

Nemko Korea CO., Ltd.

300-2, Osan-Ri, Mohyun-Myun, Yongin-City, Kyungki-Do, KOREA

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FCC EVALUATION REPORT FOR CERTIFICATION

Applicant :

Samsung Electronics Co., Ltd.

314, Maetan3-Dong, Youngtong-Gu,

Suwon-Shi, Kyunggi-Do, Korea.

(Post code : 442-743)

Attn. : Mr. Yeon-Chun, Park

Dates of Issue : April 22, 2004

Test Report No. : NK2EE242

Test Site : Nemko Korea Co., Ltd.

EMC site, Korea

FCC ID

A3LWIP5001A

Brand Name

SAMSUNG

CONTACT PERSON

Samsung Electronics Co., Ltd.

314, Maetan3-Dong, Youngtong-Gu, Suwon-Shi,

Kyunggi-Do, Korea, 442-743.

Mr. Yeon-Chun, Park

Telephone No. : +82 32 279 4398

Applied Standard:

FCC 47 CFR Part 15, Subpart C : 2001

Classification :

FCC Class B Device

EUT Type:

WIP Adaptor

The device bearing the brand name and FCC ID specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-2001.

I attest to the accuracy of data and all measurements reported herein were performed by me or were made under my supervision and are 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.



Tested By : C. S. Choi

Senior Engineer



Reviewed By : H.H. Kim

Manager & Chief Engineer

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SCOPE

Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission under FCC part 15.

Responsible Party :	Samsung Electronics Co., Ltd.
Contact Person :	Mr. Yeon Chun, Park
Manufacturer :	UniData Communication Systems, Inc. 2F, OhSung-Bldg, 82-15, NonHyun-Dong, GangNam-Gu, Seoul, Korea, 135-010.

- FCC ID: A3LWIP5001A
- Model: WIP-5001A
- Brand Name: SAMSUNG
- EUT Type: WIP ADAPTOR
- Classification: FCC Class B
- Applied Standard: FCC 47 CFR Part 15 , Subpart C
- Test Procedure(s): ANSI C63.4 (2001)
- Dates of Test: April 7, 2004 ~ April 22, 2004
- Place of Tests: Nemko Korea Co., Ltd. EMC Site
- Test Report No.: NK2EE242

INTRODUCTION

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C63.4-2001) was used in determining radiated and conducted emissions emanating from **Samsung Electronics Co., Ltd.**

MODEL : **WIP-5001A**

These measurement tests were conducted at **Nemko Korea Co., Ltd. EMC Laboratory**.

The site address is 300-2, Osan-Ri, Mohyun-Myun, Yongin-City, Kyungki-Do, KOREA

The area of Nemko Korea Corporation Ltd. EMC Test Site is located in a mountain area at 80 kilometers (48 miles) southeast and Incheon International Airport (Incheon Airport), 30 kilometers (18miles) south-southeast from central Seoul.

It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures.

The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4 on June 06, 2001.



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Fig. 1. The map above shows the Seoul in Korea vicinity area.
The map also shows Nemko Korea Corporation Ltd. EMC Lab. and Incheon Airport.

TEST CONDITIONS & EUT INFORMATION

Operating During Test

Set loop with a notebook computer via a LAN cable, then sent and received a data during test. At the same time, transmitted each channel's (the Lowest channel, Middle channel, Highest channel) data with test program in Notebook computer.

EUT & Support Equipment

WIP Adaptor (EUT)	Samsung Electronics Co., Ltd. FCC ID : A3LWIP5001A	S/N : N/A
Adaptor (WIP Adaptor)	Samsung Electronics Co.,Ltd. Model ; DSA-0101F-05A 2.0m unshielded DC power cable	S/N : N/A
Notebook Computer	LG Electronics. Model ; CM2080	S/N : N/A
USB Mouse	Logitech. Model : M-BD53	S/N : N/A
Printer	HP Model : C2644A	S/N : N/A

:

EUT Information

Clock	4.8MHz (X1)
Clock(RF Card)	32.768KHz(Y1) , 44MHz(OSC1)
Chipset	IC1(IP2022)
Chipset(RF Card)	U5(ISL3871), U11(ISL3684)
RF Frequency(Center Frequency)	2412 ~ 2462MHz (11 CH)
Ethernet Port	10MBPS speed
RF output power	Maximum of 15dBm
Size(with stand)	69.5(width) X 108.7(length) X 146.5(height)mm
Weight	0.2Kg
Power	AC/DC adaptor (100-240V/5V)

SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specification:

Name of Test	Paragraph No.	Result	Remark
Restricted bands of operation	15.205	Complies	
Power line Conducted Emission	15.207	Complies	
Radiated Emission (Spurious)	15.209	Complies	
Modulated Bandwidth (6dB Bandwidth)	15.247(a)(2)	Complies	
Peak Power Output	15.247(b)	Complies	
Conducted Spurious Emission	15.247(c)	Complies	
Radiated Spurious Emission	15.247(c)	Complies	
Power Spectral Density	15.247(d)	Complies	
Maximum Permissible Exposure	1.1307(b)	Complies	

RECOMMENDATION/CONCLUSION

The data collected shows that the **Samsung Electronics Co., Ltd.**

FCC ID : **A3LWIP5001A**

The highest emission observed was at **25.0 MHz** for conducted emissions with a A.V margin of **12.8 dB**, at **746.31 MHz** for radiated emissions with a margin of **6.8 dB**.

