

## Nemko Korea CO., Ltd.

300-2, Osan-Ri, Mohyun-Myun, Yongin-City, Kyungki-Do, KOREA  
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### FCC EVALUATION REPORT FOR CERTIFICATION

**Manufacture :**

Woori Technology Inc.  
#1205, 12F, Byucksan Digital Valley III,  
212-13, Guro-Dong, Guro-Gu, Seoul, Korea

Dates of Tests : Aug. 20 – Sep 19, 2006  
Test Report No. : [NK 2GE 738.FCC](#)  
Test Site : Nemko Korea Co., Ltd.  
EMC site, Korea.

Attn : Y. S. Um

FCC ID

**RO3AVR21EN**

MODEL

**AVR21EN**

BRAND NAME

**AUDIOACCESS**

CONTACT PERSON

#1205, 12F, Byucksan Digital Valley III,,  
212-13, Guro-Dong, Guro-Gu, Seoul, Korea  
Y. S. Um

Telephone No. : + 82-2-2102-5315

FCC Rule Part(s)

: [Part 15 & 2](#)

Classification

: [FCC Class B Device \(AV Receiver\)](#)

Port/Connector(s)

: Audio INOUT (18), 8CH DVD Audio Direct IN (8), Subwoofer Pre-out (1),  
Pre-amp.-OUT (7), Component Video IN/OUT (7), S-Video IN/OUT (10),  
Composite Video IN/OUT (10), Digital Coaxial IN/OUT (4), RS-232 (1),  
DVD Changer Interface Terminal (3), Remote IR IN/Out (2),  
Multi Room LINK (2), Common IR Control Out (1), Source IP Control (6),  
Trigger OUT (1), Source SPS Input (6), Video Source Out (6),  
Door A/V Audio IN (1), Door A/V Composite Video IN (1).  
Antenna FM/AM (4), Speaker (7), Microphone (1), Headphone (1)

The device bearing the trade name and model 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 C63.4-2006.

The test results of this report are deemed satisfactory evidence of compliance with Industry Canada Interference-Causing Equipment Standard ICES-003.

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.



Test By : J. Y. YU  
Engineer



Reviewed By : H.H. Kim  
Manager & Chief Engineer

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## MEASUREMENT REPORT

*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.*

<b>Responsible Party* :</b>	<b>WOORI Technology Inc.</b>
<b>Contact Person :</b>	Mr. Y. S. Um (Michael Um)
	Tel No.: + 82-2-2102-5315
	Fax No.: + 85-2-2102-5319
<b>Factory:</b>	<b>Guangzhou Telefield Ltd.</b>
	No. 1 Industrial Area, Zhuliao, Guanzhou Baiyun Area,
	Guangdong Province, P.R. China.
	Tel No.: + 86-20-8744-0109 (ext. 218)
	Mr. Young Dae, Rho (Managing Director)

- **FCC ID:** *RO3AVR21EN*
- **Trade / Model:** *AVR21EN*
- **Brand Name:** *AUDIOACCESS*
- **EUT Type:** *AV Receiver*
- **Port/Connectors:** Audio INOUT (18), 8CH DVD Audio Direct IN (8), Subwoofer Pre-out (1), Pre-amp.-OUT (7), Component Video IN/OUT (7), S-Video IN/OUT (10), Composite Video IN/OUT (10), Digital Coaxial IN/OUT (4), RS-232 (1), DVD Changer Interface Terminal (3), Remote IR IN/Out (2), Multi Room LINK (2), Common IR Control Out (1), Source IP Control (6), Trigger OUT (1), Source SPS Input (6), Video Source Out (6), Door A/V Audio IN (1), Door A/V Composite Video IN (1). Antenna FM/AM (4), Speaker (7), Microphone (1), Headphone (1)
- **Classification:** *FCC Class B*
- **Rule Part(s):** *FCC Part 15 & Part 2, ICES-003*
- **Test Procedure(s):** ANSI C63.4 (2006)
- **Dates of Test:** August 20 – September 19, 2006
- **Place of Tests:** Nemko Korea Co., Ltd. EMC Site
- **Test Report No.:** *NK 2G E 738. FCC*

\* NOTE: Please refer to the duties and responsibilities of the Responsible Party attached.

## INTRODUCTION

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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 9 kHz to 40GHz (ANSI C63.4-2006) was used in determining radiated and conducted emissions emanating from **WOORI Technology Inc.**

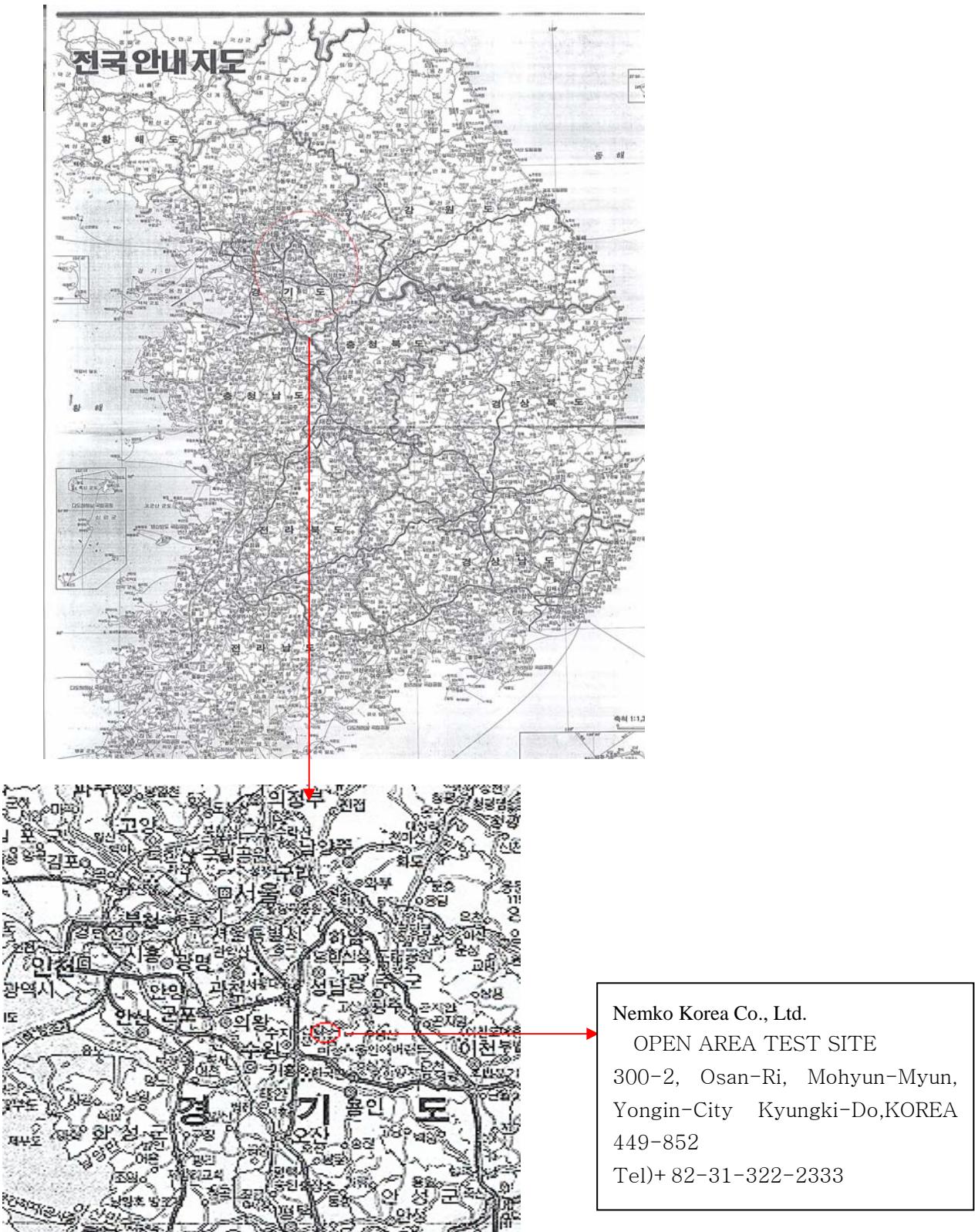
### **FCC ID : RO3AVR21EN, AV Receiver.**

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 50 kilometers (30 miles) southeast and Seoul International Airport (Kimpo 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 manufacturers.

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 July 06, 2006.



**Fig. 1.** The map above shows the Seoul in Korea vicinity area.

The map also shows Nemko Korea Corporation Ltd. EMC Lab and Kimpo Airport.

