

## ***FCC EVALUATION REPORT FOR CERTIFICATION***

### ***FCC Class B (Class II Permissive Change)***

**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 : July 23, 2004**

**Test Report S/N : GETEC-E3-04-031**

**Test Site : Gumi College EMC Center**

**FCC ID**

**RZXMULTISCAN**

**APPLICANT**

**Hanatech Co., Ltd.**

|                           |                                                                                                                                                                |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Rule Part(s)</b>       | <b>: FCC Part 15 Subpart B</b>                                                                                                                                 |
| <b>Equipment Class</b>    | <b>: Class B computing device peripheral</b>                                                                                                                   |
| <b>Application Type</b>   | <b>: Class II Permissive Change</b>                                                                                                                            |
| <b>EUT Type</b>           | <b>: Automotive Handheld Scantool</b>                                                                                                                          |
| <b>Model No.</b>          | <b>: MULTISCAN</b>                                                                                                                                             |
| <b>Trade name</b>         | <b>: Hanatech</b>                                                                                                                                              |
| <b>Class II Change(s)</b> | <b>: Add Communication Module (Hanatech, Model No.: MB Pin 38 DLC Multiplexer Module),<br/>Cosmetics and design change of Key Pad except electrical parts.</b> |

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,**

**Reviewed by,**



**Jea-Woon Choi, EMC engineer**  
**GUMI College EMC center**



**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:** 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** RZXMULTISCAN
- **EUT Type** Automotive Handheld Scantool
- **Model No.** MULTISCAN
- **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** July 8, 2004
- **Place of Test** Gumi College EMC Center
- **Test Report No.** GETEC-E3-04-031
- **Class II Change(s)** Add Communication Module (Hanatech, Model No.: MB Pin 38 DLC Multiplexer Module)  
Cosmetics and design change of Key Pad except electrical parts

## 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.: MULTISCAN)**

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 Daegu 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

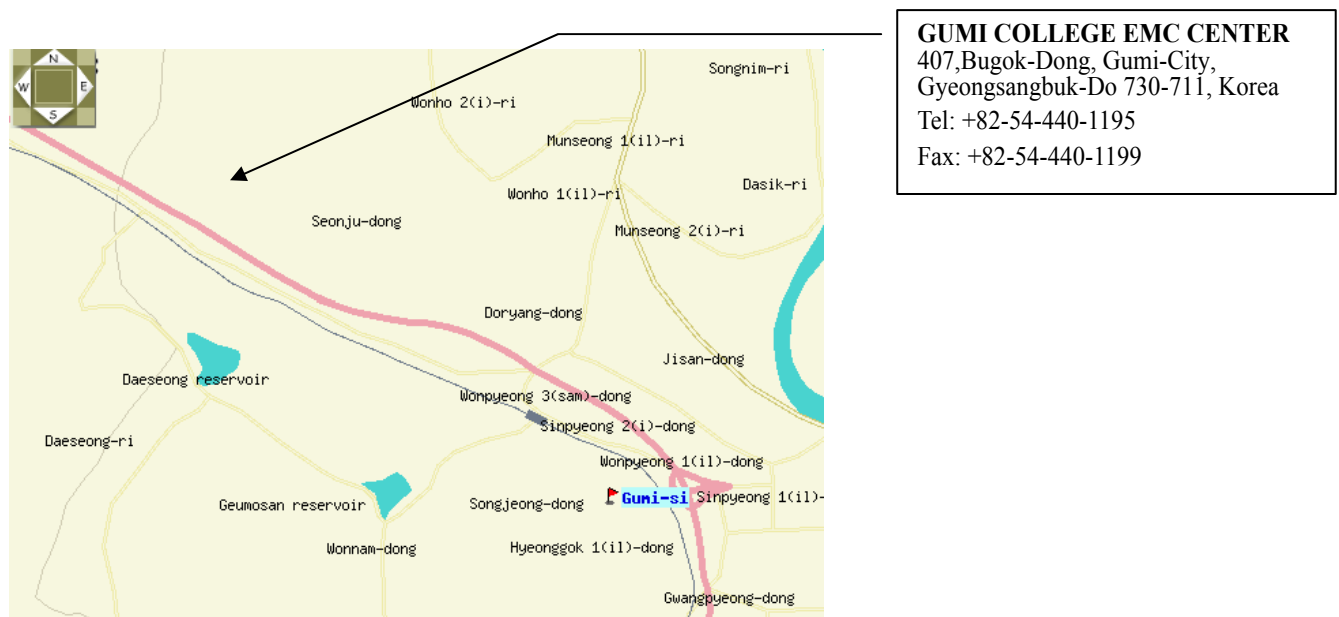


Fig 1. The map above shows the Gumi College in vicinity area.