SAMPLE CALCULATION

$$\text{dB } \mu\text{V} = 20 \log_{10} (\mu\text{V}/\text{m})$$

$$\mu\text{V} = 10^{(\text{dB } \mu\text{V}/20)}$$

EX. 1.

@57.7 MHz

Class B limit = 100 $\mu\text{V}/\text{m}$ = 40.0 dB $\mu\text{V}/\text{m}$

Reading = 19.1 dB μV (calibrated level)

Antenna factor + Cable Loss + Amplifier Gain = 10.12 dB

Total = 29.22 dB $\mu\text{V}/\text{m}$

Margin = 40.0 – 29.22 = 10.78

10.78 dB below the limit

DESCRIPTION OF TESTS

Conducted Emissions

The Line conducted emission test facility is located inside a 4 X 7 X 2.5 meter shielded enclosure.

It is manufactured by EM engineering. The shielding effectiveness of the shielded room is in accordance with MIL-STD-285 or NSA 65-6.

A 1m X 1.5m wooden table 0.8m height is placed 0.4m away from the vertical wall and 1.5m away from the side of wall of the shielded room

Rohde & Schwarz (ESH3-Z5) and Kyoritsu (KNW-408) of the 50ohm/50uH Line Impedance Stabilization Network(LISN) are bonded to the shielded room.

The EUT is powered from the Rohde & Schwarz LISN and the support equipment is powered from the Kyoritsu LISN. Power to the LISN s are filtered by high-current high insertion loss Power line filters. The purpose of filter is to attenuate ambient signal interference and this filter is also bonded to shielded enclosure. All electrical cables are shielded by tinned copper zipper tubing with inner diameter of 1/2".

If DC power device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the LISNs,

All interconnecting cables more than 1 meter were shortened by non inductive bundling (serpentine fashion) to a 1 meter length.

Sufficient time for 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 spectrum analyzer to determine the frequency producing the maximum EME from the EUT. The spectrum was scanned from 150kHz to 30MHz with 20msec sweep time.

The frequency producing the maximum level was re-examined using the EMI test receiver. (Rohde & Schwarz ESCS30).

The detector function were set to CISPR quasi-peak mode & average mode.

The bandwidth of receiver was set to 9KHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission.

Each emission was maximized by; switching power lines; varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and of support equipment, and powering the monitor from the floor mounted outlet box and computer aux AC outlet, if applicable; which ever determined the worst case emission.

Each EME reported was calibrated using the R&S signal generator.

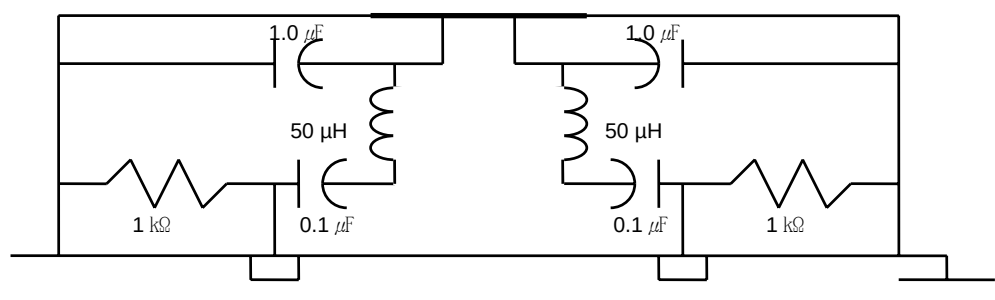


Fig. 2. LISN Schematic Diagram

DESCRIPTION OF TESTS

Radiated Emissions

Preliminary measurement were made indoors at 3 meter using broad band antennas, broadband amplifier, and spectrum analyzer to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The Technology configuration, clock speed, mode of operation or video resolution, turntable azimuth with respect to the antenna was note for each frequency found.

The spectrum was scanned from 27 to 1000MHz using Biconical log Antenna(ARA, LPB-2520/A). Above 1GHz, Doppels Teg Horn antenna (EMCO, DAA-37121:upto 1~18GHz) was used.

Final Measurements were made outdoors at 3 or 10m test range using Logbicon Super Antenna(Schwarzbeck, VULB9166) or Doppels Teg Horn antenna.(EMCO, DAA-37121)

The test equipment was placed on a wooden 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 reexamined and investigated using EMI test receiver.(ESCS30)

The detector function was set to CISPR peak mode or quasi-peak mode or average mode and the bandwidth of the receiver was set to 120KHz or 1MHz depending on the frequency or type of signal.

The half wave dipole antenna was tuned to the frequency found during preliminary radiated measurements.

The EUT support equipment and interconnecting cables were re configured to the setup producing the maximum emission for the frequency and were placed on top of a 0.8m high non- metallic 1.0X 1.5 meter table.