## PRODUCT INFORMATION

### Equipment Description:

The Equipment Under Test (EUT) is the *WOORI Technology Inc.*

**FCC ID: RO3AVR21EN, AV Receiver.**

<b>Clock :</b>	12.288 MHz (Y101), 20.0 MHz (Y102), 14.318 MHz (Y100), 27.0 MHz (Y102), 13.5 MHz (Y103), 24.576 MHz (U1), 49.152 (Y2), 7.3728 MHz (Y3), 8.0 MHz (Y901), 7.2 MHz (X-Tal)
<b>Chipset(s) :</b>	74VHC244MX (IC23), uPD70F3032B (IC11), uPD6464AGT (IC35), AVD7400 (IC37), FLI2300 (IC29), TSB43CB43A (U1), TSB41BA3A (U2), MSP430F149 (U12), S3P825A (IC93), LC72131M (IC02)
<b>Port(s) :</b>	Audio INOUT (18), 8CH DVD Audio Direct IN (8), Subwoofer Pre-out (1), Pre-amp.-OUT (7), Component Video IN/OUT (7), S-Video IN/OUT (10), Composite Video IN/OUT (10), Digital Coaxial IN/OUT (4), RS-232 (1), DVD Changer Interface Terminal (3), Remote IR IN/Out (2), Multi Room LINK (2), Common IR Control Out (1), Source IP Control (6), Trigger OUT (1), Source SPS Input (6), Video Source Out (6), Door A/V Audio IN (1), Door A/V Composite Video IN (1). Antenna FM/AM (4), Speaker (7), Microphone (1), Headphone (1)
<b>Power Consumption :</b>	AC 120V/60Hz 600W

### *PWB Description*

P.W. Board Name	Part No.(Model)	Manufacture	S/N.	Remark
<b>Front</b>	PBD 66 KRCI 20	Woori Technology Inc.	N/A	
<b>Processor</b>	PBD 66 KPOC 20	Woori Technology Inc.	N/A	
<b>Video</b>	PBD 66 KVDH 20	Woori Technology Inc.	N/A	
<b>Digital Amp.</b>	PBD 66 KAMC 20	Woori Technology Inc.	N/A	
<b>1394</b>	PBD 66 KNOC 20	Woori Technology Inc.	N/A	
<b>Outlet</b>	PBD 66 KOUI 20	Woori Technology Inc.	N/A	
<b>SMPS Power</b>	MPA-WT04A01	Mures Co., Ltd	N/A	
<b>Tuner</b>	KST-MV014MA	KWANG SUNG	N/A	

EMI suppression device(s) installed in production:

- see circuit diagram ([Appendix B](#))

EMI suppression device(s) added and/or modified during testing:

- none

## 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 1mX 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-407) 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 LISN's,

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 out put 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 150 kHz to 30MHz with 20msec sweep time.

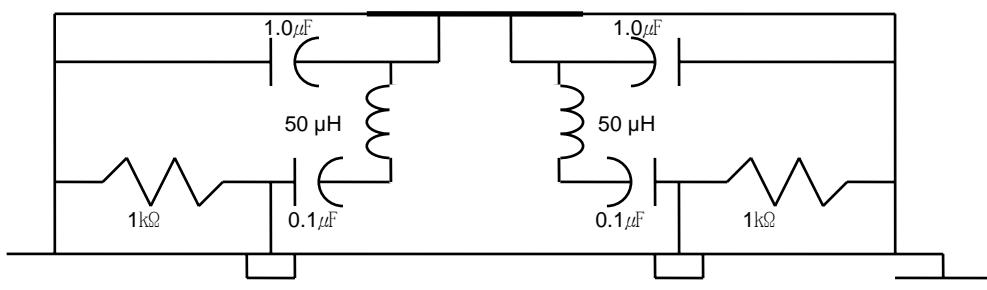
The frequency producing the maximum level was re-examined using the EMI test receiver. (Rohde & Schwarz ESCS30).

The detector function was set to CISPR quasi-peak mode.

The bandwidth of receiver was set to 9 kHz. 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 measurements were made indoors at 1 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 system 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 30 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 quasi-peak mode and the bandwidth of the receiver was set to 120 kHz or 1MHz depending on the frequency or type of signal.

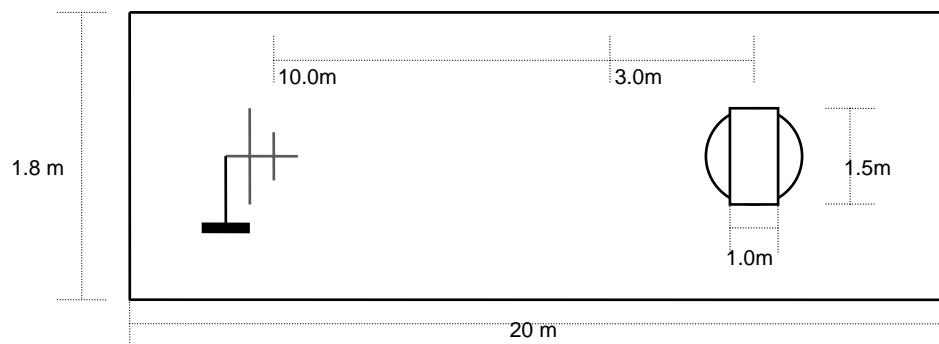
The half wave dipole antenna was tuned to the frequency found during preliminary radiated measurements.

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 system 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

## ***SUPPORT EQUIPMENT USED***

<i>Description</i>	<i>Model No.</i>	<i>Spec.</i>	<i>Manufacture</i>	<i>S/N</i>	<i>Remark</i>
AV Receiver (EUT)	<b><i>RO3AVR21EN</i></b>	120V/60Hz	WOORI TG	N/A	
WHEN	<b><i>AVH21/KP21, WPS21</i></b>	120V/60Hz	WOORI TG	N/A	
RCA Cable	-	-	-	N/A	1.5 M Shield Cable
S-Video Cable	-	-	-	N/A	1.5 M Shield Cable
Component Video	-	-	-	N/A	1.5 M Shield Cable
Remote Cable	-	-	-	N/A	1.5 M Shield Cable
Multiroom Link Cable	-	-	-	N/A	2.0 M Non Shield Cable
Microphone	Ez Set/EQ	-	Harman Kardon	N/A	5.0 M Non Shield Cable
Headphone	B.K Sound	-	B.K Sound	N/A	2.0 M Shield Cable
R-Load	IRF500NC	8 ohm	RARA	N/A	1.0 M non Shield Cable
RS-232C	-	-	-	-	2.0 M Shielded
Notebook	NT-X20F	P-IV	Samsung	955C93CY800185K	
Notebook Adapter	AD9019N		AcBel Eletric.		2.0M Shield cable
Printer	Stylus C-80		Epson	G3FE005162	2.0M Shield D-sub cable
Keyboard	SEM-DT35US	-	Samsung	63002030	1.8M shield USB cable
PS/2 Mouse	SMP2000WX	-	Samsung	N/A	1.8M shield Din cable

## TEST DATA

### Conducted Emissions

FCC ID : RO3AVR21EN

#### 1. Tuner Testing Mode :

##### 1-1. Tuner FM 98.0 MHz (with Ground)

Frequency (MHz)	Level(dB $\mu$ N)		Line	Limit(dB $\mu$ N)		Margin(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.23	43.0	39.3	L1	62.4	52.4	19.4	13.1
0.38	45.9	45.1	N	58.3	48.3	12.4	3.2
0.46	41.5	35.3	L1	56.7	46.7	15.2	11.4
0.70	50.0	36.3	L1	56.0	46.0	6.0	9.7
3.02	47.4	35.0	N	56.0	46.0	8.6	11.0
12.17	49.1	42.0	N	60.0	50.0	10.9	8.0

##### 1-2. Test Mode : Tuner FM 98.0 MHz (Non Ground)

Frequency (MHz)	Level(dB $\mu$ N)		Line	Limit(dB $\mu$ N)		Margin(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.22	42.8	41.9	N	62.8	52.8	20.0	10.9
0.45	41.8	36.9	N	56.9	46.9	15.1	10.0
0.68	48.8	36.4	N	56.0	46.0	7.2	9.6
0.92	45.6	32.6	L1	56.0	46.0	10.4	13.4
3.18	48.0	34.0	L1	56.0	46.0	8.0	12.0
16.90	38.4	35.5	L1	60.0	50.0	21.6	14.5

## 2. Other Testing Mode :

### 2-1. DVD 7CH Stereo Mode (with Ground)

Frequency (MHz)	Level(dB $\mu$ N)		Line	Limit(dB $\mu$ N)		Margin(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.22	43.5	42.6	L1	62.8	52.8	19.3	10.2
0.38	45.0	44.9	N	58.3	48.3	13.3	3.4
0.66	47.4	33.9	L1	56.0	46.0	8.6	12.1
0.86	48.0	33.1	L1	56.0	46.0	8.0	12.9
3.10	46.6	30.1	N	56.0	46.0	9.4	15.9
9.21	51.1	43.3	N	60.0	50.0	8.9	6.7

### 2-2. Test Mode : DVD 7CH Stereo Mode (Non Ground)

Frequency (MHz)	Level(dB $\mu$ N)		Line	Limit(dB $\mu$ N)		Margin(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.22	43.5	42.2	L1	62.8	52.8	19.3	10.6
0.38	46.5	43.3	L1	58.3	48.3	11.8	5.0
0.66	46.6	31.5	N	56.0	46.0	9.4	14.5
0.86	48.5	35.2	L1	56.0	46.0	7.5	10.8
3.10	48.5	30.1	N	56.0	46.0	7.5	15.9
13.10	42.6	43.3	N	60.0	50.0	17.4	6.7

## 3. WHEN System Connected Testing Mode :

### 3-1. Test Mode : WHEN Connected Operating Mode (with Ground)

Frequency (MHz)	Level(dB $\mu$ N)		Line	Limit(dB $\mu$ N)		Margin(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.23	42.6	41.8	N	62.4	52.4	19.8	10.6
0.46	41.5	36.8	L1	56.7	46.7	15.2	9.9
0.68	49.7	37.1	L1	56.0	46.0	6.3	8.9
0.91	46.3	32.2	L1	56.0	46.0	9.7	13.8
3.02	48.1	35.4	N	56.0	46.0	7.9	10.6
8.44	48.5	45.4	N	60.0	50.0	11.5	4.6

**3-2. Test Mode : WHEN Connected Operating Mode (Non Ground)**

Frequency (MHz)	Level(dB $\mu$ N)		Line	Limit(dB $\mu$ N)		Margin(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.23	42.6	42.0	N	62.4	52.4	19.8	10.4
0.45	43.0	39.9	L	56.9	46.9	13.9	7.0
0.68	48.1	41.1	L1	56.0	46.0	7.9	4.9
0.88	46.8	33.1	L1	56.0	46.0	9.2	12.9
3.12	50.3	35.0	N	56.0	46.0	5.7	11.0
9.72	45.2	43.7	L1	60.0	50.0	14.8	6.3