### 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.: MULTISCAN)

**FCC ID: RZXMULTISCAN**

*EUT is designed for diagnostic use of vehicle and it can be controlled by PC with USB communication.*

|                                 |                                                                                                                                                                                                                                                                                                                           |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CPU</b>                      | 16bit, 33MHz                                                                                                                                                                                                                                                                                                              |
| <b>RAM</b>                      | 1Mbyte (SRAM)                                                                                                                                                                                                                                                                                                             |
| <b>Program Cartridge Memory</b> | 128Mbytes built-in Flash Memory                                                                                                                                                                                                                                                                                           |
| <b>Display</b>                  | 320*240 Monochrome Graphic LCD with Back Light                                                                                                                                                                                                                                                                            |
| <b>Key Pad</b>                  | 20 Membrane keys, embossing type                                                                                                                                                                                                                                                                                          |
| <b>Com Port</b>                 | USB and RS232                                                                                                                                                                                                                                                                                                             |
| <b>Power</b>                    | DC 8~18V, 600mA or higher                                                                                                                                                                                                                                                                                                 |
| <b>Automobile Battery</b>       | <b>MF55L</b> (Korea Storage Battery Ltd.)<br>Output: 12Vdc 55AH                                                                                                                                                                                                                                                           |
| <b>Module</b>                   | <b>MB Pin38 DLC Multiplexer Module</b> (Hanatech Co., Ltd.)                                                                                                                                                                                                                                                               |
| <b>Cable(s)</b>                 | 1.5m DC power cable<br>Connected to the MB Pin38 Module and Automobile Battery<br>2.6m Data link cable<br>Connected to the EUT and MB Pin38 Module<br>1.2m RS232 cable<br>Open<br>1.8m USB cable<br>Connected to the EUT and PC<br>0.65m MB Pin38 Module cable<br>Connected to the MB Pin38 Module and Automobile Battery |
| <b>Dimensions</b>               | 22.2×18.7×5.1cm                                                                                                                                                                                                                                                                                                           |
| <b>Weight</b>                   | 9.5Kg                                                                                                                                                                                                                                                                                                                     |

**3.2 Support Equipment used**

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

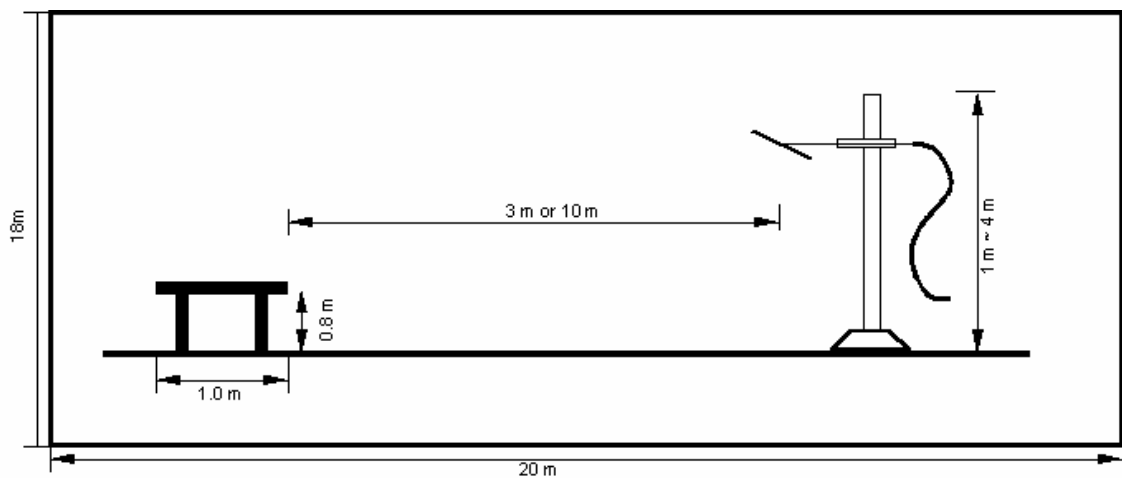


Fig 3. Dimensions of Open Site Test Area

### 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 : 31 °C  
Relative humidity : 63 %

### 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<br>Receiver VRC : $\Gamma_I = 0.09$<br>Antenna VRC : $\Gamma_g = 0.43$ (Bi) 0.23 (Lp)<br>Uncertainty limits $20\log(1 \pm \Gamma_I \Gamma_g)$ | U-shaped                 | 0.33<br>-0.35    | 0.33<br>-0.35 | 0.33<br>-0.18     | 0.33<br>-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<br>-1.88    | 1.90<br>-1.90 | 2.33<br>-2.32     | 1.94<br>-1.93 |
| Extended uncertainty U                                                                                                                                 | Normal (k=2)             | 3.77<br>-3.77    | 3.80<br>-3.80 | 4.65<br>-4.63     | 3.87<br>-3.85 |