The EUT, support equipment and interconnecting cables were re-arranged and manipulated to maximize each EME emission.

The turn table containing the Technology was rotated; the antenna height was varied 1 to 4meter and stopped at the azimuth or height producing the maximum emission Each emission was maximized by : switching power lines; varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and of support equipment, and powering the monitor from the floor mounted outlet box and computer aux AC outlet, if applicable; which ever determined the worst case emission.

Each EME reported was calibrated using the R/S signal generator.

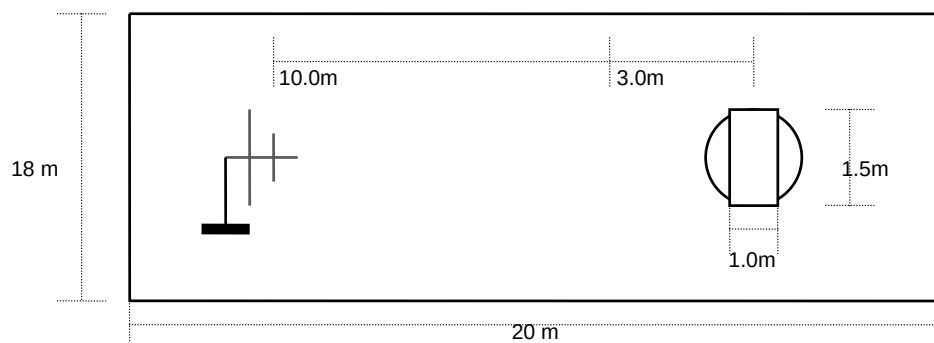
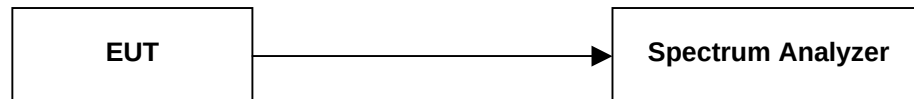


Fig. 3. Dimensions of Outdoor Test Site

DESCRIPTION OF TESTS

Modulated Bandwidth (6dB Bandwidth)

Test Setup



Test Procedure

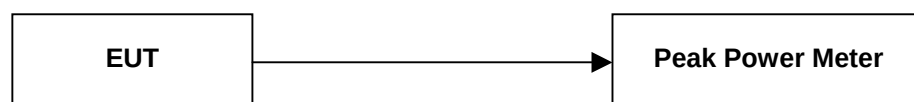
The transmitter is connected to the spectrum analyzer.

The RBW of spectrum analyzer is set to 100KHz and VBW is set to the 100KHz.

The sweep time is coupled.

Peak Power Output

Test Setup



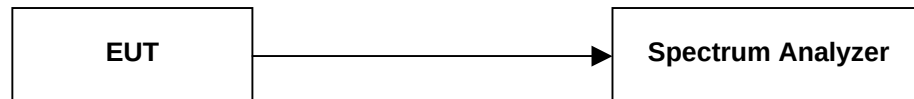
Test Procedure

The transmitter is connected to the Peak power meter.

DESCRIPTION OF TESTS

Conducted Spurious Emission

Test Setup



Test Procedure

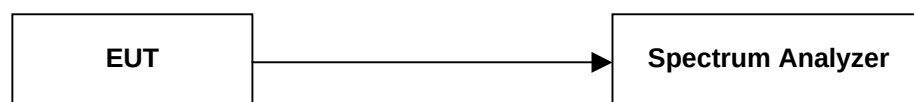
The transmitter is connected to the spectrum analyzer.

The RBW of spectrum analyzer is set to 100KHz and VBW is set to the 100KHz.

Measurements are made over the 30MHz to 26.5GHz range with the transmitter set to the Lowest, Middle, and highest channels within the 2.4GHz band.

Peak Power Spectral Density

Test Setup



Test Procedure

The transmitter is connected to the Spectrum analyzer.

The maximum level in a 3KHz bandwidth is measured with the spectrum analyzer.

The RBW of spectrum analyzer is set to 3KHz and VBW is set to 10KHz.

The sweep time is set to Span/3KHz and video averaging is turned off.

The PPSD is the highest level found across the emission in any 3KHz band.

TEST DATA

Conducted Emissions – 15.207

FCC ID : A3LWIP5001A

Test Mode : Set to each channel

Frequency (MHz)	Level(dB μ V)		Line	Limit(dB μ V)		Margin(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.16	50.5	39.6	L	65.5	55.5	14.9	15.8
0.34	38.4	29.7	L	59.2	49.2	20.9	19.5
1.03	29.8	20.9	N	56.0	46.0	26.3	25.1
1.72	29.2	18.4	N	56.0	46.0	26.8	27.6
3.08	31.2	19.2	N	56.0	46.0	24.8	26.8
25.00	37.5	37.2	L	60.0	50.0	22.5	12.8

Table 1. Line Conducted Emissions Tabulated Data

NOTES:

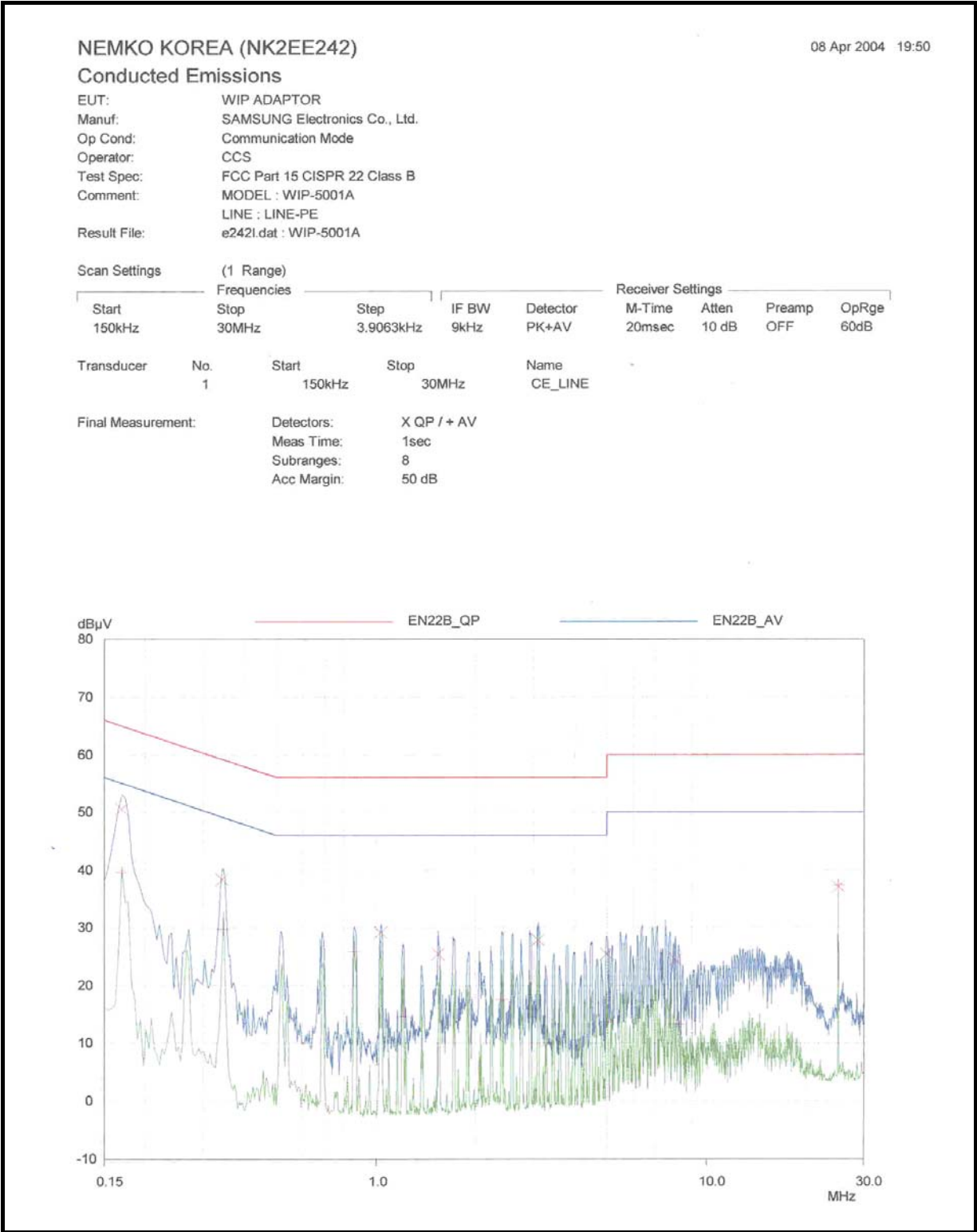
1. Measurements using CISPR quasi-peak mode & average mode.
2. All modes of operation were investigated and the worst-case emissio are reported.
See attached Plots.
3. The limit for Class B device is on the FCC Part section 15.207.
4. Line L = Line Line N = Neutral