**Table 1. Line Conducted Emissions Tabulated Data**
**NOTES:**

1. Measurements using CISPR quasi-peak mode
2. All modes of operation were investigated and the worst -case emission are reported. See attached Plots.
3. The limit for Class B device is on the FCC part section 15.107 (a).
4. LINE : L1 =Line , N = Neutral




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Tested by **Jae Young, Yu**

## TEST DATA

### 1. Radiated Emissions (*Receiving Mode*)

FCC ID : RO3AVR21EN

T.Freq.* (MHz)	Freq. (MHz)	Reading (dB $\mu$ V)	AFCL+ Amp. (dB)**	Pol *** (H/V)	Limit (dB $\mu$ V)	Result (dB $\mu$ V)	Margin (dB)
87.5	98.20	38.0	-11.51	V	43.5	26.5	17.00
	196.40	40.7	-9.48	H	43.5	31.2	12.30
	294.60	36.6	-8.35	H	46.0	28.2	17.80
	392.80	37.3	-7.21	H	46.0	30.1	15.90
98.0	108.70	38.9	-11.35	V	43.5	27.5	16.00
	217.40	41.9	-9.70	H	46.0	32.2	13.80
	326.10	39.1	-8.30	H	46.0	30.8	15.20
	434.80	30.7	-6.05	H	46.0	24.6	21.40
108.0	118.70	40.6	-11.24	V	43.5	29.4	14.10
	237.40	46.6	-10.02	V	46.0	36.6	9.40
	356.10	38.8	-8.36	H	46.0	30.4	15.60
	474.80	34.4	-5.00	H	46.0	29.4	16.60

Table 2. Radiated Measurements at 3meters.

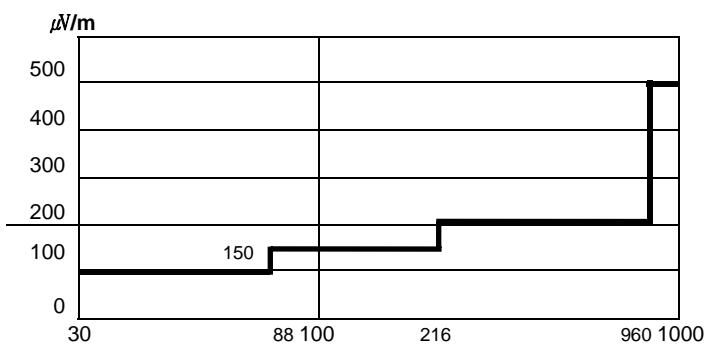


Fig. 4. Limits at 3 meters

#### 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  $\mu$ V/m.

MHz

\* T.Freq = Turning Frequency

\*\* AFCL+Amp. = Antenna Factor + Cable Loss + Amplifier

\*\*\* Measurements using CISPR quasi-peak mode. Above 1GHz, peak detector function mode is used using a resolution bandwidth of 1MHz and a video bandwidth of 1MHz. The peak level complies with the average limit. Peak mode is used with linearly polarized horn antenna and low-loss microwave cable.



Tested by **Jae Young, Yu**

**TEST DATA****2. Radiated Emissions (Others)****FCC ID : RO3AVR21EN****Test Mode : DVD Analog 7CH Stereo Mode**

Frequency (MHz)	Reading (dB $\mu$ V)	Pol* (H/V)	AFCL+ Amp. (dB)**	Result (dB $\mu$ N/m)	Limit (dB $\mu$ N/m)	Margin (dB)
73.73	52.8	V	-16.6	36.2	40.0	3.8
122.87	51.1	H	-13.1	38.0	43.5	5.5
135.16	47.0	H	-8.3	38.7	43.5	4.8
245.75	50.4	H	-9.9	40.5	46.0	5.5
294.90	52.6	V	-9.8	42.8	46.0	3.2
331.77	51.6	V	-8.9	42.7	46.0	3.3
466.93	50.5	H	-7.8	42.7	46.0	3.3
516.08	49.8	V	-7.2	42.6	46.0	3.4
552.95	48.6	H	-5.8	42.8	46.0	3.2
602.10	47.1	H	-4.8	42.3	46.0	3.7
774.13	46.3	V	-4.6	41.7	46.0	4.3
946.15	41.9	V	-1.8	40.1	46.0	5.9

\* Above 1GHz : Not significant or detectable.

**Table 2. Radiated Measurements at 3meters**

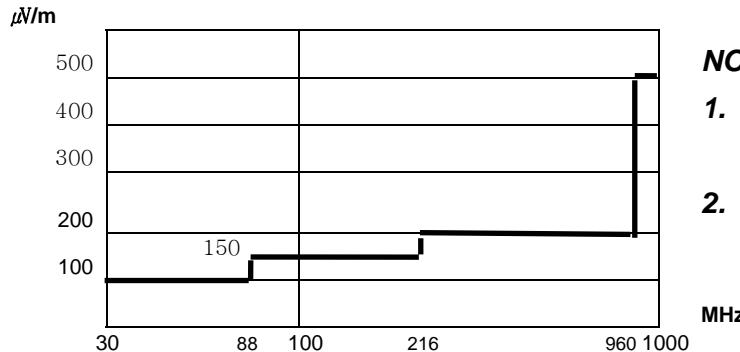


Fig. 4. Limits at 3 meters

**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 $\mu$ V/m.

\* Pol. H=Horizontal V=Vertical

\*\* AFCL+Amp. = Antenna Factor + Cable Loss + Amplifier.

\*\*\* Measurements using CISPR quasi-peak mode. Above 1GHz, peak detector function mode is used using a resolution bandwidth of 1MHz and a video bandwidth of 1MHz. The peak level complies with the average limit. Peak mode is used with linearly polarized horn antenna and low-loss microwave cable.

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Tested by **Jae Young, Yu**

## TEST DATA

### 1. Antenna Power Conducted Emissions (*Receiving Mode*)

FCC ID : RO3AVR21EN

#### 1-1. Tuner 1

T.Freq.* (MHz)	Freq. (MHz)	Level (dB $\mu$ V)	MPL** (dB)	Limit (dB $\mu$ V)	F/S (dB $\mu$ V)	Margin*** (dB)
87.5	98.20	23.2	7.5	50.0	30.70	19.30
	196.40	21.8	7.5	50.0	29.30	20.70
	294.60	13.7	7.5	50.0	21.20	28.80
	392.80	16.8	7.5	50.0	24.30	25.70
	491.00	18.5	7.5	50.0	26.00	24.00
	589.20	10.5	7.5	50.0	18.00	32.00
	687.40	11.2	7.5	50.0	18.70	31.30
	785.60	20.8	7.5	50.0	28.30	21.70
	883.80	10.1	7.5	50.0	17.60	32.40
	982.00	10.3	7.5	50.0	17.80	32.20
98.0	108.70	24.7	7.5	50.0	32.20	17.80
	217.40	23.0	7.5	50.0	30.50	19.50
	326.10	18.0	7.5	50.0	25.50	24.50
	434.80	20.5	7.5	50.0	28.00	22.00
	543.50					
	652.20					
	760.90					
	869.60					
	978.30					
108.0	118.70	26.4	7.5	50.0	33.90	16.10
	237.40	22.5	7.5	50.0	30.00	20.00
	356.40	22.9	7.5	50.0	30.40	19.60
	474.80	20.4	7.5	50.0	27.90	22.10
	593.50					
	712.20					
	830.90	29.5	7.5	50.0	37.00	13.00
	949.60	13.1	7.5	50.0	20.60	29.40

Table 4-1. Antenna Power Conducted Emissions Tabulated Data

**1-2. Tuner 2**

T.Freq.* (MHz)	Freq. (MHz)	Level (dB $\mu$ W)	MPL** (dB)	Limit (dB $\mu$ W)	F/S (dB $\mu$ W)	Margin*** (dB)
87.5	98.20	23.3	7.5	50.0	30.80	19.20
	196.40	21.0	7.5	50.0	28.50	21.50
	294.60	12.6	7.5	50.0	20.10	29.90
	392.80					
	491.00					
	589.20					
	687.40					
	785.60	19.9	7.5	50.0	27.40	22.60
	883.80	9.8	7.5	50.0	17.30	32.70
	982.00	8.6	7.5	50.0	16.10	33.90
98.0	108.70	24.7	7.5	50.0	32.20	17.80
	217.40	22.2	7.5	50.0	29.70	20.30
	326.10	16.2	7.5	50.0	23.70	26.30
	434.80	11.2	7.5	50.0	18.70	31.30
	543.50					
	652.20					
	760.90					
	869.60					
	978.30					
	118.70	26.5	7.5	50.0	34.00	16.00
108.0	237.40	21.7	7.5	50.0	29.20	20.80
	356.40	20.3	7.5	50.0	27.80	22.20
	474.80	10.5	7.5	50.0	18.00	32.00
	593.50					
	712.20					
	830.90					
	949.60					

**Table 4-2. Antenna Power Conducted Emissions Tabulated Data**
**NOTES :**

1. All modes of operation were investigated the worst-case emission are reported.
2. The limits is 2.0 nanowatts from 30MHz to 960MHz.

\* T.Freq = Turning Frequency.

\*\* MPL = Matching Pad Loss.

\*\*\* Measurements using CISPR quasi-peak mode.




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Tested **Jae-Young, Yu**

## 2. Antenna Power Conducted Emissions (*Others*)

FCC ID : RO3AVR21EN

Freq. (MHz)	Level (dB $\mu$ W)	MPL** (dB)	Limit (dB $\mu$ W)	F/S (dB $\mu$ W)	Margin*** (dB)

Table 5. Antenna Power Conducted Emissions Tabulated Data

**NOTES:**

1. All modes of operation were investigated the worst-case emission are reported.
2. The limits is 2.0 nanowatts from 30MHz to 960MHz.

\* T.Freq = Turning Frequency.

\*\* MPL = Matching Pad Loss.

\*\*\* Measurements using CISPR quasi-peak mode.



