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FCC EVALUATION REPORT FOR CERTIFICATION

Manufacturer : Hanatech Co., Ltd.
Hana-B/D, 80-1, Songjung –dong, Gumi-si,
Gyeongsangbuk-do, Korea
Attn : Mr. Woo-jun Hwang / Senior engineer

Date of Issue : May 25, 2004
Test Report S/N : GETEC-E3-04-018
Test Site : Gumi College EMC Center

FCC ID	**RZXDCNPRO**
APPLICANT	**Hanatech Co., Ltd.**

Rule Part(s)	**: FCC Part 15 Subpart B**
Equipment Class	**: Class B computing device peripheral**
EUT Type	**: Automotive Handheld Scantool**
Model No.	**: DCN-PRO**
Trade name	**: Hanatech**

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 vest 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, EMC engineer
GUMI College EMC center

Reviewed by,

Tae-Sig Park, Technical manager
GUMI College EMC center

CONTENTS

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: **Hanatech Co., Ltd.**

Contact Person: **Mr. Woo-jun Hwang / Senior engineer**

Manufacturer: **Hana-B/D, 80-1, Songjung-dong, Gumi-si, Gyeongsangbuk-do, Korea**
Tel No.: +82-54-454-9009

- **FCC ID** RZXDCNPRO
- **EUT Type** Automotive Handheld Scantool
- **Model No.** DCN-PRO
- **Trade Name** Hanatech
- **Rule Part(s)** FCC Part 15 Subpart B
- **Test Procedure(s)** ANSI C63.4 (1992)
- **Standard(s)** EN55022:1998 (CISPR22:1997)
- **Dates of Test** April 7, 2004
- **Place of Test** Gumi College EMC Center
- **Test Report No.** GETEC-E3-04-018

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 **Hanatech Co., Ltd. Automotive Handheld Scantool (Model No.: DCN-PRO)**

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

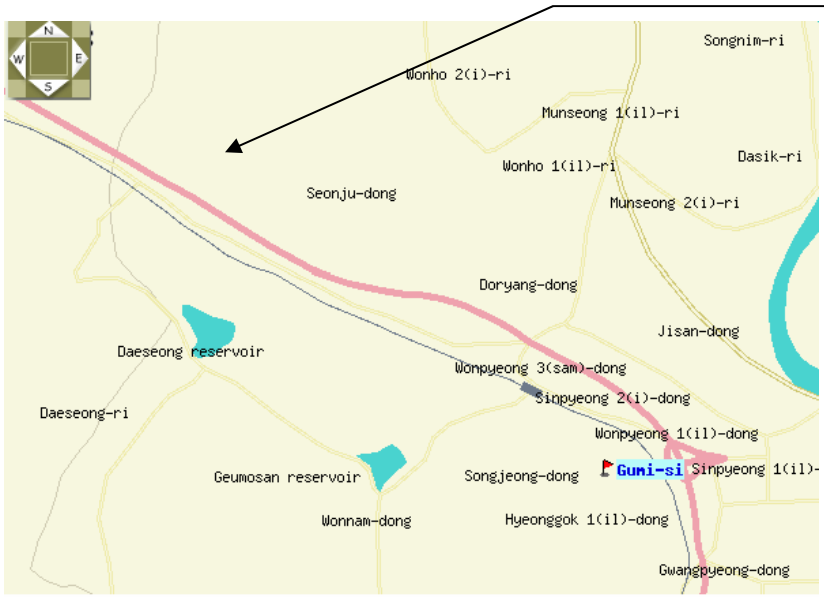

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Fig 1. The map above shows the Gumi College in vicinity area.

3. Test Conditions & EUT Information

3.1 Description of EUT

The Equipment Under Test (EUT) is the Hanatech Co., Ltd. Automotive Handheld Scantool (Model No.: DCN-PRO)
FCC ID: RZXDCNPRO
EUT is designed for diagnostic use of vehicle and it can be controlled by PC with USB communication.

