

# RF MEASUREMENT REPORT

## CERIFICATION OF COMPLIANCE

PRODUCT : RF CARD READER  
MODEL/TYPE NO : DE-600S  
FCC ID : SWUDE-600S  
TRADE NAME : DUALi INC.  
APPLICANT : DUALi INC.  
#505, Samsung Technopark, 471, Woncheon-dong, Yungtong-gu,  
Suwon, Korea  
Attn. : TAEYANG-HA/ Team manager  
FCC CLASSIFICATION : DX- Part 15 Low Power Communication Device Transmitter  
FCC RULE PART(S) : FCC Part 15 Subpart C Section 15.225  
FCC PROCEDURE : Certification  
DATES OF TEST : June 7 to July 20, 2006  
DATES OF ISSUE : July 27, 2006  
TEST REPORT No. : BWS-06-RF-0018  
TEST LAB. : BWS TECH Inc. (Registration No. : 553281)

This Digital Transmission System 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 radiated emission limits specified in FCC Rule Part15 Subpart C Section 15.247.

I attest to the accuracy of data. All measurement herein was 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.

2006/7/27  
(Date)

Tested by EunJung, Yang

2006/7/27  
(Date)

Reviewed by TaeHyun, Nam

**BWS TECH Inc.**

www.bws.co.kr

#611-1 Maesan-Ri, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do 449-853, Korea

TEL: +82 31 333 5997 FAX: +82 31 333 0017



---

1. General Information	3
2. Description of Test Facility	4
3. Product Information	5
4. Description of Tests	6
5. Test Condition	8
6. Test Results	10
7. Test Equipment List	25

Appendix 1 Test Setup Photos

Appendix 2 External Photos of EUT

Appendix 3 Internal Photos of EUT

Appendix 4 Block Diagram

Appendix 5 Schematics

Appendix 6 User Manual

Appendix 7 Part list

Appendix 8 Operational Description

Appendix 9 Statement request

Appendix 10 FCC ID Label and location

# 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** : DUALi INC.  
**Company Address** : #505, Samsung Technopark, 471, Woncheon-dong,  
Yungtong-gu, Suwon, Korea  
**Phone/Fax** : Phone : +82-31-213-0078 Fax : +82-31-213-0074

### Manufacturer

**Company Name** : DUALi INC.  
**Company Address** : #505, Samsung Technopark, 471, Woncheon-dong,  
Yungtong-gu, Suwon, Korea  
**Phone/Fax** : Phone : +82-31-213-0078 Fax : +82-31-213-0074

- **EUT Type** : RF CARD READER
- **Model Number** : DE-600S
- **FCC Identifier** : SWUDE-600S
- **S/N** : Prototype
- **Freq. Range** : 13.56MHz
- **Number of Channels** : 1
- **Modulation Method** : ASK
- **FCC Rule Part(s)** : Part 15 Subpart C Section 15.225
- **Test Procedure** : ANSI C63.4-2000
- **Dates of Tests** : June 7 to July 20, 2006

- **Place of Tests** : BWS TECH Inc.  
EMC Testing Lab (FCC Registration Number : 553281)  
#611-1 Maesan-Ri, Mohyeon-Myeon, Cheoin-Gu,  
Yongin-Si, Gyeonggi-Do 449-853, Korea  
TEL: +82 31 333 5997 FAX: +82 31 333 0017

- **Test Report No.** : BWS-06-RF-0018

---

## 2. Description of Test Facility

---

The measurement for radiated emission test were practiced at the open area test site of BWS TECH Inc. Measurement for conducted emission test were practiced at the semi EMC Anechoic Chamber test site of BWS TECH Inc. facility located at #611-1 Maesan-Ri, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do 449-853, 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 C63.4-1992 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 emissions from the DUALi INC. Model : DE-600S.

---

### 3. Product Information

---

#### 3.1 Equipment Description

The Equipment Under Test (EUT) is RF transmitter by the DUALi INC. Model : DE-600S. (FCC ID : SWUDE-600S).

