

FCC EVALUATION REPORT FOR CERTIFICATION

Manufacturer : DONGYANG Electronics Co., Ltd.

760, Daemang-Ri, Goa-Eub, Gumi-City

Gyeongsangbuk-Do, Korea

Attn : Mr. Ho-Seok Gwak, QA Manager

Date of Issue : February 10, 2004

Test Report S/N : GETEC-E3-04-007

Test Site : Gumi College EMC Center

FCC ID.

APPLICANT

RCDVC10T

DONGYANG Electronics Co., Ltd.

Rule Part(s)

: FCC Part 15 Subpart C

Equipment Class

: Lower Power Communication Device Transmitter (DXX)

EUT Type

: RF Transmitter (Built in AV Junction Controller)

Model No.

: VC-10T

This equipment has been shown to be in compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-1992.

I attest to the accuracy of data. 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,


Jea-Woon Choi, Senior engineer
GUMI College EMC center

Reviewed by,


Tae-Sig Park, Technical manager
GUMI College EMC center

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1. Scope

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

Responsible Party	: DONGYANG Electronics Co., Ltd.
Contact Person	: Mr. Ho-Seok Gwak, Q.A manager
Manufacturer	: DONGYANG Electronics Co., Ltd.
760, Daemang-ri, Goa-eub, Gumi-city, Gyeongsangbuk-do, Korea	

- Equipment Class** Lower Power Communication Device Transmitter (DXX)
- FCC ID** RDCVC10T
- EUT Type** RF Transmitter (Built in AV Junction Controller)
- Power Source** DC 12V
- Model No.** VC-10T
- Rule Part(s)** FCC Part 15, Subpart C, Section 15.209
- Test Procedure(s)** ANSI C63.4 (1992)
- Dates of Test** February 3, 2004
- Place of Test** Gumi College EMC Center
- Test Report No.** GETEC-E3-04-007

2. Introduction

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Nose Emissions From Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ASNI C63.4-1992) was used in determining radiated and conducted emissions emanating from **DONGYANG Electronics Co., Ltd.** **RF Transmitter (Built in AV Junction Controller Model No.: VC-10T), FCC ID.: RCDVC10T**

These measurement tests were conducted at **Gumi College EMC Center**.

The site address is 407, Bugok-Dong, Gumi-City, Gyeongsangbuk-Do, Korea`

This test site is one of the highest point of Gumi 1 college at about 200 kilometers away from Seoul city and 40 kilometers away from Daege city. 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 October 19, 1992



GUMI COLLEGE EMC CENTER
407,Bugok-Dong, Gumi-City,
Gyeongsangbuk-Do 730-711, Korea
Tel: +82-54-440-1195~8
Fax: +82-54-440-1199

Fig 1. The map above shows the Gumi College in vicinity area.

3. Test Conditions & EUT Information

3.1 Description of EUT

The Equipment Under Test (EUT) is the **DONGYANG Electronics Co., Ltd. RF Transmitter (Built in AV Junction Controller Model No.: VC-10T)**

It can transmit the audio signals of the car A/V equipments to the RF receiver (Wireless headphone) in a car using RF frequency.

Power Supply	DC 12V (Supplied from car battery)
Test Mode	Continuous Transmitting mode
RF Transmitting Frequency	416MHz, 418MHz (2ch.)
Modulation Type	FM

3.2 Support Equipment used

Description	Model	Manufacturer	Serial No.
■ - 6.5" LCD Monitor	VST-6500	Dongyang Electronics	-
■ - Wireless headphone	VHP-2	Dongyang Electronics	-
■ - DVD player	DV-525	PIONEER	UEYD0R390LL
■ - DC power supply	6544A	Agilent	MY40000116

3.3 Cable(s)

The EUT was tested with following cables

DC Power cable	1.5 m	Connected to the EUT and DC power supply
AV input cable	1.5m	Connected to the EUT
AV output cable	1.5m	Open
Monitor output cable	1.8m	Connected to the EUT and LCD Monitor
DVD power supply	1.5m	Connected to the EUT and DVD Player

4. Antenna Requirement-§15.203

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the applicant can be used with the device. The use of permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with this requirement.

4.1 Description of Antenna

The Remote Solution RF Remote Control comply with the requirement of §15.203 with a built-in antenna permanently attached to the transmitter.

5. Description of tests

5.1 Radiated Emission

Preliminary measurements were conducted 3m semi anechoic chamber using broadband antennas 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, mode of operation and turntable azimuth with respect to antenna was noted for each frequency found.

The spectrum was scanned from 30 to 1000MHz using biconical log antenna (Schwarzbeck, VLB9160).

Final measurements were made outdoors at 3 m-test range using biconical antenna (R&S, HK116) and log-periodic antenna (R&S, HL223).

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 and investigated using EMI test receiver. (ESCS30)

The detector function was set to Average mode and CISPR quasi-peak mode, the bandwidth of the receiver was set to 120KHz.