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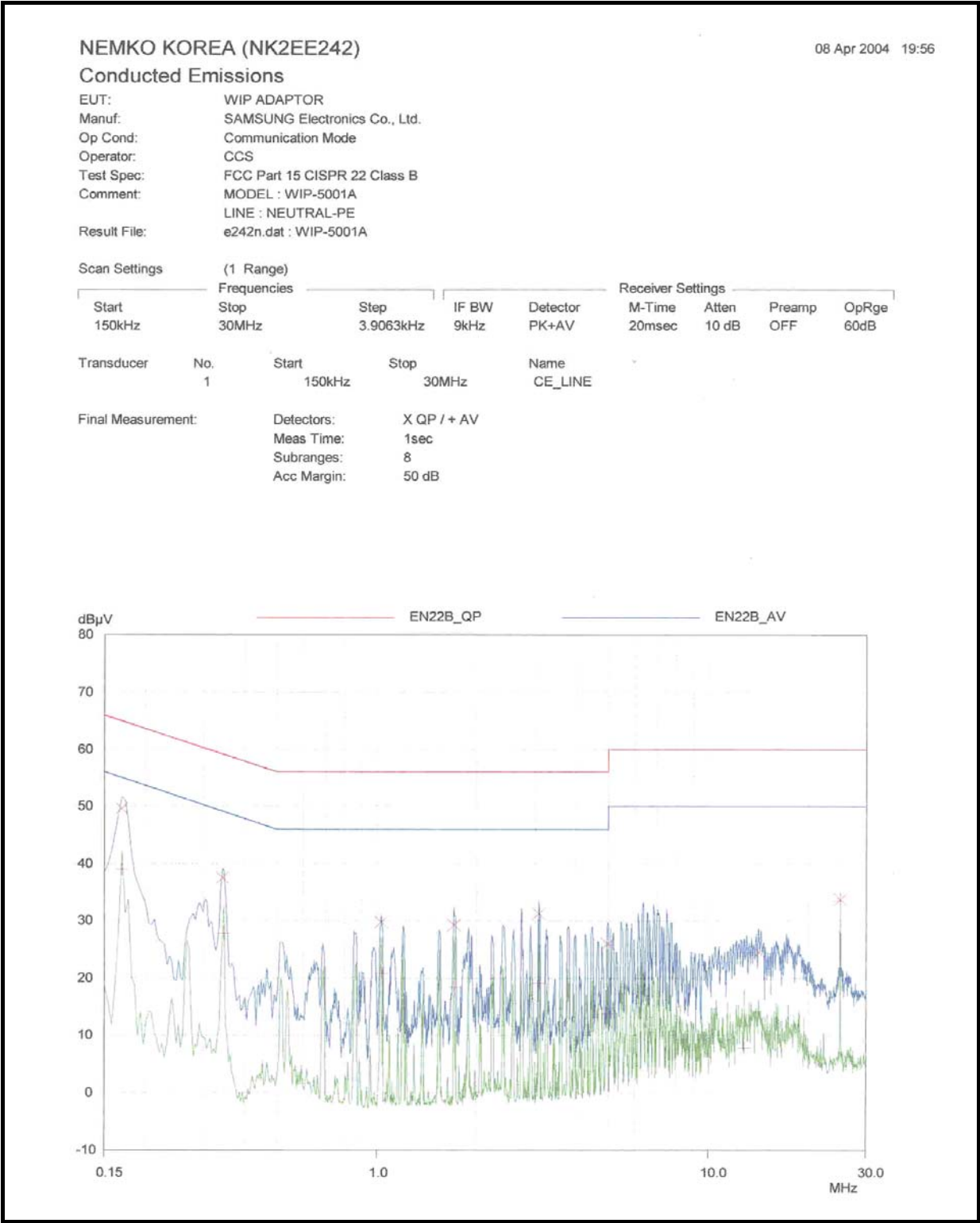
PLOTS OF EMISSIONS

• Conducted Emission at the Mains port (Line)



PLOTS OF EMISSIONS

- Conducted Emission at the Mains port (Neutral)



TEST DATA

Radiated Emissions(general requirements) - 15.209

FCC ID : A3LWIP5001A

Test Mode : The test data show the worst emission level from lowest channel and Middle channel and Highest channel

Below 1GHz

Frequency (MHz)	Reading (dB μ V)	Pol* (H/V)	AF+CL+Amp (dB)**	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
120.01	48.2	V	-17.3	30.9	43.5	12.6
176.00	35.2	V	-13.2	22.0	43.5	21.5
240.03	46.5	H	-12.7	33.8	46.0	12.2
264.00	42.6	V	-12.2	30.4	46.0	15.6
352.00	46.4	H	-10.0	36.4	46.0	9.6
746.31	38.9	H	0.3	39.2	46.0	6.8

Table 1. Radiated Measurements at 3meters

Above 1GHz

Frequency (GHz)	Reading (dB μ V)		Pol* (H/V)	AF+CL+Amp (dB)**	Limits (dB μ V/m)		Results (dB μ V/m)	
	Peak	Average			Peak	Average	Peak	Average
4.824***	52.16	41.30	H	4.74	74.00	54.00	56.90	46.04
4.874***	52.07	39.10	H	4.93	74.00	54.00	57.00	44.03
4.924***	50.08	39.40	H	5.12	74.00	54.00	55.20	44.52

Table 2. Radiated Measurements at 3meters

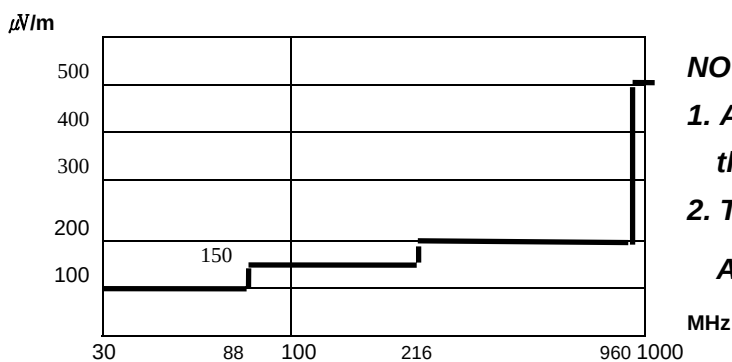


Fig. 4. Limits at 3 meters

NOTES:

1. All modes of operation were investigated the worst-case emission are reported.
2. The radiated limits are shown on Figure 4.

