Electromagnetic Emission

FCC MEASUREMENT REPORT

VERIFICATION OF COMPLIANCE
FCC PART15 CERTIFICATION

Product	:	**Numeric Pager**
Model/Type No.	:	**AN1000**
FCC ID	:	**ODGAN1000**
Trade Nane	:	**NA**
Applicant	:	**HANTEL CO., LTD. Suntech city, Sangdaewon-Dong, Jungwon-Gu, Seongnam, Kyunggi-Do 462-806, Korea Attn. : Seo, Sung won / Manager Tel No. : 82-31-737-3641 Fax No. : 82-31-777-2340**
FCC Classification	:	**CXX : Communications Rcvr for use w/ licensed Tx and CBs**
FCC Rule	:	**FCC Part 15, Section 15.101**
FCC Procedure	:	**Certification**
Dates of Test	:	**November 14, 2003**
Dates of Issuing	:	**November 10, 2003**
Test Report No.	:	**BWS-03-EF-0048**
Test Lab.		**BWS Tech., Inc. (Registration No. : 553281)**

This Numeric Pager has been tested in accordance with the measurement procedures specified in ANSI C63.4-2000 at the BWS TECH/EMC Test Laboratory and has been shown to be complied with the electromagnetic emission limits specified in FCC Rule Part15 Subpart B Section15.107 and 15.109
I attest to the accuracy of data. All measurement 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. The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Tae Hyun Nam
President of
BWS TECH Inc.

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FCC TEST 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)*

1. General Information

Applicant

Company Name	:	**HANTEL CO., LTD.**
Company Address	:	**Suntech city, Sangdaewon-Dong, Jungwon-Gu, Seongnam, Kyunggi-Do 462-806, Korea**
Phone/Fax	:	**Tel No. : 82-31-737-3641 Fax No. : 82-31-777-2340**

Manufacturer

Company Name	:	**HANTEL CO., LTD.**
Company Address	:	**Suntech city, Sangdaewon-Dong, Jungwon-Gu, Seongnam, Kyunggi-Do 462-806, Korea**
Phone/Fax	:	**Tel No. : 82-31-737-3641 Fax No. : 82-31-777-2340**

- EUT Type : **Numeric Pager**
- Model Number : **AN1000**
- FCC Identifier : **ODGAN1000**
- S/N : **Prototype**
- FCC Rule Part(s) : **CFR Title 47 Part 15 ,Section 15.101**
- Test Procedure : **ANSI C63.4-2000**
- FCC Classification : **CXX : Communications Rcvr for use w/ licensed Tx and CBs**
- Dates of Tests : **Nov 14, 2003**
- Place of Tests : **BWS TECH Inc.**
  EMC Testing Lab (FCC Registration Number : 553281)
  294-9, Jungdae-Dong, Kwangju-Si, Kyunggi-Do, 464-080, Korea
  TEL: +82 31 762 0124 FAX: +82 31 762 0126
- Test Report No. : **BWS-03-EF-0048**

2. Description of Test Facility

The measurement test for radiated and conducted emission test were conducted at the open area test site of BWS TECH Inc. facility located at 294-9, Jungdae-Dong, Kwangju-Si, Kyunggi-Do, Korea. The site is constructed in conformance with the requirements of the ANSI C63.4-2000 and CISPR Publication 16. The BWS TECH measurement facility has been filed to the Commission 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 C63.4-2000 and registered to the Federal Communications Commission(Registration Number : 553281).

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.63.4-2000) was used in determining radiated and conducted emissions from the HANTEL CO., LTD. Numeric Pager Model : AN1000.

3. Product Information

3.1 Equipment Description

The HANTEL CO.,LTD., Model AN1000 is a Numeric Pager that uses a microcomputer to control radio frequency(RF) circuits and other customized decoding hardware to receive, decode, store, and display numeric pages. A page is received via the main RF carrier modulated with the proper base band sequence defined by the paging protocol.

3.2 General Specification

Chassis type	Plastic
List of each OSC. Or CRY. Frequency.(FREQ.≥ 1MHz)	21.4MHz, 20.945MHz, 2MHz
Power requirement	DC 1.5V Battery
Tuning Frequency	929MHz ~ 932MHz
Detect Method	Super heterodyne Detector

3.3 Variations covered by this report

Model Difference : N/A

Technical Deviation :N/A.

3.4 Additional Information Related to Testing

N/A

4. Description of Tests

4.1 Conducted Emission Measurement

Conducted emissions measurements were made in accordance with section 11, "Measurement of Information Technology Equipment" of ANSI C63.4-2000. The measurement were performed over the frequency range of 0.15MHz to 30MHz using a 50Ω/50uH LISN as the input transducer to a Spectrum Analyzer or a Field Intensity Meter. The measurements were made with the detector set for "Peak" amplitude within an bandwidth of 10KHz or for "quasi-peak" within a bandwidth of 9KHz.