#### 5.4 Limit

| Frequency<br>(MHz)                | FCC Limit @ 3m.<br>Quasi-Peak dB (μV/m) | FCC Limit @ 10m.*<br>Quasi-Peak dB (μV/m) | CISPR Limit @ 10m.<br>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 Mast         | 240/565/01    | NCR             |

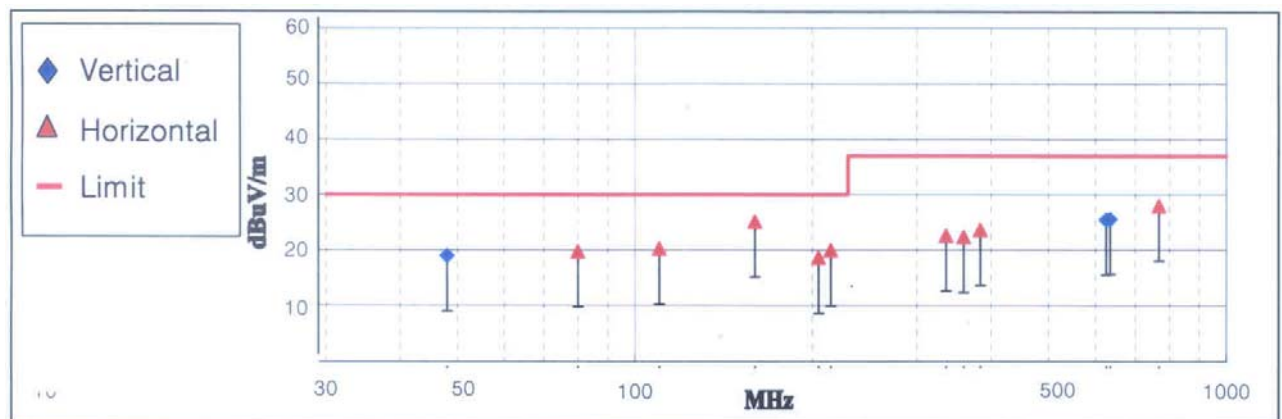
## 5.6 Test data for radiated emission

### 5.6.1 Operating Condition: Download mode

- Test Date : July 8, 2004
- Resolution bandwidth : 120kHz
- Frequency range : 30MHz ~ 1000MHz (Quasi-peak detector mode)
- Power Source : DC 12V

| Frequency (MHz) | Reading (dBuV) | Ant. Pol. (H/V) | Ant. Factor(dB/m) | Cable Loss | Emission Level(dBuV/m) | Limits (dBuV/m) | Margin (dB) |
|-----------------|----------------|-----------------|-------------------|------------|------------------------|-----------------|-------------|
| 48.01           | 7.8            | V               | 9.23              | 1.96       | 19.0                   | 30.0            | 11.0        |
| 80              | 9.5            | H               | 7.83              | 2.40       | 19.7                   | 30.0            | 10.3        |
| 110             | 8.3            | H               | 9.14              | 2.80       | 20.2                   | 30.0            | 9.8         |
| 160             | 9.4            | H               | 12.22             | 3.50       | 25.1                   | 30.0            | 4.9         |
| 205.01          | 0.9            | H               | 13.72             | 3.96       | 18.6                   | 30.0            | 11.4        |
| 215.01          | 1.7            | H               | 14.13             | 4.08       | 19.9                   | 30.0            | 10.1        |
| 336.02          | 4.2            | H               | 13.18             | 5.21       | 22.6                   | 37.0            | 14.4        |
| 360.01          | 2.9            | H               | 14.00             | 5.45       | 22.4                   | 37.0            | 14.6        |
| 384.01          | 3.1            | H               | 14.83             | 5.69       | 23.6                   | 37.0            | 13.4        |
| 625.02          | -0.3           | V               | 18.40             | 7.40       | 25.5                   | 37.0            | 11.5        |
| 635.02          | -0.4           | V               | 18.57             | 7.42       | 25.6                   | 37.0            | 11.4        |
| 768.04          | -0.4           | H               | 20.20             | 8.16       | 28.0                   | 37.0            | 9.0         |

