

# **Electromagnetic Emission**

## **F C C M E A S U R E M E N T R E P O R T**

**According to the FCC Rule Part 15 Subpart B**

**Product : Paging Receiver**

**Model : KWF-901**

**Serial Number : Prototype**

**FCC ID : PKDKWF-901**

**Prepared for :**

**K-WON C&C Co., Ltd.**  
544-2, Guro 5-dong, Guro-gu,  
Seoul, Korea

**Prepared by:**

**Report Date : April 8, 2001**

**E-RAE Testing Laboratory Inc.**

**371-51, Gasan-Dong, Geumcheon-Gu,**  
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# FCC MEASUREMENT REPORT

*Scope – Measurement and determination of electromagnetic emission(EME) of radio frequency devices including intentional radiators and/or unintentional radiators for compliance with the technical rules and regulations of the U.S Federal Communications Commission(FCC)*

**Applicant Name** : K-WON C&C Co., Ltd.  
**Address** : 544-2, Guro 5-dong, Guro-gu, Seoul, Korea  
**Attention** : Byung Joon, Park / Manager of R&D Lab.

**EUT Type** : Paging Receiver  
**Trade Name** : DIVATELCOM  
**Model Number** : KWF-901  
**FCC Identifier** : PKDKWF-901  
**S/N** : Prototype  
**Freq. Range** : 917MHz – 932MHz  
**FCC Rule Part(s)** : FCC Part 15 Subpart B  
**FCC Procedure** : Certification  
**FCC Classification** : Communication Receivers for use with licensed Tx and CBs  
**Bit Rate** : 1,600/ 3,200/ 6,400 bps  
**Channel pacing** : 25KHz  
**Dates of Tests** : April 4, 2001  
**Place of Tests** : E-Rae Testing Lab. / EMI Test Site  
584, Sangwhal-Ri, Kanam-Myun, Yoju-Kun,  
Kyounggi-Do, Korea  
Tel : (031) 885-0072 Fax : (031) 885-0074  
**Test Report No.** : E01.0406.FCC15B.115.N

## SUMMARY

This equipment was tested in accordance with the measurement procedures specified in **ANSI C63.4-1992**. The equipment fulfill the technical requirements of section15.109 and complies with the general approval requirements set forth in the regulation of FCC Part 15 Subpart B of CFR 47.

Prepared by : *Yo Han, Park*

Reviewed by : *Kayoung Kim*

Name Yo Han, Park  
Title Test Engineer

Name Kayoung Kim  
Title Chief Engineer / EMC Lab.

## 1. Introduction

The measurement test for radiated and conducted emission test were conducted at the open area test site of E-RAE Testing Laboratory Inc. facility located at 584, Sangwhal-ri, Ganam-myun, Youju-kun, Kyungki-do, Korea. The site is constructed in conformance with the requirements of the ANSI C63.4-1992 and CISPR Publication 16. The ETL has site descriptions on file with the FCC for 3 and 10 meter site configurations. Detailed description of test facility was found to be in compliance with the requirements of Section 2.948 FCC Rules according to the ANSI C63.4-1992 and registered to the Federal Communications Commission(Registration Number : 95422 ).

The measurement procedure described in American National Standard for Method of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C.63.4-1992) was used in determining radiated and conducted emissions from the K-WON C&C Co.,Ltd. Paging Receiver Model : KWF-901.

## 2. Product Information

### 2.1 Equipment Description

The Equipment Under Test(EUT) is the K-WON Computer & Communication Co., Ltd.  
Kind of Type:Alphanumeric Radio Paging Receiver Model:KWF-901.

### 2.2 General Specification

|  |  |
|--|--|
| - Chassis Type                                     | PLASTIC  |
| - List of Each OSC. Or X-Tal. Freq.( $\geq 1$ MHz) | 12.8MHz, 20.945MHz, 10MHz<br>Logic : 76.8KHz , RF: 21.4MHz   |
| - Chipset Brand&Part NO.                           | SAMSUNG : KA8512DTF-SDT<br>SAMSUNG : KS8809DTF<br>SUPERTECK : HV826LG<br>MITSUBISHI : M30620SGP<br>SAMSUNG : KS8701<br>SIPEX : SP3232ECY<br>SST : SST-31LF041-70 |
| - Power Consumption                                | DC 1.5V(Input from the Battery)  |
| - Number of Layers                                 | DIGITAL BOARD 4 LAYER<br>RF BOARD 4 LAYER  |
| - Freq. Range                                      | 917MHz – 932MHz  |
| - Bit Rate   | 1,600/ 3,200/ 6,400 bps  |
| - Channel Spacing                                  | 25KHz  |
| - 1 <sup>st</sup> IF                               | 21.4MHz  |
| - 2 <sup>nd</sup> IF                               | 455KHz   |
| - Antenna  | Loop   |

### 2.3 EMI Suppression Device(s)

The equipment is not modified anything, mechanical or circuits to improve EMI status during a measurement. No EMI suppression device(s) was added and/or modified during testing.