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

The turntable containing the test sample was rotated; the antenna height was varied 1 to 4 meter and stopped at the azimuth or height producing the maximum emission. Each EME reported was calibrated using the R/S signal generator

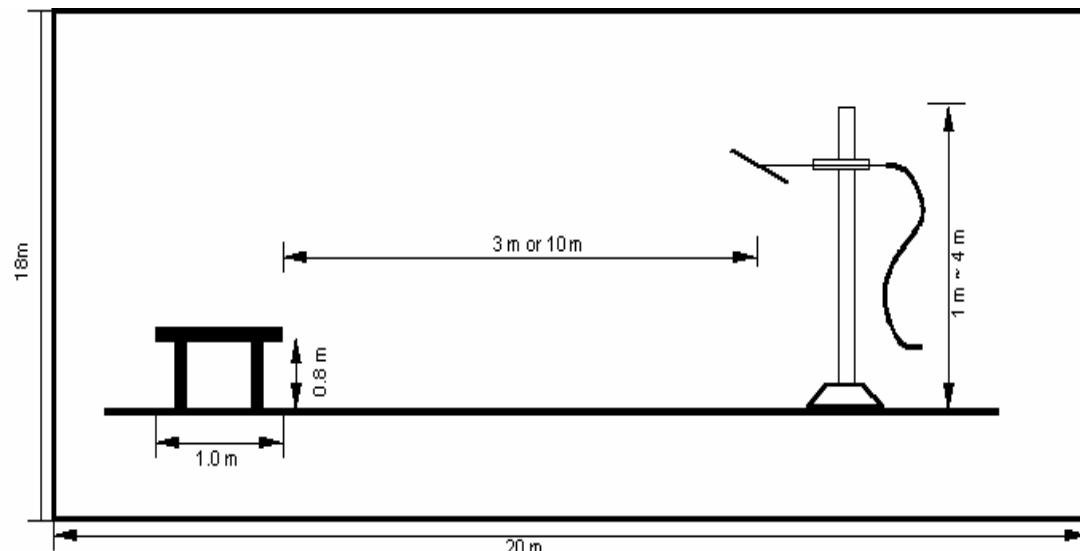


Fig 2. Dimensions of Open Site Test Area

5.2 Conducted Emission

This equipment is supplied DC power from the car battery. Therefore, no conducted limits apply for this equipment.

6. Radiated emission test

6.1 Operating environment

Temperature : 22 °C
 Relative humidity : 52 %

6.2 Test set-up

A preliminary scan with peak mode was performed in the semi anechoic chamber using the procedure in ANSI C63.4/1992 13.1.4.1 and found frequency for open area test site.

The formal radiated emission was measured at 3m-distance open area test site.

The EUT was placed on a non-conductive turntable approximately 0.8 meters above the ground plane.

The turntable with EUT was rotated 360°, and the antenna was varied in height between 1.0 and 4.0 meters in order to determine the maximum emission levels.

This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

6.3 Measurement uncertainty

The measurement uncertainty was calculated in accordance with ISO “Guide to the expression of uncertainty in measurement”.

The measurement uncertainty was given with a confidence of 95%.

Contribution	Probability Distribution	Uncertainty (dB)			
		Biconical Ant.		Log-periodic Ant.	
		3m	10m	3m	10m
Ambient signal					
Antenna factor calibration	Normal (k=2)	1.00	1.00	1.00	1.00
Receiver specification	Rectangular	1.00	1.00	1.00	1.00
Antenna directivity	Rectangular	0.50	0.00	3.00	0.50
Antenna phase center variation	Rectangular	0.00	0.00	1.00	0.20
Antenna factor frequency interpolation	Rectangular	0.25	0.25	0.25	0.25
Measure distance variation	Rectangular	0.60	0.40	0.60	0.40
Site imperfections	Rectangular	2.83	-2.94	-1.96	-2.96
Mismatch					
Receiver VRC : $\Gamma_l = 0.09$	U-shaped	0.33	0.33	0.33	0.33
Antenna VRC : $\Gamma_g = 0.43 (Bi) 0.23 (Lp)$					
Uncertainty limits $20\log(1 \pm \Gamma_l \Gamma_g)$		-0.35	-0.35	-0.18	-0.18
System repeatability	Std Deviation	0.07	0.05	0.06	0.10
Cable loss calibration	Normal (k=2)	0.20	0.20	0.20	0.20
Combined standard uncertainty $U_{c(y)}$	Normal	1.88 -1.88	1.90 -1.90	2.33 -2.32	1.94 -1.93
Extended uncertainty U	Normal (k=2)	3.77 -3.77	3.80 -3.80	4.65 -4.63	3.87 -3.85

6.4 Limit

Frequency (MHz)	FCC Limit @ 3m. Quasi-Peak dB (μ V/m)
30 – 88	40.0
88 – 216	43.5
216 – 230	46.0
230 – 960	46.0
>960	54.0