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Tested **Jae-Young, Yu**

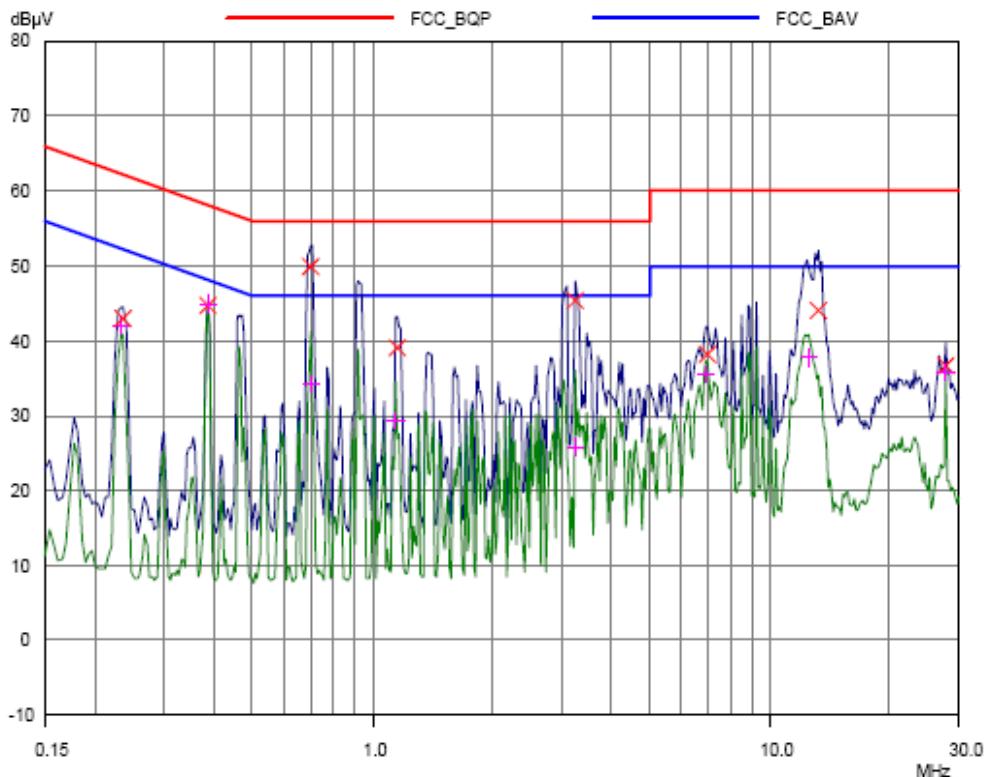
## ***PLOTS OF EMISSIONS***

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**1-1. Tuner Mode**
**(L1 : with Ground)**
**NEMKO KOREA (NK-2G-E738)**
**Conducted Emissions**

**EUT:** AV Receiver  
**Manuf:** Danech  
**Op Cond:** AC 120V / 60Hz (1kHz Signal IN, FM 98.0MHz Stereo mode)  
**Operator:** J.Y. YU  
**Test Spec:** FCC Class B  
**Comment:** Model : AVR21EN (With GND)  
**LINE : L1**

Scan Settings		(1 Range)				Receiver Settings				
		Frequencies		Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
Start	150kHz	Start	30MHz	Step	3.8063kHz	IF BW	9kHz	Detector	20msec	20 dB
Stop		Stop				PK+AV			Preamp	OFF
Transducer	No.	Start	Stop			Name				
	1	150kHz	30MHz			CE_LINE				
Final Measurement:		Detectors:	X QP / + AV							
		Meas Time:	1sec							
		Subranges:	8							
		Acc Margin:	30 dB							

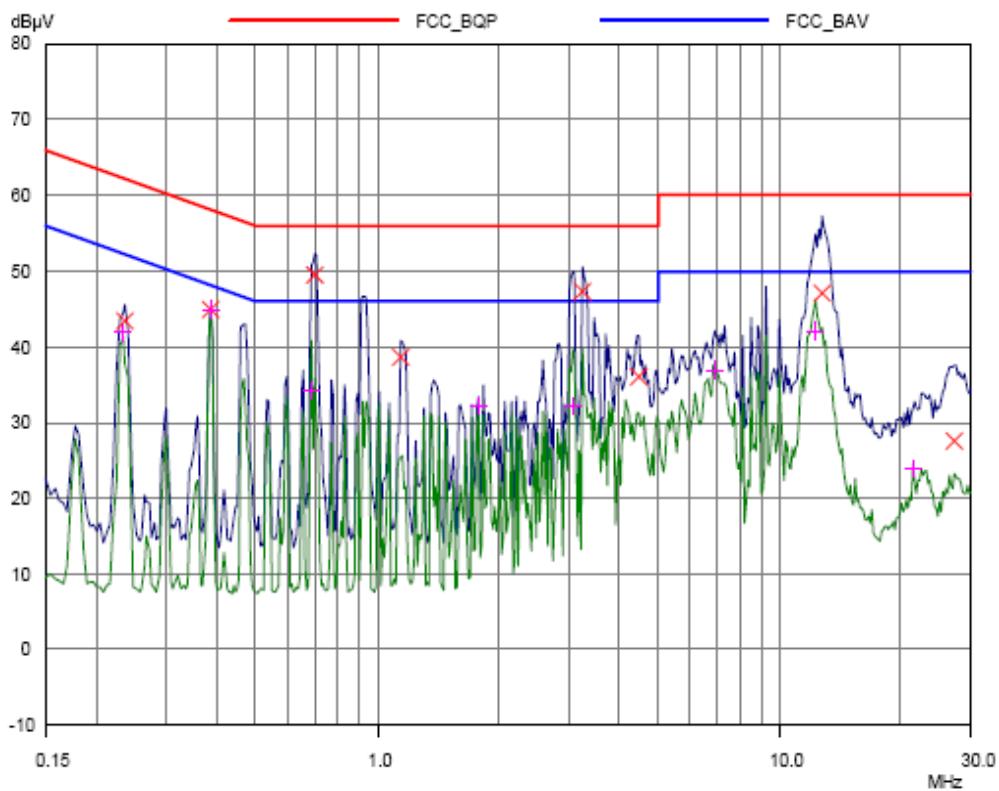


**Tested Jae-Young, Yu**

**1-2. Tuner Mode**  
**(Neutral : with Ground)**
**NEMKO KOREA (NK-2G-E738)**
**Conducted Emissions**

EUT: AV Receiver  
 Manuf: Danech  
 Op Cond: AC 120V / 60Hz (1kHz Signal IN, FM 98.0MHz Stereo mode)  
 Operator: J.Y. YU  
 Test Spec: FCC Class B  
 Comment: Model : AVR21EN (With GND)  
 LINE : Neutral

Scan Settings		(1 Range)			Receiver Settings						
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge			
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	20msec	20 dB	OFF	60dB			
Transducer		No.	Start	Stop	Name						
		1	150kHz	30MHz	CE_NEUT						
Final Measurement:		Detectors:		X QP / + AV							
		Meas Time:		1sec							
		Subranges:		8							
		Acc Margin:		30 dB							

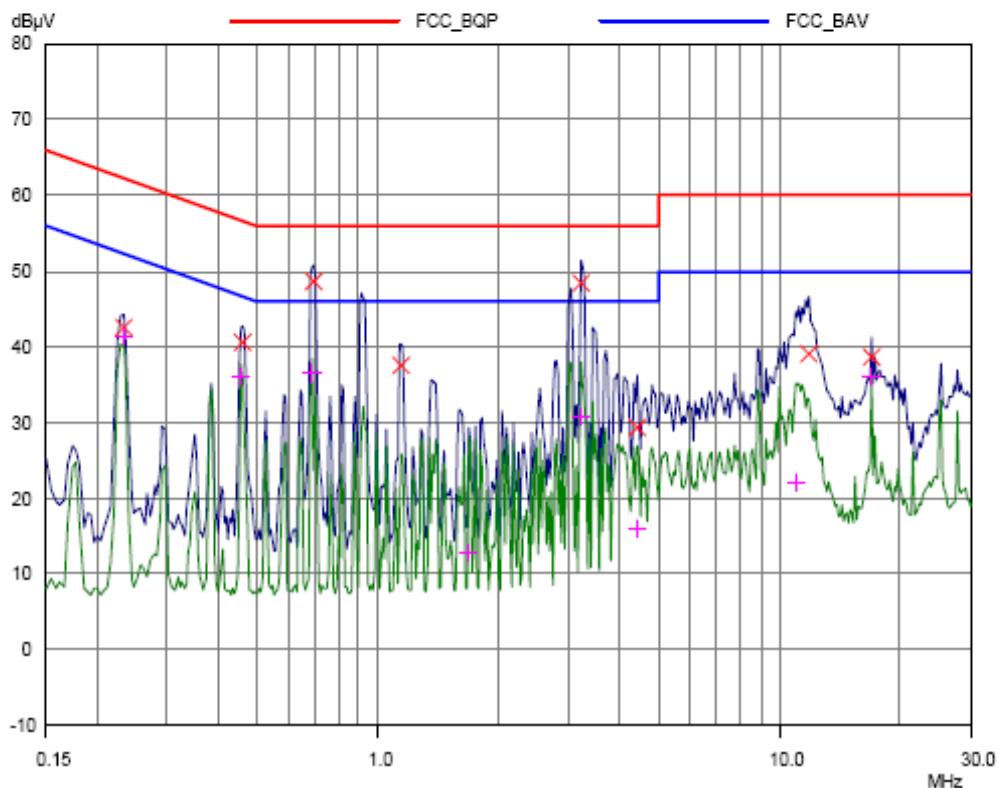


**Tested Jae-Young, Yu**

**1-3. Tuner Mode**
**(L1 : Non Ground)**
**NEMKO KOREA (NK-2G-E738)**
**Conducted Emissions**

EUT: AV Receiver  
 Manuf: Danech  
 Op Cond: AC 120V / 60Hz (1kHz Signal IN, FM 98.0MHz Stereo mode)  
 Operator: J.Y. YU  
 Test Spec: FCC Class B  
 Comment: Model: AVR21EN  
 LINE : L1