### 3. Description of Test and Procedure

#### 3.1 Radiated Emission Test

Preliminary measurements were made at indoors 3 meter semi EMC Anechoic Chamber using broadband antennas, broadband amplifier, and spectrum analyzer to determine the emission frequencies producing the maximum EME.

Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30 to 1000MHz using biconilog antenna and above 1000MHz, linearly polarized double ridge horn antennas were used. Above 1GHz, linearly polarized double ridge horn antennas were used. The measurements were performed with three frequencies which were selected as bottom, middle and top frequency in the operating band. Emission level from the EUT with various configurations were examined on the spectrum analyzer connected with the RF amplifier and plotted graphically.

Final measurements were made outdoors open site at 3-meter test range using biconilog antenna. The output from the antenna was connected, via a preselector or a preamplifier, to the input of the EMI Measuring Receiver and Spectrum analyzer(for above 1GHz). The detector function was set to the quasi-peak or peak mode as appropriate. The measurement bandwidth on the Field strength receiver was set to at least 120kHz (1MHz for measurement above 1GHz), with all post-detector filtering no less than 10 times the measurement bandwidth. 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 preliminary measurement was examined and investigated as the same set up and configuration which produced the maximum emission level.

The EUT , support equipment and interconnecting cables were configured to the set-up producing the maximum emission for the frequency and were placed on top of a 0.8-meter high non-metallic 1m x 1.5 meter table. The turntable containing the system was rotated and the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission.

Each emission was maximized by varying the mode of operating frequencies of the EUT. The worst case emissions are recorded in the data tables. If necessary, the radiated emission measurement could be performed at a closer distance to ensure higher accuracy and the results were extrapolated to the specified distance using an inverse linear distance extrapolation factor(20Db/decade) as per section 15.31(f).

Photographs of the worst-case emission test setup can be seen in Appendix B.

#### 3.2 AC Line Conducted Emission Test

Not applicable to this equipment, The EUT is a battery only operated device.

## 4. Test Configuration

The device was configured for testing in a typical fashion (as a customer would normally use it). During the tests, the following conditions and configurations were used.

### 4.1 Radiated Emission Test

Preliminary radiated emission tests were conducted using the procedure in ANSI C63.4/1992 Clause 8.3.1.1 to determine the worst operating condition. Final radiated emission tests were conducted at 10 meter open field test site.

### 4.2 EUT operation

The EUT was set to the normal receiving mode during the radiated emission testing in a manner similar to a typical use. The three typical operating frequencies as bottom, middle and top were tuned for the testing.

## 5. Radiated Emissions Test Results

|                       |   |
|-----------------------|---|
| EUT                   | Paging Receiver Model : KWF-901 (SN:Prototype)    |
| Limit apply to        | FCC Part15 Subpart B Section 15.109               |
| Test Date             | April 4, 2001                                     |
| Operating Condition   | Pager Receiving Mode( Frequency Tuning : 917MHz ) |
| Environment Condition | Humidity Level : 37 %RH, Temperature : 22         |
| Result                | Passed by – 4.44dB                                |

### Radiated Emission Test Data

The following table shows the highest levels of radiated emissions on both polarization of horizontal and vertical.

Detector mode : CISPR Quasi-Peak mode ( 6dB Bandwidth : 120 kHz )  
 Measurement Distance : 3 meters

| Frequency [MHz] | Reading [dBμV] | Polarization (*H/**V) | Ant. Factor [dB] | Cable Loss [dB] | Emission Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] |
|-----------------|----------------|-----------------------|------------------|-----------------|-------------------------|----------------|-------------|
| 223.9           | 4.8            | H                     | 9.75             | 2.88            | 17.43                   | 46.0           | 28.57       |
| 448.7           | 4.3            | H                     | 15.48            | 4.05            | 23.83                   | 46.0           | 22.17       |
| 895.6           | 13.1           | H                     | 22.46            | 6.00            | 41.56                   | 46.0           | 4.44        |
| 1119.5          | -              | -                     | -                | -               | -                       | -              | -           |
| -               | -              | -                     | -                | -               | -                       | -              | -           |
|                 |                |                       |                  |                 |                         |                |             |
|                 |                |                       |                  |                 |                         |                |             |
|                 |                |                       |                  |                 |                         |                |             |
|                 |                |                       |                  |                 |                         |                |             |
|                 |                |                       |                  |                 |                         |                |             |
|                 |                |                       |                  |                 |                         |                |             |
|                 |                |                       |                  |                 |                         |                |             |
|                 |                |                       |                  |                 |                         |                |             |

