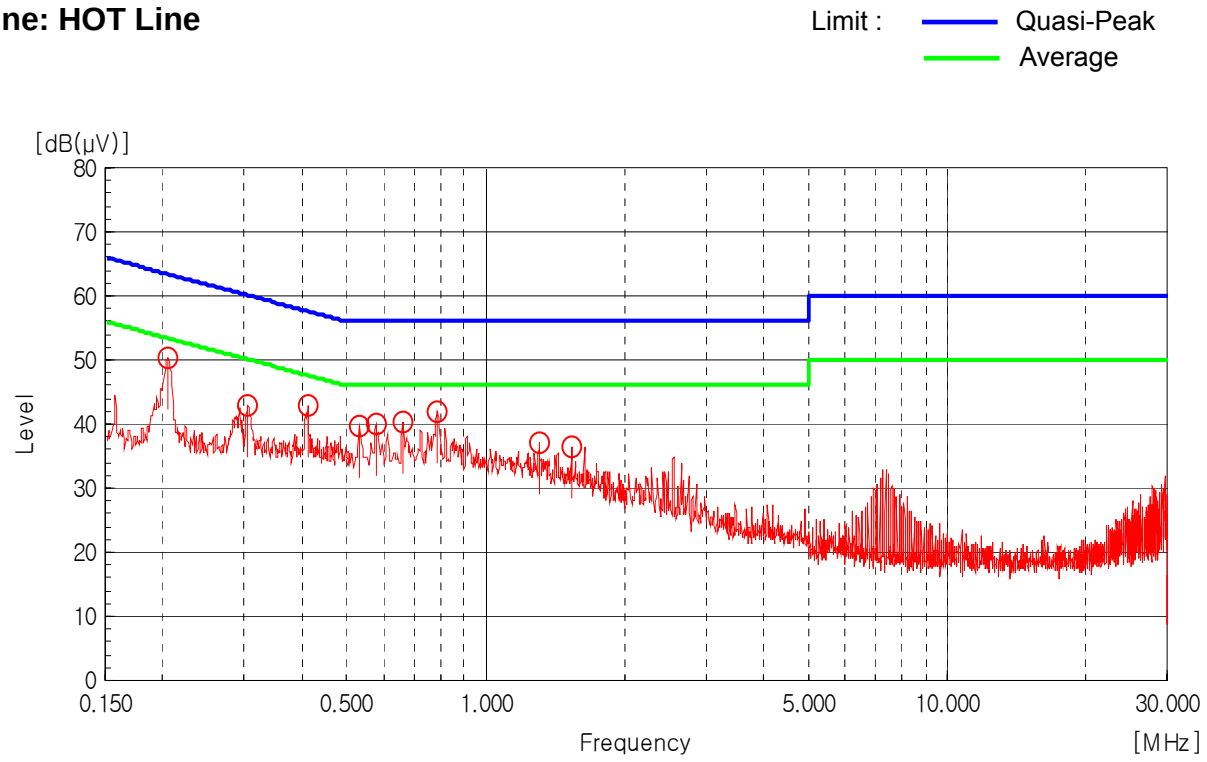
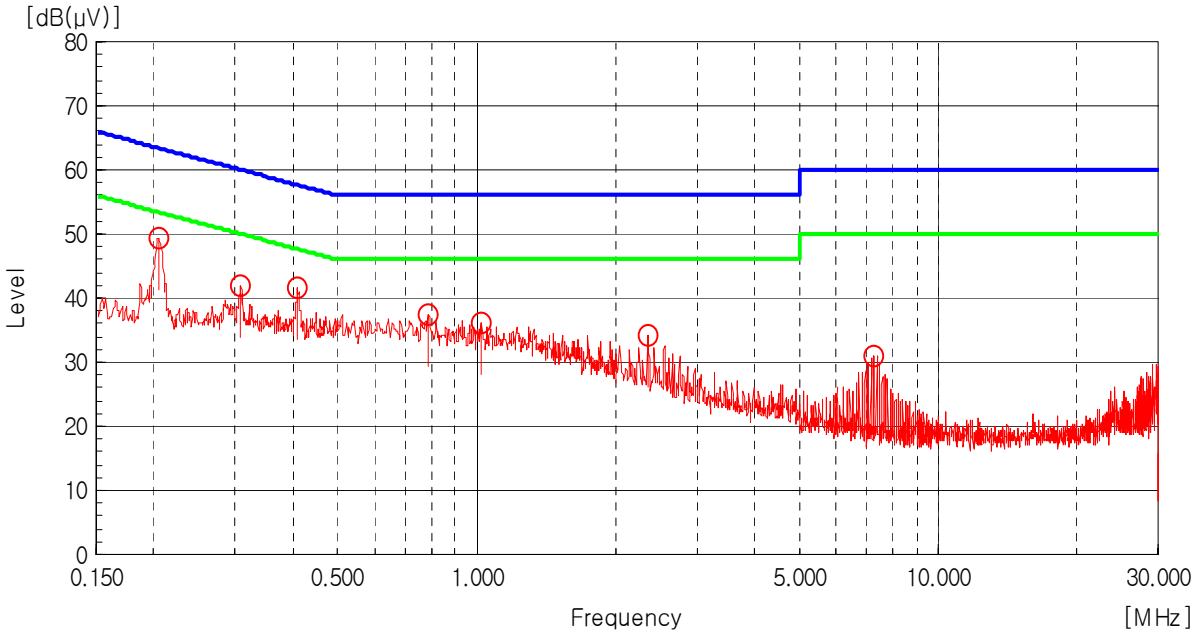
Line: HOT Line



Line: Neutral Line



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6. SAMPLE CALCULATION

Sample Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor.
The basic equation with a sample calculation is as follows:

FS = RA + AF + CF

Where FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor

$dB(\mu V) = 20 \log_{10} (uV)$: Equation

Example : @ 372.46 MHz

Class B Limit = 46.00 dB(uV/m)

Reading = 23.78 dB(uV)

Antenna Factor + Cable Loss = 14.03 + 4.99 = 19.02 dB(uV/m)

Total = 42.80 dB(uV/m)

Margin = 46.00 – 42.80 = 3.20 dB

= 3.20 dB below Limit

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7. List of test equipments used for measurements

Test Equipment		Model	Mfg.	Serial No.	Cal. Due Date
■	EMI Test Receiver	ESVS10	R & S	835165/001	10-04-02
■	EMI TEST Receiver	ESPI3	R & S	100478	10-09-18
■	Spectrum Analyzer	E7405A	H.P	US41160290	10-09-18
■	Spectrum Analyzer	R3273	Advantest	95090411	10-04-02
■	LogBicon Antenna	VULB9160	Schwarzbeck	3082	10-01-25
■	Loop Antenna	AL-130	Com-Power	17100	11-03-02
■	Broad band Horn antenna	BBHA 9120D	Schwarz Beck	227	11-03-16
■	Broad band Horn antenna	BBHA 9120D	Schwarz Beck	285	11-03-16
■	Preamplifier	8447D	H.P	3307A02865	10-09-18
■	System Power Supply	6030A	Agilent	1036546	10-04-03
■	Power Meter	NRVS	R & S	834053/060	10-09-18
■	Controller	HD2000	HD GmbH	C/125	N/A
■	Antenna Master	MA2400	HD GmbH	N/A	N/A
■	Turn-Table	MFT-120S	Max-Full Antenna Corp	N/A	N/A
■	Antenna Master	MFA-440E	Max-Full Antenna Corp	N/A	N/A

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