Scan Settings		(1 Range)				Receiver Settings				
		Frequencies		Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
Start	Stop	Start	Stop	3.9063kHz	9kHz	PK+AV	20msec	20 dB	OFF	60dB
Transducer	No.	Start	Stop							
	1	150kHz	30MHz							
Final Measurement:		Detectors:	X QP / + AV							
		Meas Time:	1sec							
		Subranges:	8							
		Acc Margin:	30 dB							

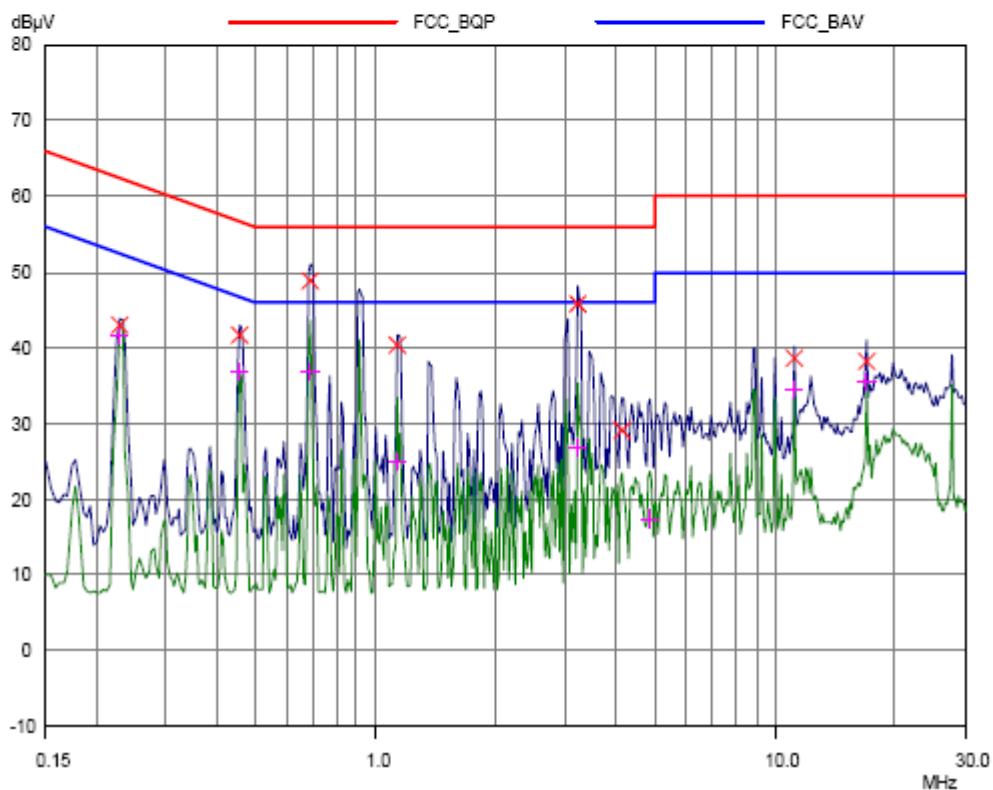


**Tested Jae-Young, Yu**

**1-4. Tuner Mode**  
**(Neutral : Non Ground)**
**NEMKO KOREA (NK-2G-E738)**
**Conducted Emissions**

**EUT:** AV Receiver  
**Manuf:** Danech  
**Op Cond:** AC 120V / 60Hz (1kHz Signal IN, FM 98.0MHz Stereo mode)  
**Operator:** J.Y. YU  
**Test Spec:** FCC Class B  
**Comment:** Model: AVR21EN  
 LINE : Neutral

Scan Settings		(1 Range)			Receiver Settings					
		Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
		150kHz	30MHz	3.9063kHz	9kHz	PK+AV	20msec	20 dB	OFF	60dB
Transducer	No.	Start	Stop			Name				
	1	150kHz	30MHz			CE_NEUT				
Final Measurement:		Detectors:	X QP / + AV							
		Meas Time:	1sec							
		Subranges:	8							
		Acc Margin:	30 dB							

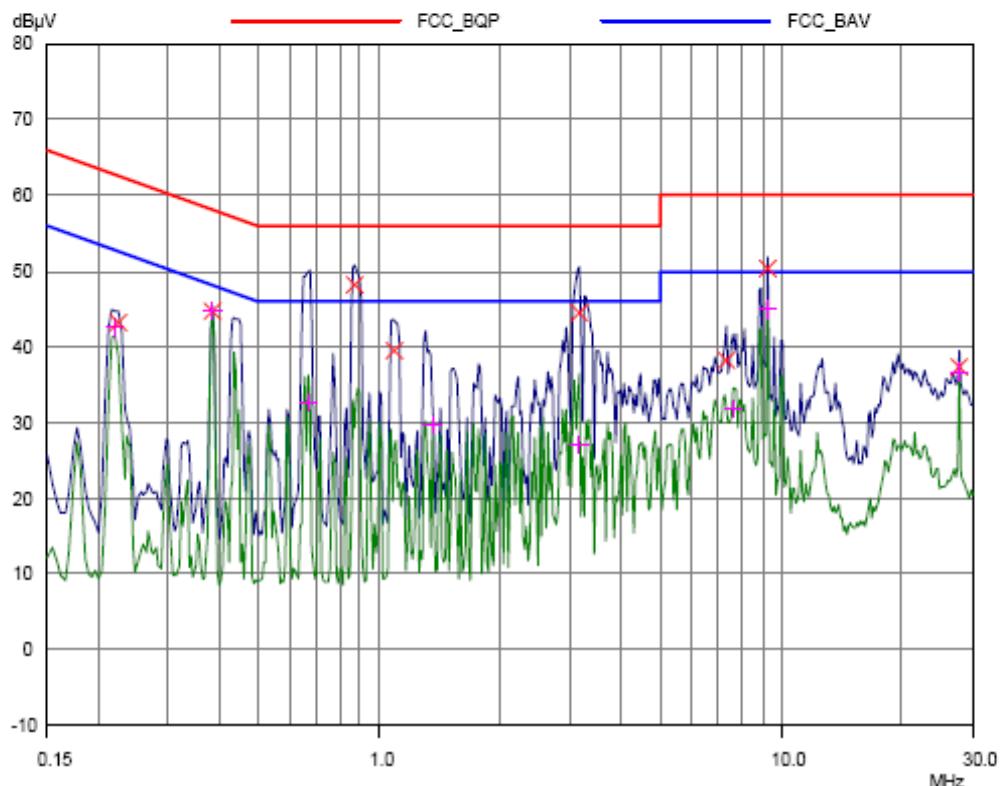


**Tested Jae-Young, Yu**

**2-1. DVD 7CH Stereo Mode**  
**(L1 : with Ground)**
**NEMKO KOREA (NK-2G-E738)**
**Conducted Emissions**

**EUT:** AV Receiver  
**Manuf:** Danech  
**Op Cond:** AC 120V / 60Hz (1kHz Signal IN, 7CH Stereo mode)  
**Operator:** J.Y. YU  
**Test Spec:** FCC Class B  
**Comment:** Model : AVR21EN (With GND)  
 LINE : L1

Scan Settings		(1 Range)				Receiver Settings						
		Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge		
		150kHz	30MHz	3.0063kHz	9kHz	PK+AV	20msec	20 dB	OFF	60dB		
Transducer	No.	Start		Stop		Name						
	1	150kHz		30MHz		CE_LINE						
Final Measurement:		Detectors:	X QP / + AV									
		Meas Time:	1sec									
		Subranges:	8									
		Acc Margin:	30 dB									

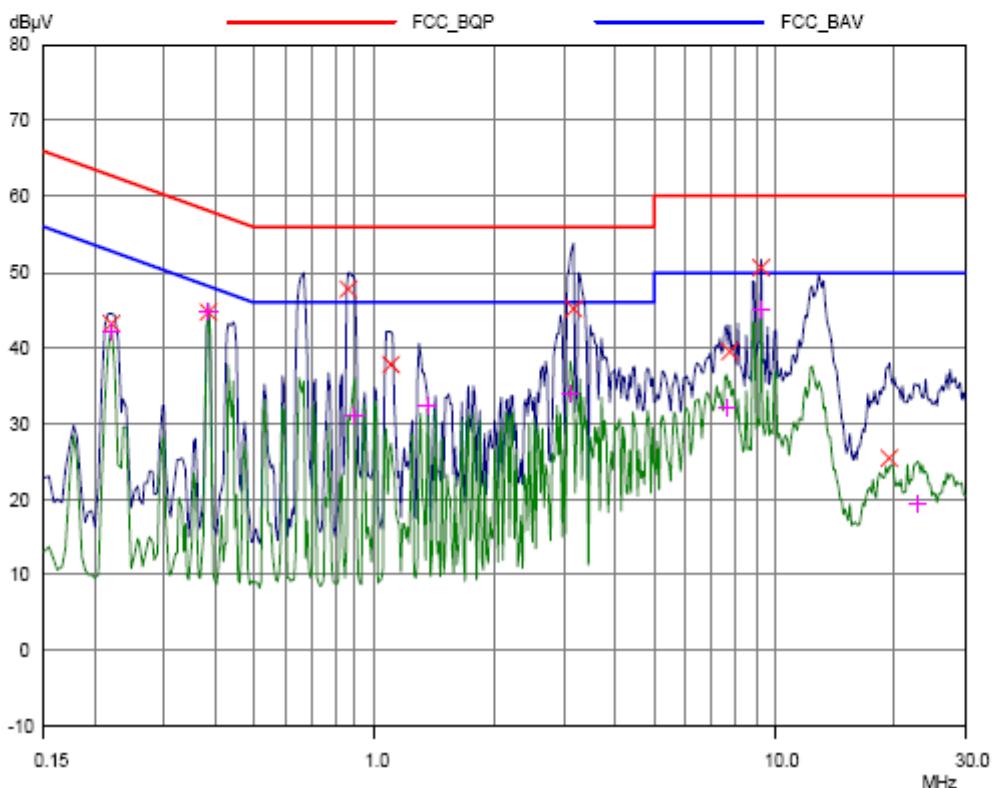


**Tested Jae-Young, Yu**

**2-2. DVD 7CH Stereo Mode**  
**(Neutral : with Ground)**
**NEMKO KOREA (NK-2G-E738)**
**Conducted Emissions**

**EUT:** AV Receiver  
**Manuf:** Danech  
**Op Cond:** AC 120V / 60Hz (1kHz Signal IN, 7CH Stereo mode)  
**Operator:** J.Y. YU  
**Test Spec:** FCC Class B  
**Comment:** Model : AVR21EN (With GND)  
 LINE : Neutral