Remarks : \* H : Horizontal polarization , \*\* V : Vertical polarization  
 Emission Level = Reading + Antenna factor + Cable loss  
 Margin value = Emission Level - Limit  
 All other emissions not reported above 1.0 GHz were more than 25dB below the permitted limit.

|                       |   |
|-----------------------|---|
| EUT                   | Paging Receiver Model : KWF-901 (SN:Prototype)      |
| Limit apply to        | FCC Part15 Subpart B Section 15.109                 |
| Test Date             | April 4, 2001                                       |
| Operating Condition   | Pager Receiving Mode( Frequency Tuning : 924.5MHz ) |
| Environment Condition | Humidity Level : 37 %RH, Temperature : 22           |
| Result                | Passed by – 4.49dB                                  |

### Radiated Emission Test Data

The following table shows the highest levels of radiated emissions on both polarization of horizontal and vertical.

Detector mode : CISPR Quasi-Peak mode ( 6dB Bandwidth : 120 kHz )  
 Measurement Distance : 3 meters

| Frequency [MHz] | Reading [dBμV] | Polarization (*H/**V) | Ant. Factor [dB] | Cable Loss [dB] | Emission Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] |
|-----------------|----------------|-----------------------|------------------|-----------------|-------------------------|----------------|-------------|
| 225.9           | 2.3            | H                     | 10.00            | 2.90            | 15.20                   | 46.0           | 30.80       |
| 451.9           | 6.5            | H                     | 16.03            | 4.10            | 26.63                   | 46.0           | 19.37       |
| 903.1           | 12.8           | H                     | 22.64            | 6.07            | 41.51                   | 46.0           | 4.49        |
| 1128.9          | -              | -                     | -                | -               | -                       | -              | -           |
| -               | -              | -                     | -                | -               | -                       | -              | -           |
|                 |                |                       |                  |                 |                         |                |             |
|                 |                |                       |                  |                 |                         |                |             |
|                 |                |                       |                  |                 |                         |                |             |
|                 |                |                       |                  |                 |                         |                |             |
|                 |                |                       |                  |                 |                         |                |             |
|                 |                |                       |                  |                 |                         |                |             |
|                 |                |                       |                  |                 |                         |                |             |
|                 |                |                       |                  |                 |                         |                |             |

Remarks : \* H : Horizontal polarization , \*\* V : Vertical polarization  
 Emission Level = Reading + Antenna factor + Cable loss  
 Margin value = Emission Level - Limit  
 All other emissions not reported above 1.0 GHz were more than 25dB below the permitted limit.



|                       |  |
|-----------------------|--|
| EUT                   | Paging Receiver Model : KWF-901 (SN:Prototype)         |
| Limit apply to        | FCC Part15 Subpart B Section 15.109                    |
| Test Date             | April 4, 2001  |
| Operating Condition   | Pager Receiving Mode( Frequency Tuning : 931.9875MHz ) |
| Environment Condition | Humidity Level : 37 %RH, Temperature : 22              |
| Result                | Passed by – 3.59dB                                     |

### Radiated Emission Test Data

The following table shows the highest levels of radiated emissions on both polarization of horizontal and vertical.

Detector mode : CISPR Quasi-Peak mode ( 6dB Bandwidth : 120 kHz )  
 Measurement Distance : 3 meters

| Frequency [MHz] | Reading [dBμV] | Polarization (*H/**V) | Ant. Factor [dB] | Cable Loss [dB] | Emission Level [dBμV/m] | Limit [dBμV/m] | Margin [dB] |
|-----------------|----------------|-----------------------|------------------|-----------------|-------------------------|----------------|-------------|
| 228.6           | 3.4            | H                     | 10.00            | 2.90            | 16.30                   | 46.0           | 29.70       |
| 456.0           | 5.7            | H                     | 16.03            | 4.10            | 25.83                   | 46.0           | 20.17       |
| 911.1           | 13.7           | H                     | 22.64            | 6.07            | 42.41                   | 46.0           | 3.59        |
| 1130.3          | -              | -                     | -                | -               | -                       | -              | -           |
| -               | -              | -                     | -                | -               | -                       | -              | -           |
|                 |                |                       |                  |                 |                         |                |             |
|                 |                |                       |                  |                 |                         |                |             |
|                 |                |                       |                  |                 |                         |                |             |
|                 |                |                       |                  |                 |                         |                |             |
|                 |                |                       |                  |                 |                         |                |             |
|                 |                |                       |                  |                 |                         |                |             |
|                 |                |                       |                  |                 |                         |                |             |
|                 |                |                       |                  |                 |                         |                |             |

Remarks : \* H : Horizontal polarization , \*\* V : Vertical polarization  
 Emission Level = Reading + Antenna factor + Cable loss  
 Margin value = Emission Level - Limit  
 All other emissions not reported above 1.5 GHz were more than 25dB below the permitted limit.