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



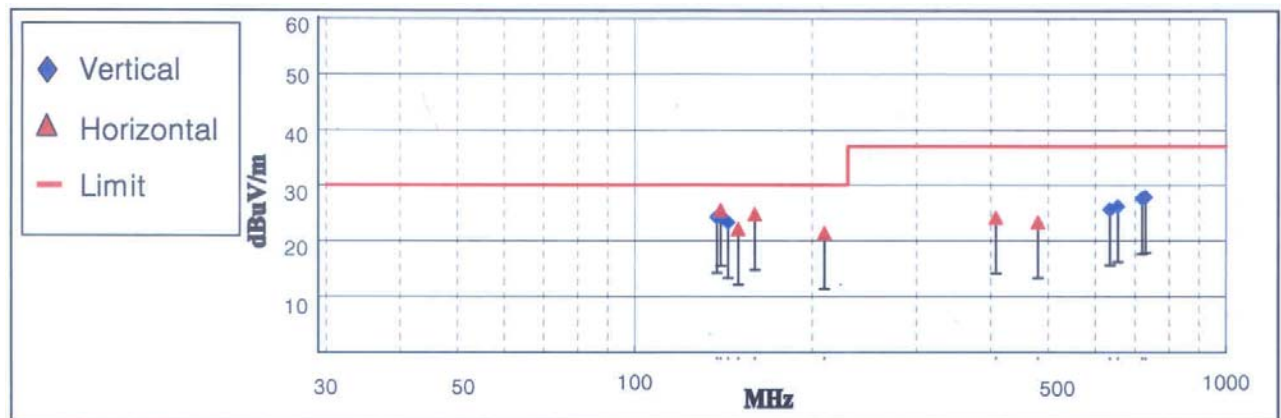
< Fig 4. Radiated emission result >

## 5.6.1 Operating Condition: Stand by mode

- Test Date : July 8, 2004
- Resolution bandwidth : 120kHz
- Frequency range : 30MHz ~ 1000MHz (Quasi-peak detector mode)
- Power Source : DC 12V

| Frequency (MHz) | Reading (dBuV) | Ant. Pol. (H/V) | Ant. Factor(dB/m) | Cable Loss | Emission Level(dBuV/m) | Limits (dBuV/m) | Margin (dB) |
|-----------------|----------------|-----------------|-------------------|------------|------------------------|-----------------|-------------|
| 138             | 10.1           | V               | 10.86             | 3.23       | 24.2                   | 30.0            | 5.8         |
| 139.98          | 11.3           | H               | 10.94             | 3.25       | 25.5                   | 30.0            | 4.5         |
| 144.01          | 8.8            | V               | 11.18             | 3.31       | 23.3                   | 30.0            | 6.7         |
| 150             | 7.1            | H               | 11.54             | 3.40       | 22.0                   | 30.0            | 8.0         |
| 160.02          | 9              | H               | 12.22             | 3.50       | 24.7                   | 30.0            | 5.3         |
| 210             | 3.4            | H               | 13.92             | 4.02       | 21.3                   | 30.0            | 8.7         |
| 408.02          | 2.5            | H               | 15.66             | 5.93       | 24.1                   | 37.0            | 12.9        |
| 480.02          | -0.2           | H               | 17.13             | 6.37       | 23.3                   | 37.0            | 13.7        |
| 635.02          | -0.4           | V               | 18.57             | 7.42       | 25.6                   | 37.0            | 11.4        |
| 655.03          | -0.2           | V               | 18.91             | 7.47       | 26.2                   | 37.0            | 10.8        |
| 720.05          | -0.3           | V               | 20.02             | 7.86       | 27.6                   | 37.0            | 9.4         |
| 730.03          | -0.2           | V               | 20.12             | 7.93       | 27.9                   | 37.0            | 9.1         |

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



< Fig 5. Radiated emission result >

## 6. Sample Calculations

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

### 6.1 Example 1 :

#### ■ 20.3 MHz

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

### 6.2 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 $\mu\text{V}/\text{m}$ | = | - 76.0 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             |   |                                |

## 7. Recommendation & conclusion

The data collected shows that the Gumi College EMC Center.

**Hanatech Co., Ltd. Automotive Handheld Scantool (Model No.: MULTISCAN)** was complies with §15.109 of the FCC Rules.

The highest emission observed was at 139.98MHz for radiated emissions with a margin of 4.5dB (Download mode).