Above 1GHz the limit is 500 μ V/m.

NOTES:

1. *Pol. H=Horizontal V=Vertical
2. **AF+CL+Amp. = Antenna Factor + Cable Loss + Amplifier.
3. ***F : Restricted bands of operation
4. Up to the 10th harmonics were investigated according to 15.33 and the worst-case is reported.



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TEST DATA

Modulated Bandwidth (6dB Bandwidth)- 15.247(a)(2)

FCC ID : A3LWIP5001A

Test Mode : Set to Lowest channel, Middle channel and Highest channel

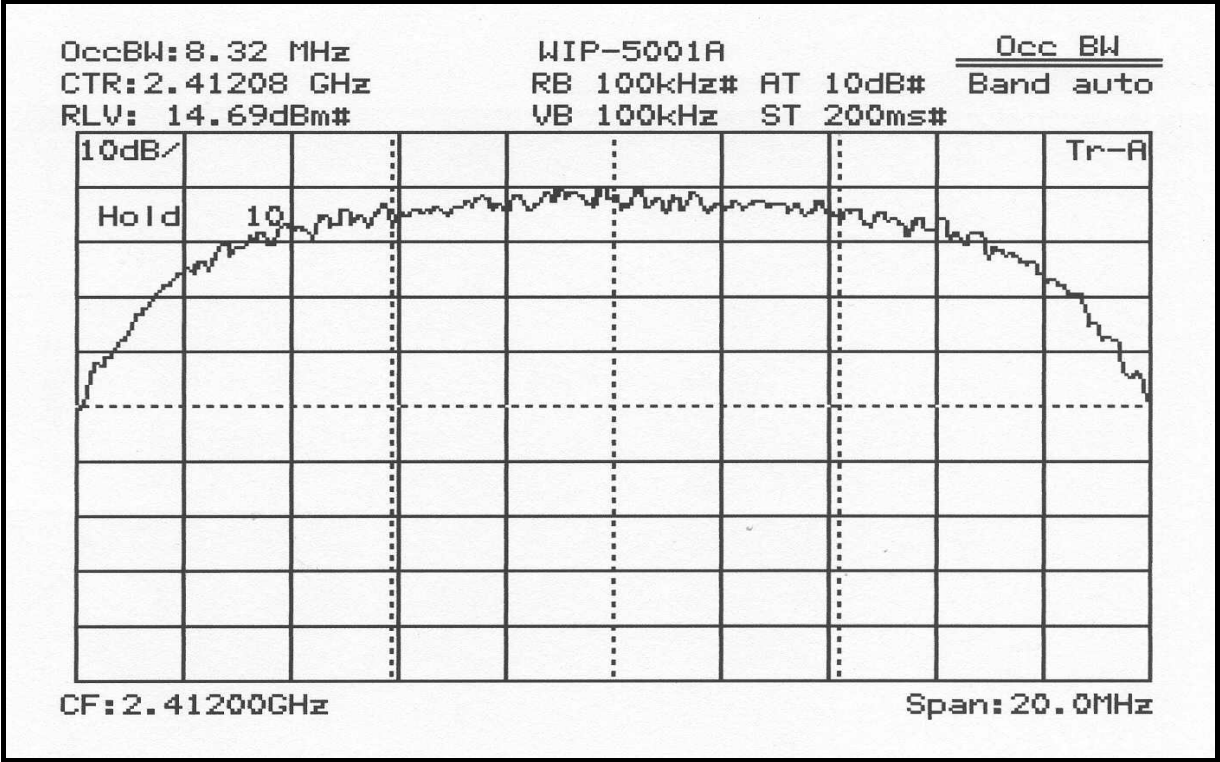
Channel	Frequency(MHz)	Result(KHz)	Limit(KHz)	Margin(KHz)
1	2412	8320	500	7820
6	2437	8080	500	7580
11	2462	8320	500	7820