*Limit extrapolated 20dB / decade

6.5 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Calibrated Date
■ - ESI	Rohde & Schwarz	EMI test receiver	830482/010	12. 17. 2003
■ - ESCS30	Rohde & Schwarz	EMI test receiver	839809/003	12. 17. 2003
■ - HK116	Rohde & Schwarz	Biconical antenna	826861/018	11. 21. 2003
■ - HL223	Rohde & Schwarz	Log-periodic antenna	829228/011	11. 21. 2003
■ - BBHA9120D	Schwarzbeck	Horn antenna	207	11. 21. 2003
■ - 8449B	Algrent	Microwave Preamplifier	3008A01828	NCR
■ - HD100	HD GmbH	Position Controller	100/692/01	NCR
■ - DS415S	HD GmbH	Turntable	415/657/01	NCR
■ - MA240	HD GmbH	Antenna Mast	240/565/01	NCR

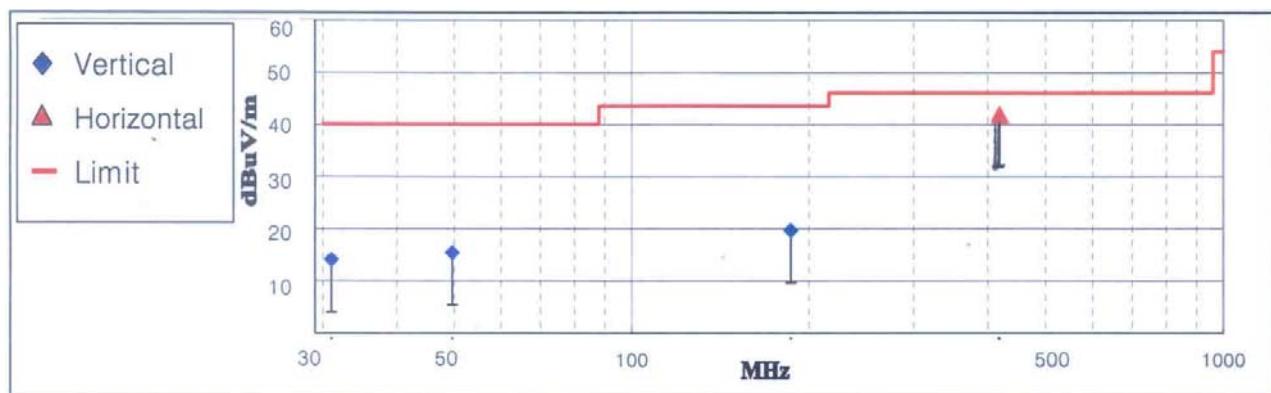
6.6 Test data for radiated emission

- Test Date : February 3, 2004
- Resolution bandwidth : 120kHz / 1MHz
- Frequency range : 30MHz ~ 5000MHz (10th Harmonics)
- Power Source : DC 12V
- Detector mode : Quasi-peak detector mode: up to 1GHz
Peak & Average detector Mode (above 1GHz)

Frequency (MHz)	Reading (dBuV)	Ant. Pol. (H/V)	Ant. Factor(dB/m)	Cable Loss	Emission Level(dBuV/m)	Limits (dBuV/m)	Margin (dB)
31.02	-0.3	V	12.69	1.64	14.0	40.0	26.0
49.62	4.4	V	9.00	1.99	15.4	40.0	24.6
186.3	1.8	V	13.84	3.99	19.6	43.5	23.9
416.63	19.1	H	16.51	6.18	41.8	46.0	4.2
418.3	19.4	H	16.53	6.19	42.1	46.0	3.9
Other Frequencies	-	-	-	-	-	-	<<

Note: "H": Horizontal, "V": Vertical

"<<": The margin is more than 30dB.



< Fig 3. Graph of the radiated emission >

7. Sample Calculations

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

$$\text{dB}\mu\text{V} = \text{dBm} + 107$$

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

7.1 Example 1 :

■ 20.3 MHz

Class B Limit	=	250 μV	=	48 dB μV
Reading	=	- 67.8 dBm (Calibrated level)		
Convert to dB μV	=	- 67.8 dBm + 107 = 39.2 dB μV		
$10^{(39.2\text{dB}\mu\text{V}/20)}$	=	91.2 dB μV		
Margin	=	39.2 - 48	=	-8.8
	=	8.8 dB below Limit		

7.2 Example 2 :

■ 66.7 MHz

Class B Limit	=	100 $\mu\text{V}/\text{m}$	=	40.0 dB $\mu\text{V}/\text{m}$
Reading	=	- 76.0 dBm (Calibrated level)		
Convert to dB $\mu\text{V}/\text{m}$	=	- 67.8 dBm + 107 = 31.0 dB $\mu\text{V}/\text{m}$		
Antenna Factor + Cable Loss	=	5.8 dB		
	Total	=	36.8 dB $\mu\text{V}/\text{m}$	
Margin	=	36.8 - 40.0	=	-3.2
	=	3.2 dB below Limit		

8. Recommendation & conclusion

The data collected shows that the Gumi College EMC Center.

DONGYANG Electronics Co., Ltd. RF Transmitter (Built in AV Junction Controller Model No.: VC-10T) was complies with §15.209 of the FCC Rules.