- Support read / write the ISO14443  
Type A & B RF-Card, Mifare Card Protocol.
- Host Communication : USB

#### 3.2 General Specification

Functions

- Mifare card read/write
- ISO 14443 A-Type card read/write
- ISO 14443 B-Type card read/write
- Buzzer ON/OFF

Characteristic

- Operation Temperature : -20℃~60℃
- Input Volatge : DC 5V(USB)
- Card Reading Range : Inside 10 Cm

#### 3.3 Variations covered by this report

Model Difference : N/A

Technical Deviation : N/A

#### 3.4 Additional information related to Testing

☒ **Note.**

This report may be reproduced in full. Partial reproduction may only be made with the written permission of the laboratory. The results in this report is only applied to the sample(s) tested.

☒ **Note.**

Please refer to the duties and responsibilities of the Responsible Party attached.



## 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 50 $\Omega$ /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 a 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 sidewall 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 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  $\phi$  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 LISN. All interconnecting cables more than 1m were shortened by non-inductive bundling (serpentine 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 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 0.45 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 configurations, 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 bi-log 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 was 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 log periodic, Horn 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 25GHz). 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.

Varying the mode of operating frequencies of the EUT maximized each emission. 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).

---

## 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 measured at 3-meter open field test site. To complete the test configuration required by the FCC, the EUT was tested in all three orthogonal planes.

### 5.2 EUT operation

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



## 6. TEST RESULTS

### 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.

APPLIED STANDARD : 47 CFR Part 15, Subpart C			
FCC Rule	Description of Test	Limit	Result
15.207	Power Line Conducted Emission	Various	Pass
15.209 & 15.225(d)	Radiated Emission	Various	Pass
15.225(a)~(c)	Emission Mask	Various	Pass
15.225(e)	Frequency Tolerance	Less than 0.01%	Pass

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.

## 6.1 Power Line Conducted Emission

Test Standard : FCC Part15 Subpart C Section 15.207  
Operating Condition : The EUT was operated at transmitting condition continuously during the test.  
Temperature/Humidity : 26.0 °C/ 42 %

The following table shows the highest levels of conducted emissions on both phase of Hot and Neutral line.