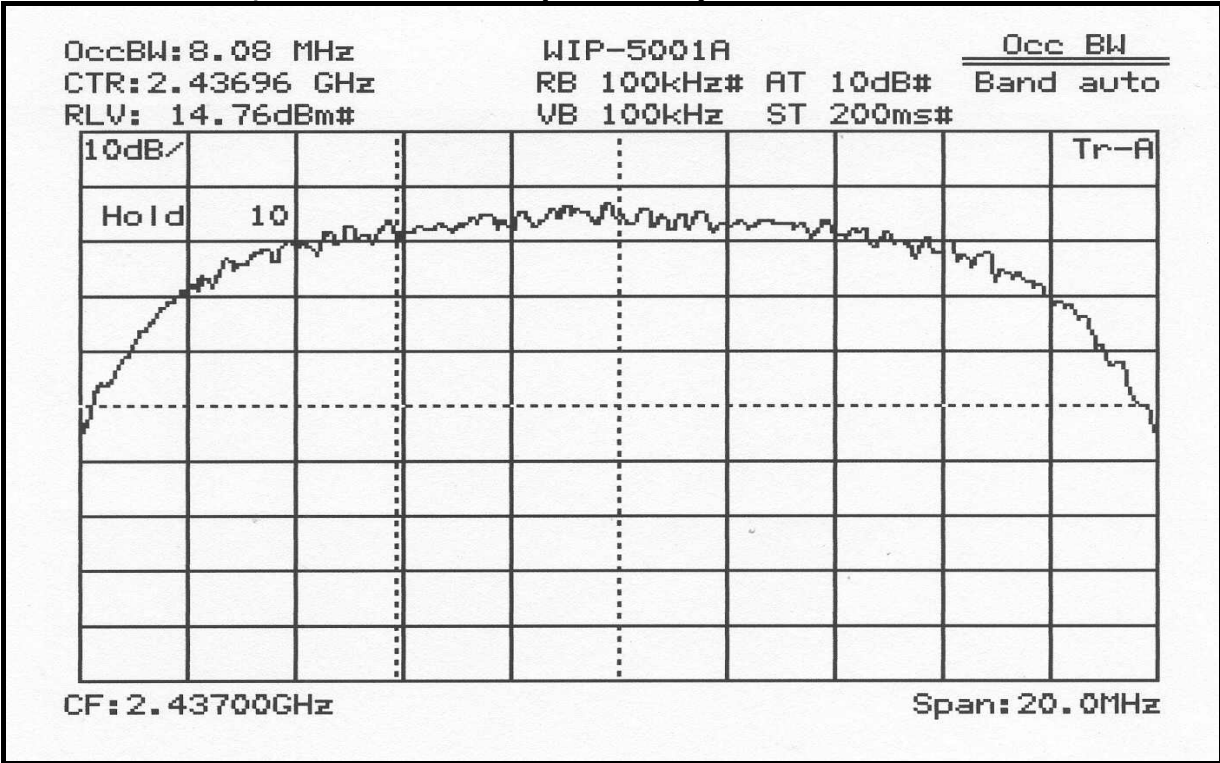
Tested by **C. S. Choi**

PLOTS OF EMISSIONS

6dB Bandwidth, Lowest Channel (2412MHz)

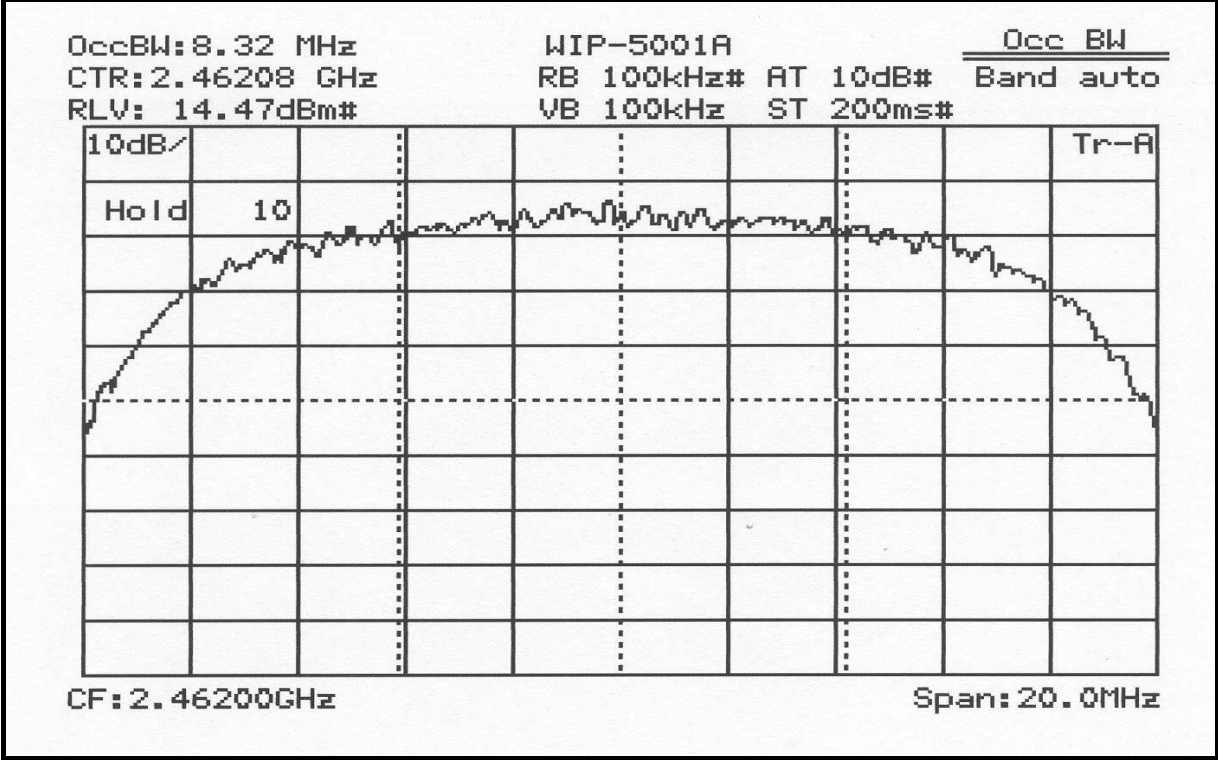


6dB Bandwidth, Middle Channel (2437MHz)