The line-conducted emission test is conducted inside a shielded anechoic chamber room with 1m x 1.5m x 0.8m wooden table which is placed 40cm away from the vertical wall and 1.5m away from the side wall of the chamber room. Two LISNs are bonded to the shielded room. The EUT is powered from the PMM LISN and the support equipment is powered from the another Koritsu LISN. Power to the LISNs is filtered by a noise cut power line filters. All electrical cables are shielded by braided tinned steel tubing with inner ϕ 1.2cm. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and these supply lines will be connected to the EMCO LISN. All interconnecting cables more than 1m were shortened by non-inductive bundling(serprntine fashion) to a 1m length. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the R3261A Spectrum Analyzer to determine the frequency producing the max. emission from the EUT. The frequency producing the max. level was reexamined using the detector function set to the CISPR Quasi-Peak mode by manual, after scanned by automatic Peak mode from 0.15 to 30MHz. The bandwidth of the Spectrum Analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was maximized by switching power lines, varying the mode of operation or resolution, clock or data exchange speed, if applicable, whichever determined the worst-case emission. Each emission reported was calibrated using self-calibrating mode.

Photographs of the worst-case emission can be seen in photographs of conducted emission test setup.

4.2 Radiated Emission Measurement

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 biconical and logperiodic 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 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 system was tested in all the three orthogonal planes and changing the polarity of the antenna. 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 A.

5. Test Condition

5.1 Test Configuration

The device was configured for testing in a typical fashion (as a customer would normally use it). During the tests, the EUT and the supported equipments were installed to meet FCC requirement and operated in a manner which tends to maximize its emission level in a typical application.

Radiated Emission Test

Preliminary radiated emission tests were conducted using the procedure in ANSI C63.4/2000 Clause 8.3.1.1 to determine the worst operating condition. Final radiated emission tests were conducted at 3 meter open field test site.

5.2 EUT operation

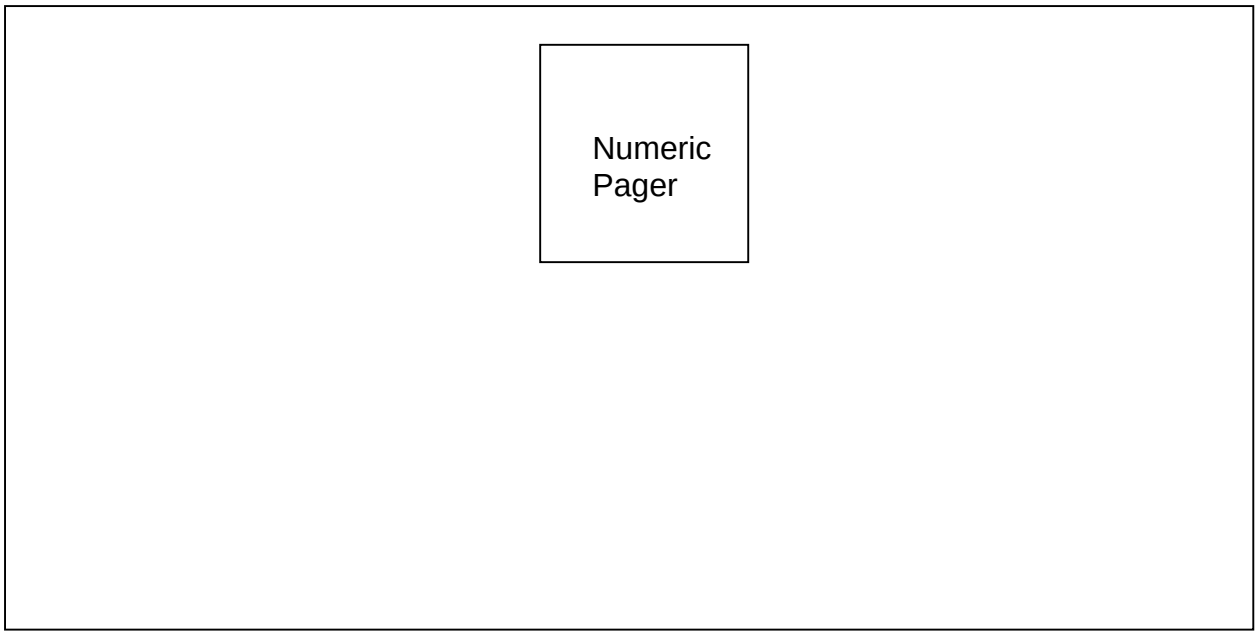
EUT was tested according to the following operation modes provided by the specifications given by the manufacturer, and reported the worst emissions.