*Yo Han, Park*

Tested by : Yo Han, Park / Test Engineer

## 6. Sample Calculations

### Sample Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor.  
 The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF$$

where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

$$dB(\mu V/m) = 20 \log_{10} (\mu V / m) : \text{Equation 1}$$

$$dB\mu V = dBm + 107 : \text{Equation 2}$$

#### Example 1 : @ 0.218 MHz

|               |   |                       |            |
|---------------|---|-----------------------|------------|
| Class B Limit | = | 441.063 uV =          | 52.89 dBuV |
| Reading       | = | 48.45dBuV             |            |
| Convert to uV | = | 264.55uV              |            |
| Margin        | = | 48.45 – 52.89 = -4.44 |            |
|               | = | -4.44dB below Limit   |            |

#### Example 2 : @664.64 MHz

|                             |   |                      |        |
|-----------------------------|---|----------------------|--------|
| Class B Limit               | = | 70.79 uV = 37.0      | dBuV/m |
| Reading                     | = | 7.38dBuV             |        |
| Antenna Factor + Cable Loss | = | 25.14                | dB     |
| Total                       | = | 32.52                | dBuV/m |
| Margin                      | = | 32.52 – 37.0 = -4.48 |        |
|                             | = | -4.48dB below Limit  |        |

## 7. Test Summary

Equipment Under Test : Paging Receiver KWF-901

FCC Requirement : FCC Rule Part 15 Subpart B

Test Results:

| Requirement | Results             |
|-------------|---------------------|
| 15.107      | N/A                 |
| 15.109      | Passed by – 3.59 dB |

## 8. List of Test Equipments Used for Measurements

|                                     | Test Equipment     | Model    | Mfg.         | Serial No.  | Cal. Due Date |
|-------------------------------------|--------------------|----------|--------------|-------------|---------------|
| <input type="checkbox"/>            | Spectrum Analyzer  | R3261A   | Advantest    | 21720033    | 01-10-08      |
| <input checked="" type="checkbox"/> | Receiver           | ESVS 10  | R & S        | 835165/001  | 01-04-06      |
| <input checked="" type="checkbox"/> | Spectrum Analyzer  | R3265A   | Advantest    | 45060321    | 02-02-28      |
| <input checked="" type="checkbox"/> | Preamplifier       | HP8447B  | HP           | 2944A07626  | 01-03-05      |
| <input checked="" type="checkbox"/> | Preamplifier       | HP 8347A | HP           | 2834A00544  | 01-05-23      |
| <input checked="" type="checkbox"/> | TriLog Antenna     | VULB9160 | Schwarz Beck | 3082        | 01-05-08      |
| <input type="checkbox"/>            | LogBicon           | VULB9165 | Schwarz Beck | 2023        | 01-05-08      |
| <input type="checkbox"/>            | Dipole Antenna     | VHAP     | Schwarz Beck | 964         | 01-05-03      |
| <input type="checkbox"/>            | Dipole Antenna     | VHAP     | Schwarz Beck | 965         | 01-05-03      |
| <input type="checkbox"/>            | Dipole Antenna     | UHAP     | Schwarz Beck | 949         | 01-05-03      |
| <input type="checkbox"/>            | Dipole Antenna     | UHAP     | Schwarz Beck | 950         | 01-05-03      |
| <input checked="" type="checkbox"/> | Double Ridged Horn | 3115     | EMCO         | 9809-2334   | 01-09-20      |
| <input checked="" type="checkbox"/> | Turn-Table         | DETT-03  | Daeil EMC    | -           | N/A           |
| <input checked="" type="checkbox"/> | Antenna Master     | DEAM-03  | Daeil EMC    | -           | N/A           |
| <input type="checkbox"/>            | Plotter            | 7440A    | H.P          | 2725A 75722 | N/A           |
| <input checked="" type="checkbox"/> | Chamber            | DTEC01   | DAETONG      | -           | N/A           |
| <input checked="" type="checkbox"/> | Thermo Hygograph   | 3-3122   | ISUZU        | 3312201     | 01-12-20      |
| <input checked="" type="checkbox"/> | BaroMeter          | -        | Regulus      |             |               |