Scan Settings		(1 Range)			Receiver Settings					
		Frequencies		Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
Transducer	No.	Start	Stop	3.9063kHz	9kHz	PK+AV	20msec	20 dB	OFF	60dB
	1	150kHz	30MHz							
Final Measurement:		Detectors: X QP / + AV		Meas Time: 1sec		Subranges: 8		Acc Margin: 30 dB		

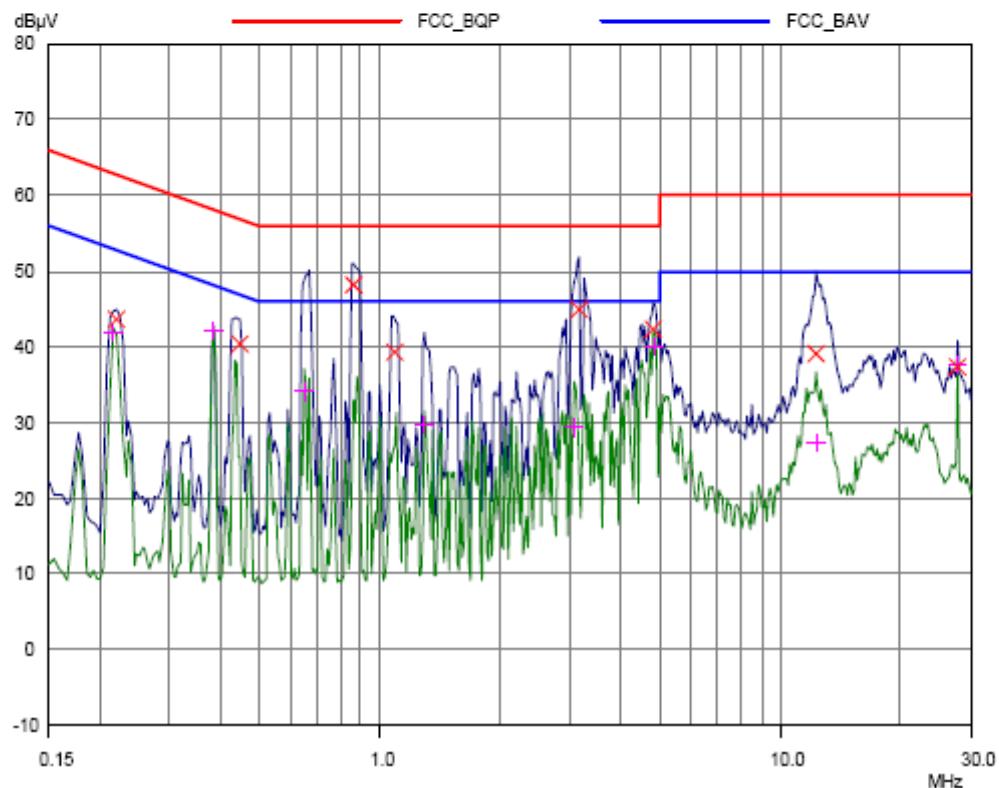


**Tested Jae-Young, Yu**

**2-3. DVD 7CH Stereo Mode**  
**(L1 : Non Ground)**
**NEMKO KOREA (NK-2G-E738)**
**Conducted Emissions**

EUT: AV Receiver  
 Manuf: Danech  
 Op Cond: AC 120V / 60Hz (1kHz Signal IN, 7CH Stereo mode)  
 Operator: J.Y. YU  
 Test Spec: FCC Class B  
 Comment: Model : AVR21EN  
 LINE : L1

Scan Settings		(1 Range)				Receiver Settings				
		Frequencies		Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
Start		Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz		30MHz		3.9063kHz	9kHz	PK+AV	20msec	20 dB	OFF	60dB
<hr/>										
Transducer	No.	Start	Stop			Name				
	1	150kHz	30MHz			CE_LINE				
<hr/>										
Final Measurement:		Detectors:	X QP / + AV							
		Meas Time:	1sec							
		Subranges:	8							
		Acc Margin:	30 dB							

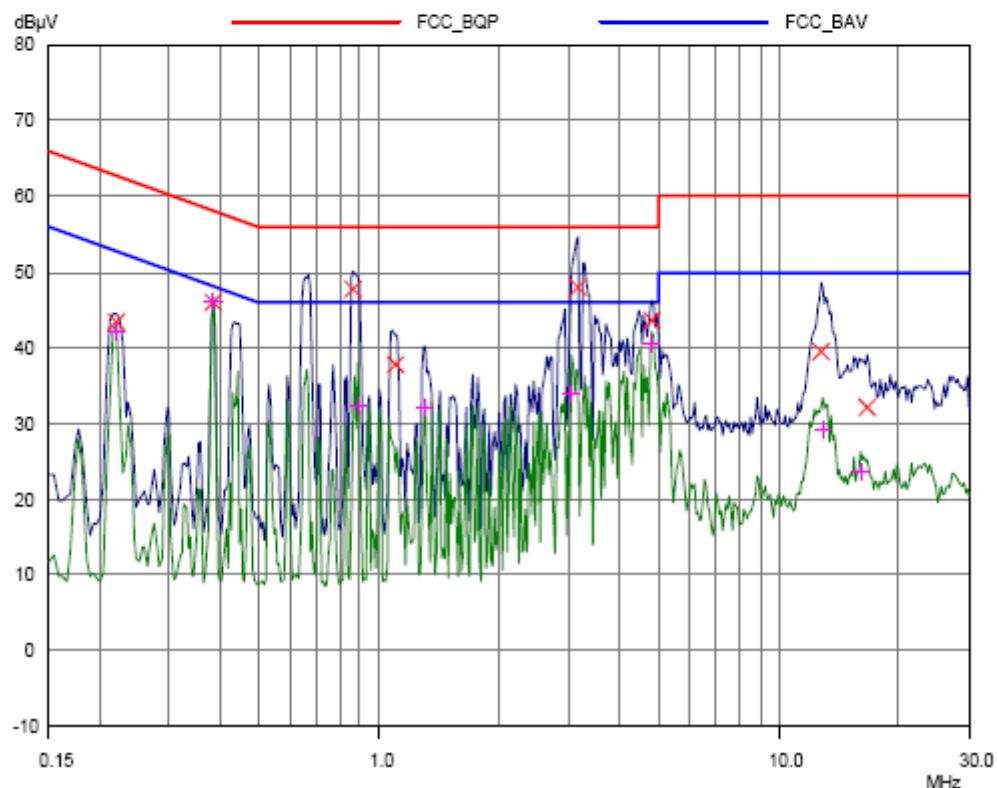


**Tested Jae-Young, Yu**

**2-4. DVD 7CH Stereo Mode**  
**(Neutral : Non Ground)**
**NEMKO KOREA (NK-2G-E738)**
**Conducted Emissions**

**EUT:** AV Receiver  
**Manuf:** Danech  
**Op Cond:** AC 120V / 60Hz (1kHz Signal IN, 7CH Stereo mode)  
**Operator:** J.Y. YU  
**Test Spec:** FCC Class B  
**Comment:** Model: AVR21EN  
 LINE : Neutral

Scan Settings		(1 Range)			Receiver Settings						
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge			
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	20msec	20 dB	OFF	60dB			
Transducer		No.	Start	Stop	Name						
		1	150kHz	30MHz	CE_NEUT						
Final Measurement:		Detectors:		X QP / + AV							
		Meas Time:		1sec							
		Subranges:		8							
		Acc Margin:		30 dB							