Description of Testing operating mode

Operation Mode	The Worse operating condition(Please check one only)
Standby	
Receiving	**x**

5.3 Test System layout on EUT and peripherals

——— Interface cable ▬▬▬ Power cable



5.4 Peripherals / Support Equipment Used

Following peripheral devices and interface cables were connected during the measurement:

Type of Peripheral Equipment Used:

Description	Model Name	Serial No.	Manufacturer	FCC ID
Pager(EUT)	AN1000	N/A	HANTEL CO., LTD..	ODGAN1000

Type of Cables Used:

NA.

6. TEST RESULTS

6.1 Summary of Test Results

The measurement results were obtained with the EUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum emission of the EUT are reported.

Configuration of Test System	Result
Conducted Emission	It does not need to test this requirement, because of the power of the EUT is supplied form a DC battery
Radiated Emissions	Passed by –7.48 dB

Note : Modification to EUT

The device tested 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.

6.2 Conducted Emissions

It does not need to test this requirement, because of the power of the EUT is supplied form a DC battery

6.3 Radiated Emissions

EUT	: Numeric Pager Model : AN1000(SN:Prototype)
Limit apply to	: FCC Part15 Subpart B Section 15.101
Test Date	: Nov 14. 2003
Operating Condition	: Receiving mode (Operating frequency : 929.2875MHz)
Environment Condition	: Humidity Level : 30 %RH, Temperature : 20 ℃
Result	: Passed by – 7.48 dB

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]	Limit [dBμV/m]	Emission Level [dBμV/m]	Margin [dB]
75.65	14.00	H	6.15	1.60	40.00	21.75	-18.25
151.30	1.96	H	14.73	2.51	43.50	19.20	-24.30
226.98	3.01	H	16.93	3.16	46.00	23.10	-22.90
302.70	6.65	H	12.79	3.67	46.00	23.11	-22.89
907.88	8.14	H	23.50	6.88	46.00	38.52	-7.48

NOTES :

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

*Tested by **Jin Seok,Kim***

EUT : Numeric Pager Model : AN1000(SN:Prototype)
Limit apply to : FCC Part15 Subpart B Section 15.101
Test Date : Nov 14. 2003
Operating Condition : Receiving mode (Operating frequency : 931.7375MHz)
Environment Condition : Humidity Level : 30 %RH, Temperature : 20 ℃
Result : Passed by – 8.76 dB

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]	Limit [dBμV/m]	Emission Level [dBμV/m]	Margin [dB]
75.86	14.75	H	6.15	1.60	40.00	22.50	-17.50
151.72	1.38	H	14.73	2.51	43.50	18.62	-24.88
227.58	1.98	H	16.96	3.16	46.00	22.10	-23.90
303.45	7.99	H	12.84	3.67	46.00	24.50	-21.50
910.34	6.76	H	23.60	6.88	46.00	37.24	-8.76

NOTES :

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

*Tested by **Jin Seok,Kim***

7. Sample Calculation and Other Information

7.1 Sample Calculations

$$dB\mu V = 20 \log 10 (\mu V / m)$$

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

EX. 1.

N / A

EX. 2.

@ 907.88 MHz Class B limit = 46.0 dBμV / m

Reading = 8.14 dBμV(calibrated level)
Antenna factor + Cable Loss = 30.38 dB
Total = 38.52 dBμV / m
Margin = 38.52 – 46.00 = -7.48 dB
7.48 dB ; below limit

7.2. Measurement Uncertainty

Measurement uncertainty of RFI Voltage Measurement test was estimated at ±3.51 dB(k=2)
Measurement uncertainty of RFI Field Strength Measurement test was estimated at ±4.34dB (k=2)

8. TEST EQUIPMENTS LIST

The listing below denotes the test equipments utilized for the test(s).

Test Equipment	Manufacture Model Number	Serial Number	Calibration Due date
Signal Analyzer	PMM PMM9000	3100570602	08 / 16 / 04
EMC Analyzer	HP E7403A	US39150108	02 / 27 / 04
Spectrum Analyzer	ADVANTEST E7403A	61720002	08 / 22 / 04
Amplifier (0.1MHz-1.3GHz)	HP 8447E	2945A02712	08 / 19 / 04
Biconical Antenna	SWALZBECK BBA9106	N / A	09 / 12 / 04
Log Periodic Antenna	SCHAFFNER UPA6109	N / A	09 / 12 / 04
Plotter	HP 7475A	007475A	N / A
Shield Room 7m x 4m x 4m	SEMITECH	000815	N / A
Turn Table	JAEMC JAC-2	N / A	N / A
Antenna Mast	Dae-il EMC JAC-1	N / A	N / A
Artificial Mains Network	PMM L3-25	1110K70403	10 / 02 / 04
Artificial Mains Network	KYORITSU KNW-242C	8-920-20	08 / 31 / 04
Antenna Turntable Controller	JAEMC JAC-2	N / A	N / A