### Power Line Conducted Emission Test Data

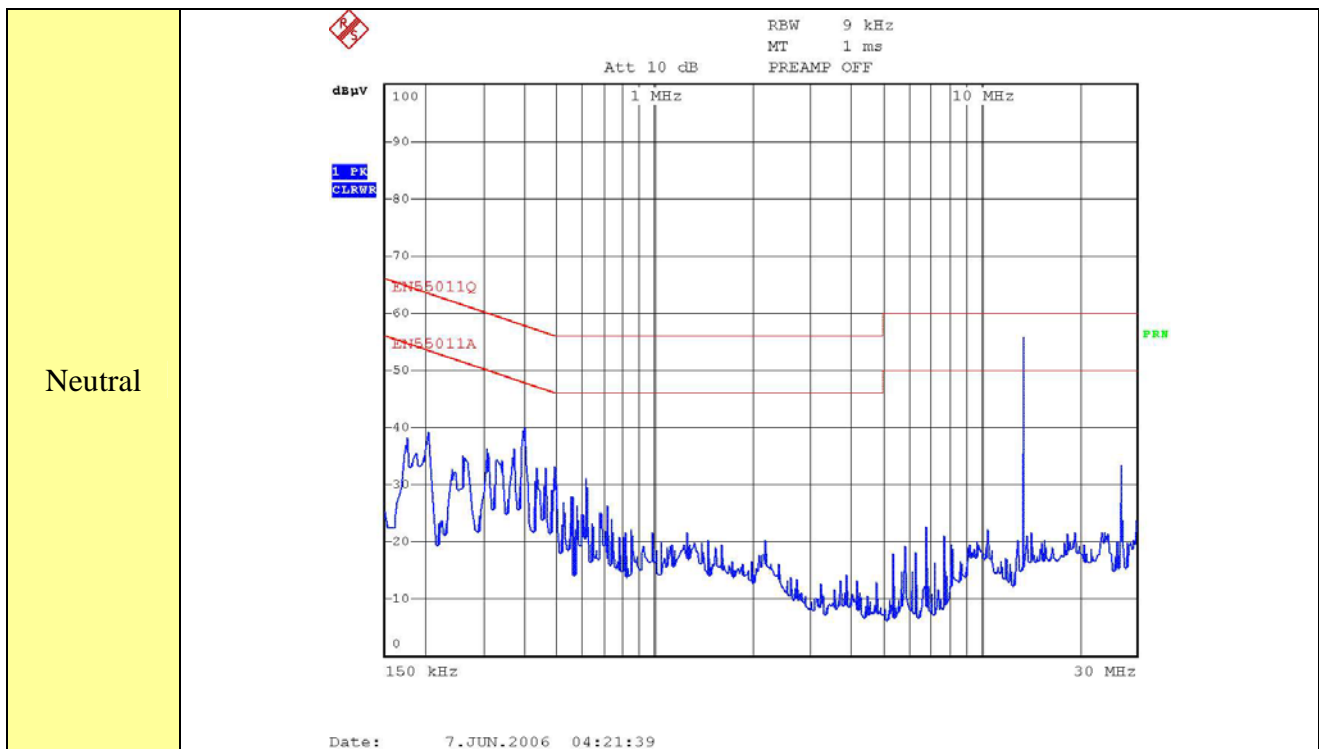
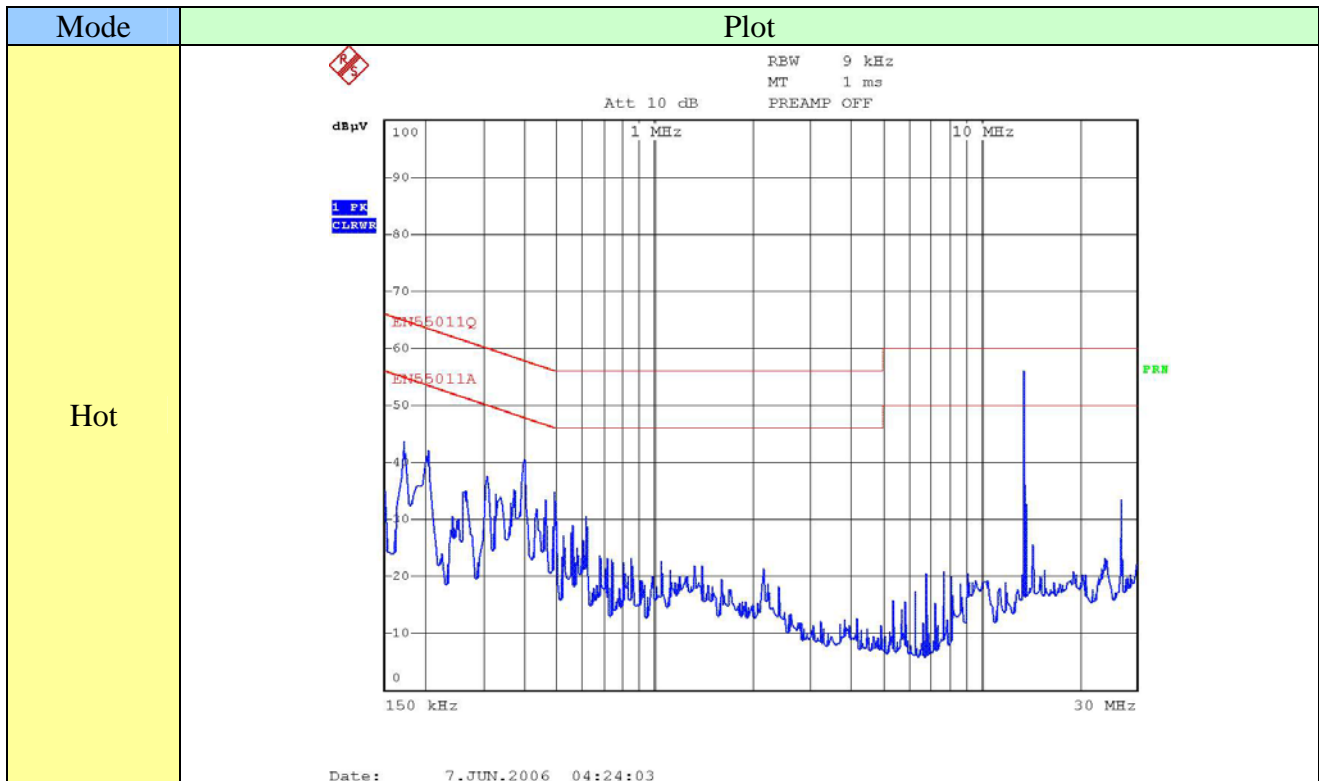
Detector Mode ; CISPR Quasi Peak mode (6dB Bandwidth : 9kHz)