CPU	16bit, 33MHz
RAM	1Mbyte (SRAM)
Program Cartridge Memory	128Mbytes built-in Flash Memory
Display	320*240 Monochrome Graphic LCD with Back Light
Key Pad	20 Membrane keys, embossing type
Com Port	USB and RS232
Power	DC 8~18V, 600mA or higher
Automobile Battery	**MF55L** (Korea Storage Battery Ltd.) Output: 12Vdc 55AH
Cable(s)	3.75m DC power cable Connected to the EUT and Automobile Battery 2.6m Data link cable Connected to the Communication Module and EUT 0.55m USB host cable Connected to the EUT and USB cable 0.5m Communication Module cable Connected to the DC power cable and data link cable 1.8m USB cable Connected to the EUT and PC
Dimensions	22.2×18.7×5.1cm
Weight	9.5Kg

3.2 Support Equipment used

PC	COMPAQ PD1075 S/N: 7041JC8F0245 FCC ID: DoC	Connected to the EUT and Peripheral equipments
Printer	H.P Deskjet 970cxi S/N: MY9B01F1FG FCC ID: DoC	Connected to the parallel port of PC
Serial Mouse	Microsoft 61402 S/N: 00696998 FCC ID: C3KKS3	Connected to the serial port of PC
PS/2 Key-board	COMPAQ 166516-AD6 S/N: B13BBOR39I006D FCC ID: AQ6-23K15	Connected to the PS/2 port of PC
Monitor	COMPAQ S710 S/N: 040CG26KD448 FCC ID: RE1124T	Connected to the PC

See "Appendix E – Test Setup Photographs" for actual system test set-up

4. Description of tests

4.1 Radiated Emissions

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 note for each frequency found.

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

Final measurements were made outdoors at 10m-test range using bicornical antenna (R&S, HK116), 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 CISPR quasi-peak mode and 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

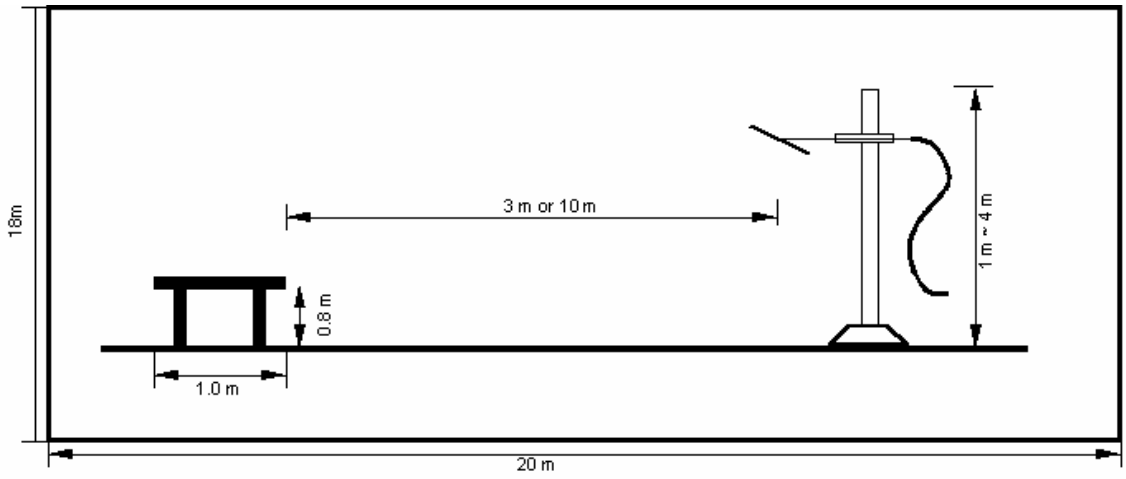


Fig 3. Dimensions of Open Site Test Area

4.2 Conducted Emission

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

5. Radiated Emission

5.1 Operating environment

Temperature : 23℃
Relative humidity : 28 %

5.2 Test set-up

A preliminary scan with peak mode was performed in the semi anechoic chamber and found frequency for open area test site.
The formal radiated emission was measured at 10m-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.