PLOTS OF EMISSIONS

6dB Bandwidth, Highest Channel (2412MHz)



TEST DATA

Peak Power Output – 15.247(b)

FCC ID : A3LWIP5001A

Test Mode : Set to Lowest channel, Middle channel and Highest channel

Channel	Frequency(MHz)	Result(dBm)	Limit(dBm)	Margin(dB)
1	2412	11.20	30	-18.80
6	2437	11.46	30	-18.54
11	2462	10.52	30	-19.48

A blue ink signature, likely of C. S. Choi, written in a cursive style.

Tested by **C. S. Choi**

TEST DATA

Conducted Spurious Emission – 15.247(c)

FCC ID : A3LWIP5001A

Test Mode : Set to Lowest channel, Middle channel and Highest channel

Channel	Frequency(MHz)	Result(dBc)	Limit(dBc)	Margin(dB)
1	2412	More than 40dBc	20	
6	2437	More than 40dBc	20	
11	2462	More than 40dBc	20	

Radiated Spurious Emission – 15.247(c)

FCC ID : A3LWIP5001A

Test Mode : Set to Lowest channel, Middle channel and Highest channel

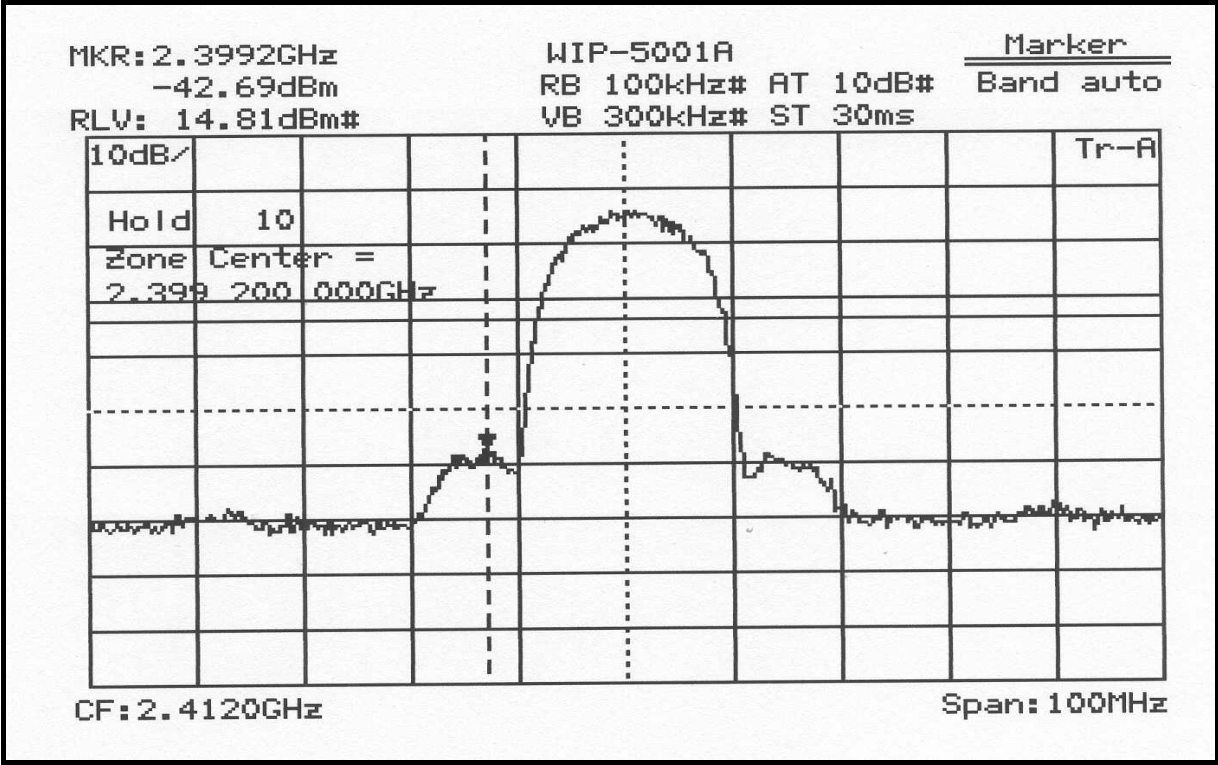
Channel	Frequency (MHz)	Pol (H/V)	Result (dBuV)	Limit (dBc)	Margin (dB)
1	2412	H	Under 20dB below Fundamental	20	
1	2412	V	Under 20dB below Fundamental	20	
6	2437	H	Under 20dB below Fundamental	20	
6	2437	V	Under 20dB below Fundamental	20	
11	2462	H	Under 20dB below Fundamental	20	
11	2462	V	Under 20dB below Fundamental	20	



Tested by **C. S. Choi**

PLOTS OF TEST DATA

Band edge at 2.4GHz, Lowest Channel



Conducted Spurious Emissions, Lowest Channel