Freq [MHz]	Correction		Phase [H/N]	Quasi-Peak Mode				Average Mode			
	AMN	C.L		Limit	Reading	Emission Level	Margin	Limit	Reading	Emission Level	Margin
				[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]
0.170	0.06	0.03	H	65.40	43.82	43.91	21.49	55.40	-	-	-
0.306	0.08	0.22	H	61.60	37.64	37.94	23.66	51.60	-	-	-
0.398	0.08	0.24	H	59.00	40.68	41.00	18.00	49.00	-	-	-
0.502	0.07	0.30	N	56.00	29.73	30.10	25.90	46.00	-	-	-
0.618	0.07	0.30	N		31.04	31.41	24.59		-	-	-
6.798	0.04	0.95	N	60.00	22.62	23.61	36.39	50.00	-	-	-
27.118	0.19	1.55	N		33.46	35.20	24.80		-	-	-

NOTES :

1. H : Hot Line , N :Neutral Line
2. Emission Level = Reading + Correction Factor
3. Measurements were performed at the AC Power Inlet of the host PC with the EUT plugged in the frequency band of 150kHz ~ 30MHz.
4. Because signal at 13.56MHz is fundamental signal, that signal is excepted.

## Plots of Power Line Conducted Emission



## 6.2 Radiated Emission

Test Standard : FCC Part15 Subpart C Section 15. 209 & 225(d)  
 Operating Condition : The EUT was operated at transmitting condition continuously during the test.  
 Temperature/Humidity : 26.2 °C/ 67 %

Measurement Distance : 3 meters

### Radiated Emission Test Data

Frequency [MHz]	Reading [dB $\mu$ V]	Polarization n [*H/**V]	Ant.Factor [dB]	Cable Loss [dB]	Limit [dB $\mu$ V/m]	Emission Level [dB $\mu$ V/m]	Margin <sup>04</sup> [dB]
40.56	13.96	H	12.70	1.06	43.50	27.72	-15.78
59.64	13.74	H	11.52	1.56	43.50	26.82	-16.68
72.08	19.03	H	8.69	1.86	46.00	29.58	-16.42
168.41	19.14	H	16.53	2.63	46.00	38.30	-7.70
203.52	19.61	H	12.61	2.71	46.00	34.93	-11.07
230.91	28.90	H	12.25	2.80	46.00	43.95	-2.05
258.33	20.76	H	12.67	2.88	46.00	36.32	-9.68