**Tested Jae-Young, Yu**

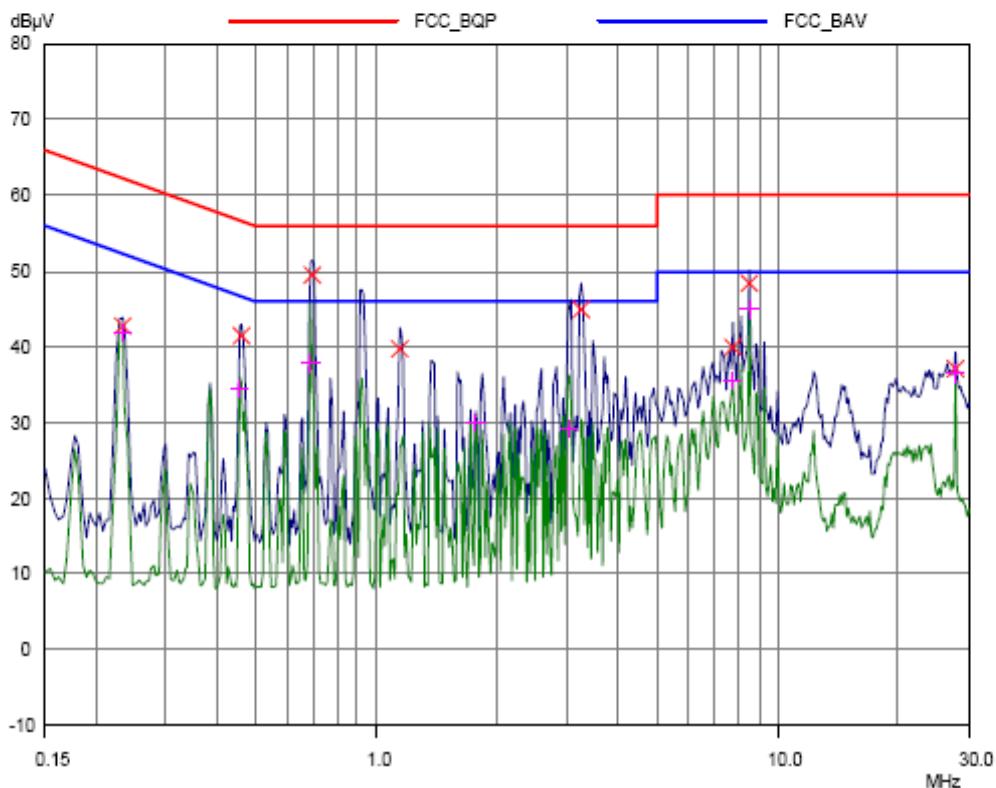
### 3-1. WPS Connected Mode (L1 : with Ground)

NEMKO KOREA (NK-2G-E738)

Conducted Emissions

EUT: AV Receiver  
 Manuf: Danech  
 Op Cond: AC 120V / 60Hz (1kHz Signal IN, 7CH Stereo mode)  
 Operator: J.Y. YU  
 Test Spec: FCC Class B  
 Comment: Model : AVR21EN (With GND, WPS21 was connected to EUT)  
 LINE : L1

Scan Settings		(1 Range)				Receiver Settings				
		Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
		150kHz	30MHz	3.9063kHz	9kHz	PK+AV	20msec	20 dB	OFF	60dB
Transducer	No.	Start	Stop			Name				
	1	150kHz	30MHz			CE_LINE				
Final Measurement:		Detectors:	X QP / + AV							
		Meas Time:	1sec							
		Subranges:	8							
		Acc Margin:	30 dB							

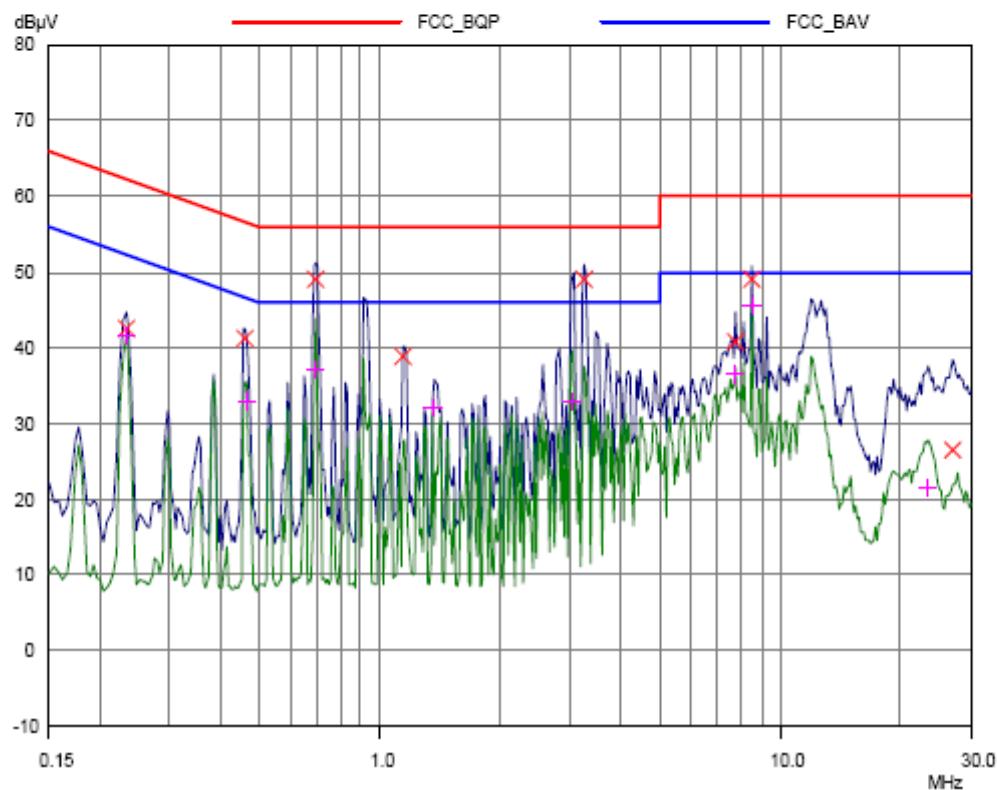



Tested **Jae-Young, Yu**

**3-2. WPS Connected Mode  
(Neutral : with Ground)**
**NEMKO KOREA (NK-2G-E738)**
**Conducted Emissions**

**EUT:** AV Receiver  
**Manuf:** Danech  
**Op Cond:** AC 120V / 60Hz (1kHz Signal IN, 7CH Stereo mode)  
**Operator:** J.Y. YU  
**Test Spec:** FCC Class B  
**Comment:** Model : AVR21EN (With GND, WPS21 was connected to EUT)  
**LINE :** Neutral

Scan Settings		(1 Range)				Receiver Settings				
		Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
		150kHz	30MHz	3.9063kHz	9kHz	PK+AV	20msec	20 dB	OFF	60dB
Transducer	No.	Start	Stop			Name				
	1	150kHz	30MHz			CE_NEUT				
Final Measurement:		Detectors:	X QP / + AV							
		Meas Time:	1sec							
		Subranges:	8							
		Acc Margin:	30 dB							



**Tested Jae-Young, Yu**

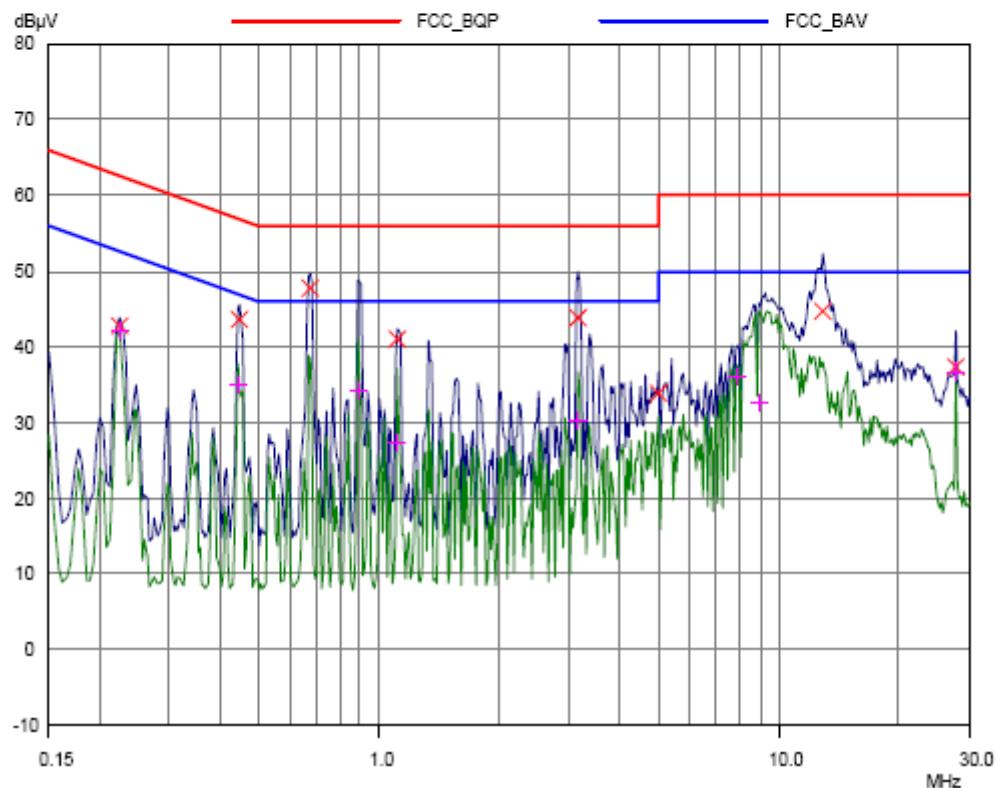
**3-3. WPS Connected Mode**  
**(L1 : Non Ground)**
**NEMKO KOREA (NK-2G-E738)**
**Conducted Emissions**

EUT: AV Receiver  
 Manuf: Danech  
 Op Cond: AC 120V / 60Hz (1kHz Signal IN, 7CH Stereo mode)  
 Operator: J.Y. YU  
 Test Spec: FCC Class B  
 Comment: Model : AVR21EN (WPS21 wsa connected to EUT)  
 LINE : L1

Scan Settings		(1 Range)				Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge		
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	20msec	20 dB	OFF	60dB		
Transducer	No.	Start	Stop	Name						
	1	150kHz	30MHz	CE_LINE						

Final Measurement:

Detectors:	X QP / + AV
Meas Time:	1sec
Subranges:	8
Acc Margin:	30 dB

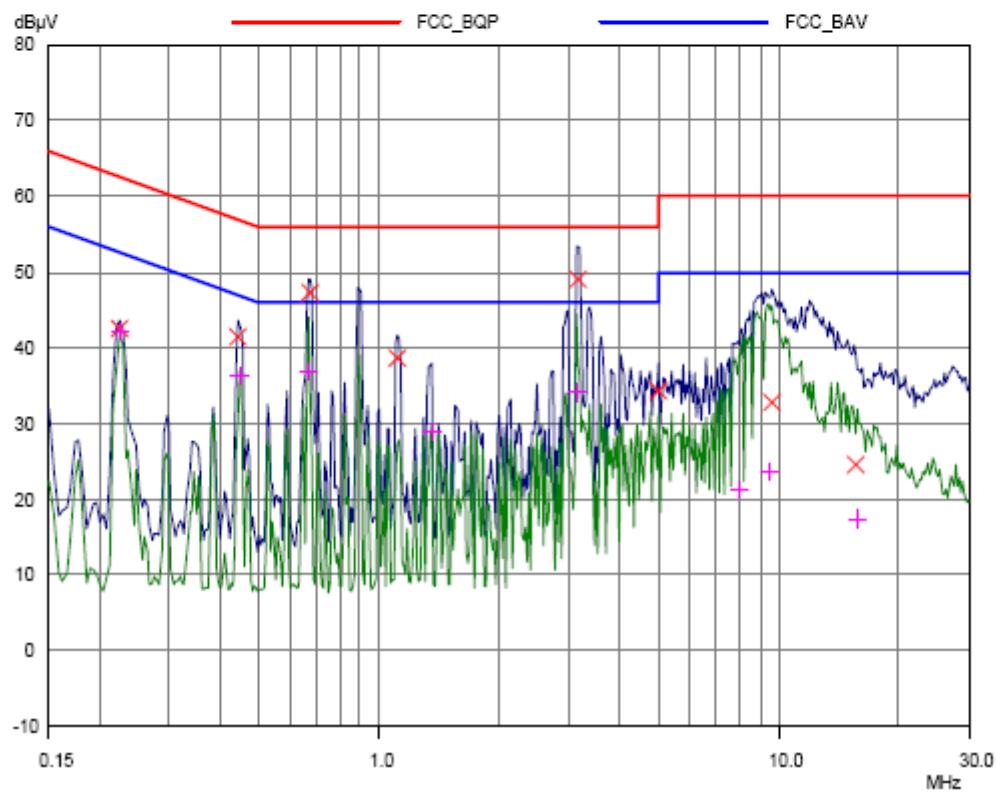


**Tested Jae-Young, Yu**

**3-4. WPS Connected Mode  
(Neutral : Non Ground)**
**NEMKO KOREA (NK-2G-E738)**
**Conducted Emissions**

**EUT:** AV Receiver  
**Manuf:** Danech  
**Op Cond:** AC 120V / 60Hz (1kHz Signal IN, 7CH Stereo mode)  
**Operator:** J.Y. YU  
**Test Spec:** FCC Class B  
**Comment:** Model : AVR21EN (WPS21 wsa connected to EUT)  
**LINE :** Neutral

Scan Settings		(1 Range)					Receiver Settings			
		Frequencies		Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
Start	Stop	Start	Stop	3.9063kHz	9kHz	PK+AV	20msec	20 dB	OFF	60dB
Transducer	No.	Start	Stop			Name				
	1	150kHz	30MHz			CE_NEUT				
Final Measurement:		Detectors:	X QP / + AV							
		Meas Time:	1sec							
		Subranges:	8							
		Acc Margin:	30 dB							



**Tested Jae-Young, Yu**

## ***SAMPLE CALCULATIONS***

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

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

### **EX. 1.**

@57.7 MHz

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

Reading = 19.1  $\text{dB}_{\mu\text{V}}$ (calibrated level)

Antenna factor + Cable Loss = 10.12 dB

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

Margin = 40.0 - 29.22 = 10.78

**10.78 dB below the limit**

## ACCURACY OF MEASUREMENT

The Measurement Uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 with the confidence level of 95%

### 1. Radiation Uncertainty Calculation

Contribution	Probability Distribution	Uncertainty(+/-dB)
Antenna Factor	Normal (k=2)	± 0.5
Cable Loss	Normal (k=2)	± 0.04
Receiver Specification	Rectangular	± 2.0
Antenna directivity	Rectangular	± 1.0
Antenna Factor variation with Height		
Antenna Phase Center Variation		
Antenna Factor Frequency Interpolation		
Measurement Distance Variation		
Site Imperfections	Rectangular	± 2.0
Mismatch:Receiver VRC ri=0.3	U-Shaped	+ 0.25 / - 0.26
Antenna VRC rR=0.1(Bi)0.4(Lp)		
Uncertainty Limits 20Log(1+/-ri rR)		
System Repeatability	Std.deviation	± 0.05
Repeatability of EUT	-	-
Combined Standard Uncertainty	Normal	± 1.77
Expended Uncertainty U	Normal (k=2)	± 3.5

### 2. Conducted Uncertainty Calculation

Contribution	Probability Distribution	Uncertainty(+/-dB)
Receiver Specification	Normal (k=2)	± 2.0
LISN coupling spec.	Normal (k=2)	± 0.4
Cable and input attenuator cal.	Rectangular	± 0.4
Mismatch:Receiver VRC ri=0.3	U-Shaped	± 0.26
LISN vrc rg=0.1		
Uncertainty Limits 20Log(1+/-ri rR)		
System Repeatability	Std.deviation	± 0.68
Repeatability of EUT	-	-
Combined Standard Uncertainty	Normal	± 1.18
Expended Uncertainty U	Normal (k=2)	± 2.4

## TEST EQUIPMENT

No.	Instrument	Manufacturer	Model	Due to Calibration
<b>1. EMI TEST SYSTEM</b>				
1	* Test Receiver	R & S	ESCS 30	2007. 08
2	* Test Receiver	R & S	ESCS 30	2006. 12
3	* Amplifier	HP	8447F	2007. 08
4	* Amplifier	HP	8447F	2007. 03
5	Spectrum Analyzer	HP	8568B	2006. 10
6	Spectrum Analyzer	Advantest	R4136	2006. 12
7	* Logbicon Super Antenna	Schwarzbeck	VULB9166	2007. 02
8	Loop Antenna	EMCO	6502	2006. 12
9	Dipole Antenna	R & S	VHA9103	2007. 05
10	Dipole Antenna	R & S	UHA9105	2007. 05
11	Biconical Log Antenna	ARA	LPB-2520/A	2007. 05
12	Asorbing Clamp	R & S	MDS21	2007. 06
13	High Voltage Probe	R & S	ESH2-Z3	2007. 09
14	Signal Generater	R & S	SMP02	2007. 08
15	* Matching Pad	R & S	RAM358_5414.02	2007. 05
16	* LISN	R & S	ESH3-Z5	2006. 10
17	* LISN	Kyoritsu	KNW-407	2007. 03
18	LISN	Kyoritsu	KNW-408	2006. 12
19	* Position Controller	Daeil EMC	N/A	N/A
20	* Turn Table	Daeil EMC	N/A	N/A
21	* Antenna Mast	Daeil EMC	N/A	N/A
22	* Anechoic Chamber	EM Eng.	N/A	N/A
23	* Shielded Room	EM Eng.	N/A	N/A
24	* Anechoic Chamber	Seo-Young EMC	N/A	N/A
25	* Shielded Room	Seo-Young EMC	N/A	N/A

\* ) Test Equipment used during the test.

No.	Instrument	Manufacturer	Model	Due to Calibration
<b>2. RADIATED IMMUNITY SYSTEM</b>				
1	Signal Generator	R & S	SMY01	2007. 04
2	Function Generator	HP	33.20A	2007. 04
3	Power Amplifier	Noiseken	NA25MF1G2010C	2006. 11
4	Power Sensor	HP	8482A	2007. 04
5	Power Meter	HP	E4419B	2007. 04
6	Biconical Antenna	EMCO	3109	2007. 05
7	Biconical log Antenna	ARA	LPB-2520/A	2007. 05
8	Wideband field probe	CHASE	EMC-20	2007. 03
<b>3. CONDUCTED IMMUNITY SYSTEM</b>				
1	Power Amplifier	Noiseken	NA01K80M5C	2006. 11
2	Current Monitor Probe	FCC	NMP-33-1	2007. 03
3	Attenuator	TME	CFA-10NPJ-20	N/A
4	Attenuator	TME	CFA-100ANJJ-3	N/A
5	CDN	FCC	NCDN-M1-16A	2007. 06
6	CDN	FCC	NCDN-M2-16A	2007. 06
7	CDN	FCC	NCDN-M3-16A	2007. 06
8	CDN	FCC	NCD-T2	2007. 06
9	CDN	FCC	NCD-T4	2007. 06
10	150-50ohm adapter	FCC	NCDN-150-50-CF	2007. 09
11	Termination	TME	CT-01BP	N/A
12	Termination	TME	CT-10NP	N/A
13	EM Clamp	FCC	NEM-32mm EM Clamp	2007. 09

**\*)** Test Equipment used during the test.

## ***RECOMMENDATION/CONCLUSION***

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The data collected shows that the ***WOORI Technology Inc.***

**FCC ID: RO3AVR21EN, AV Receiver (Model: AVR21EN)** complies with §15.107 and 15.109 and 15.111 of the FCC Rules.

The highest emission observed was at 0.38 MHz for FM Tuner mode of conducted emissions with a average margin of 3.2 dB and at 0.38 MHz for DVD analog 7CH stereo Mode of conducted emissions with a average margin of 3.4 dB and at 8.44 MHz for WPN system connected Mode of conducted emissions with a average margin of 4.6 dB and at 237.4 MHz for radiated emissions FM receiving mode with a margin of 9.4 dB and at 294.9 MHz for radiated emissions others mode with a margin of 3.2 dB and at 830.9 MHz for antenna power conducted emissions with a margin of 13.0 dB.

## *APPENDIX B - CIRCUIT DIAGRAM*

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## *APPENDIX C - TEST PHOTOGRAPHS*

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The **Line-Conducted** and **Radiated Test Picture** show the worst-case configuration and cable placement.

## ***APPENDIX D – EUT PHOTOGRAPHS***

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## *APPENDIX E - USER'S MANUAL*

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## *APPENDIX F – Schematic Diagrams*

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