5.3 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 : Γl= 0.09 Antenna VRC : Γg= 0.43 (Bi) 0.23 (Lp) Uncertainty limits 20log(1± Γl Γg)	U-shaped	0.33 -0.35	0.33 -0.35	0.33 -0.18	0.33 -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 Uc(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

5.4 Limit

Frequency (MHz)	FCC Limit @ 3m. Quasi-Peak dB (μV/m)	FCC Limit @ 10m.* Quasi-Peak dB (μV/m)	CISPR Limit @ 10m. Quasi-Peak dB (μV/m)
30 – 88	40.0	29.5	30.0
88 – 216	43.5	33.0	30.0
216 – 230	46.0	35.6	30.0
230 – 960	46.0	35.6	37.0
960 – 1000	54.0	43.5	37.0
> 1000	54.0	43.5	43.5
*Limit extrapolated 20dB / decade			

5.5 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
■ -	HD100	HD GmbH	Position Controller	100/692/01	NCR
■ -	DS415S	HD GmbH	Turntable	415/657/01	NCR
■ -	MA240	HD GmbH	Antenna Master	240/565/01	NCR

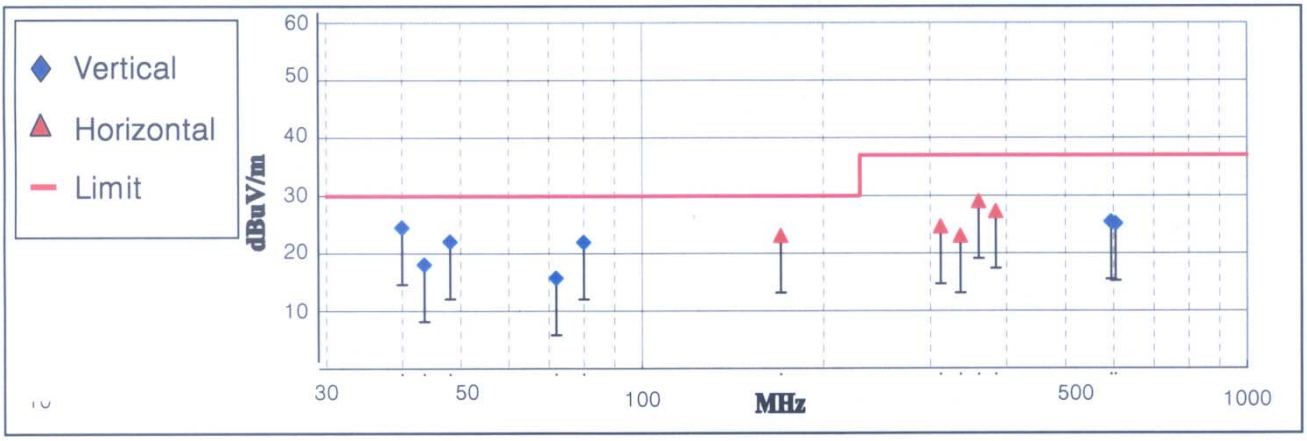
5.6 Test data for radiated emission

-. Test Date : April 7, 2004
-. Operating condition : PC operating mode
-. Resolution bandwidth : 120kHz
-. Frequency range : 30MHz ~ 1000MHz
-. Measurement : 10m
-. Power Source : DC 12V

Communication Module: J1850

Frequency (MHz)	Reading (dBuV)	Ant. Pol. (H/V)	Ant. Factor(dB/m)	Cable Loss	Emission Level(dBuV/m)	Limits (dBuV/m)	Margin (dB)
40	11.9	V	10.84	1.80	24.5	30.0	5.5
43.53	6.2	V	10.02	1.87	18.1	30.0	11.9
48.01	10.9	V	9.23	1.96	22.1	30.0	7.9
72	5.7	V	7.85	2.24	15.8	30.0	14.2
80	11.8	V	7.83	2.40	22.0	30.0	8.0
169.99	6.8	H	12.68	3.67	23.1	30.0	6.9
312.18	3.1	H	16.48	5.10	24.7	37.0	12.3
366.18	4.7	H	13.19	5.21	23.1	37.0	13.9
360.18	9.6	H	14.01	5.45	29.1	37.0	7.9
384.18	6.8	H	14.84	5.69	27.3	37.0	9.7
594.96	0.1	V	18.23	7.16	25.5	37.0	11.5
604.98	-0.3	V	18.29	7.24	25.2	37.0	11.8

Comment: Pol: H(Horizontal), N(Vertical) [Quasi- peak detector mode]

