

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.

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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.(≥1MHz)	12.8MHz, 20.945MHz, 10MHz Logic : 76.8KHz , RF: 21.4MHz
- Chipset Brand&Part NO.	SAMSUNG : KA8512DTF-SDT SAMSUNG : KS8809DTF SUPERTECK : HV826LG MITSUBISHI : M30620SGP SAMSUNG : KS8701 SIPEX : SP3232ECY SST : SST-31LF041-70
- Power Consumption	DC 1.5V(Input from the Battery)
- Number of Layers	DIGITAL BOARD 4 LAYER RF BOARD 4 LAYER
- Freq. Range	917MHz – 932MHz
- Bit Rate	1,600/ 3,200/ 6,400 bps
- Channel Spacing	25KHz
- 1 st IF	21.4MHz
- 2 nd 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 [dB μ V]	Polarization (*H/**V)	Ant. Factor [dB]	Cable Loss [dB]	Emission Level [dB μ V/m]	Limit [dB μ V/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
☐	Spectrum Analyzer	R3261A	Advantest	21720033	01-10-08
☒	Receiver	ESVS 10	R & S	835165/001	01-04-06
☒	Spectrum Analyzer	R3265A	Advantest	45060321	02-02-28
☒	Preamplifier	HP8447B	HP	2944A07626	01-03-05
☒	Preamplifier	HP 8347A	HP	2834A00544	01-05-23
☒	TriLog Antenna	VULB9160	Schwarz Beck	3082	01-05-08
☐	LogBicon	VULB9165	Schwarz Beck	2023	01-05-08
☐	Dipole Antenna	VHAP	Schwarz Beck	964	01-05-03
☐	Dipole Antenna	VHAP	Schwarz Beck	965	01-05-03
☐	Dipole Antenna	UHAP	Schwarz Beck	949	01-05-03
☐	Dipole Antenna	UHAP	Schwarz Beck	950	01-05-03
☒	Double Ridged Horn	3115	EMCO	9809-2334	01-09-20
☒	Turn-Table	DETT-03	Daeil EMC	-	N/A
☒	Antenna Master	DEAM-03	Daeil EMC	-	N/A
☐	Plotter	7440A	H.P	2725A 75722	N/A
☒	Chamber	DTEC01	DAETONG	-	N/A
☒	Thermo Hygograph	3-3122	ISUZU	3312201	01-12-20
☒	BaroMeter	-	Regulus		