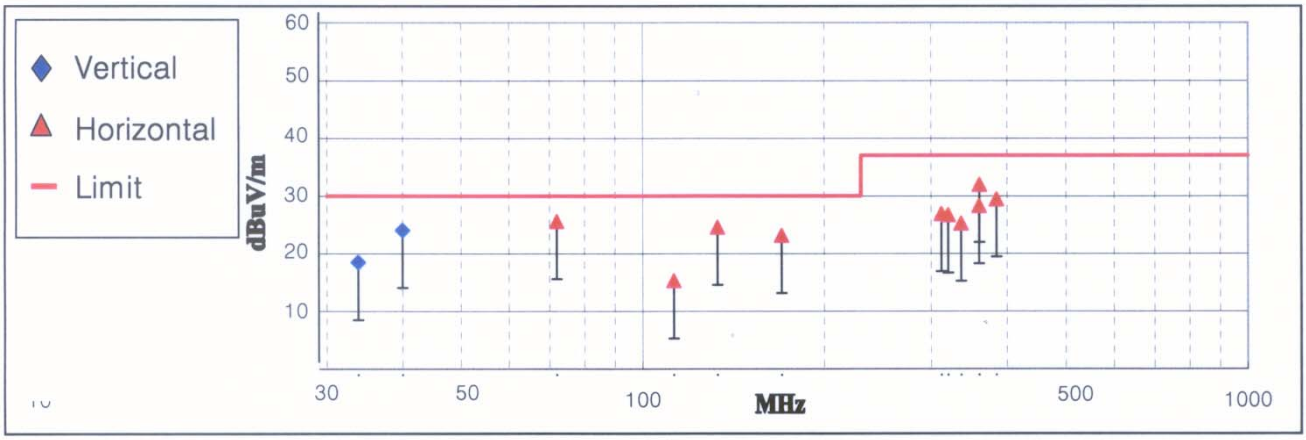


< Fig 4. Radiated emission result>

Communication Module: CAN

Frequency (MHz)	Reading (dBuV)	Ant. Pol. (H/V)	Ant. Factor(dB/m)	Cable Loss	Emission Level(dBuV/m)	Limits (dBuV/m)	Margin (dB)
33.79	4.6	V	12.10	1.75	18.5	30.0	11.5
40	11.4	V	10.84	1.80	24.0	30.0	6.0
71.99	15.5	H	7.85	2.24	25.6	30.0	4.4
112.61	3.2	H	9.24	2.83	15.3	30.0	14.7
133.19	10.7	H	10.67	3.18	24.6	30.0	5.4
169.99	6.8	H	12.68	3.67	23.1	30.0	6.9
312.16	5.3	H	16.49	5.10	26.9	37.0	10.1
319.96	7.3	H	14.25	5.10	26.7	37.0	10.3
336.18	6.8	H	13.19	5.21	25.2	37.0	11.8
359.96	8.8	H	14.00	5.45	28.3	37.0	8.7
360.19	12.5	H	14.01	5.45	32.0	37.0	5.0
384.2	8.9	H	14.84	5.69	29.4	37.0	7.6

Comment: Pol: H(Horizontal), N(Vertical) [Quasi- peak detector mode]



< Fig 5. Radiated emission result>

6. Sample Calculations

$$dB\mu V = 20 \text{ Log }_{10}(\mu V/m)$$
$$dB\mu V = dBm + 107$$
$$\mu V = 10^{(dB\mu V/20)}$$

6.1 Example 1 :

■ 20.3 MHz

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

6.2 Example 2 :

■ 66.7 MHz

Class B Limit	= 100 μV/m	= 40.0 dBμV/m
Reading	= - 76.0 dBm(Calibrated level)	
Convert to dBμV/m	= - 67.8 dBm + 107	= 31.0 dBμV/m
Antenna Factor + Cable Loss	= 5.8 dB	
	Total = 36.8 dBμV/m	
Margin	= 36.8 – 40.0	= -3.2
	= 3.2 dB below Limit	

7. Recommendation & conclusion

The data collected shows that the Gumi College EMC Center.
Hanatech Co., Ltd. Automotive Handheld Scantool (Model No.: DCN-PRO) was complies with §15.109 of the FCC Rules.