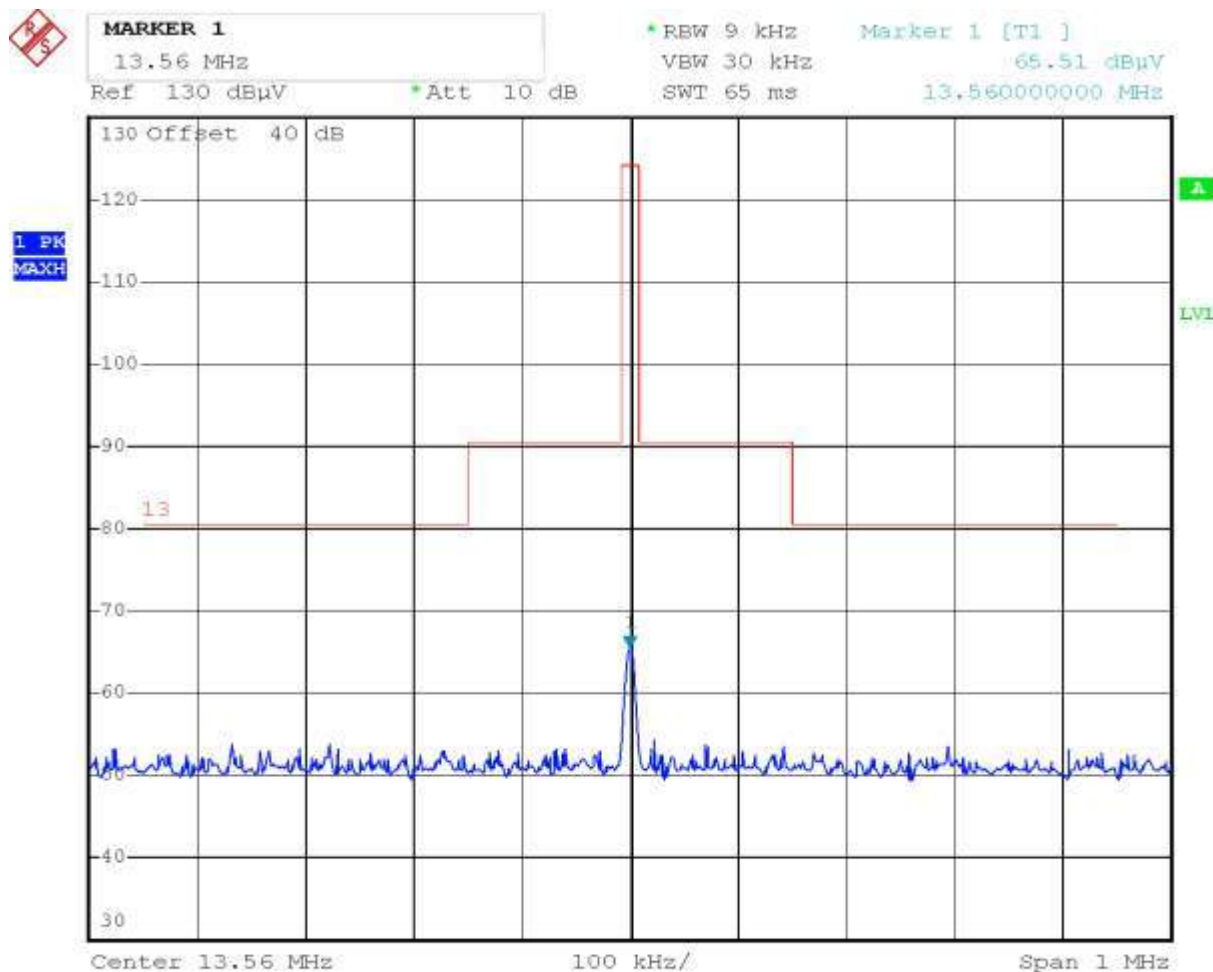
#### NOTES :

1. All modes of operation were investigated and the worst-case emissions are reported.
2. AF = Antenna Factor CL = Cable Loss F/S = Field Strength
3. POL H = Horizontal POL V = Vertical

## 6.3 Emission Mask

Test Standard : FCC Part15 Subpart C Section 15.225(a)~(c)  
Operating Condition : The EUT was operated at transmitting condition continuously during the test.  
Temperature/Humidity : 26.2 °C/ 67 %

Measurement Distance : 3 meters



Date: 16.JUN.2006 11:08:21

### NOTES :

1. Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter (50.47 dBuV/m) at 30 meters.
2. Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter (40.51 dBuV/m) at 30 meters.
3. Extrapolated from the measured distance (3 m) to the specified distance (30 m) using the square of an inverse linear distance extrapolation.

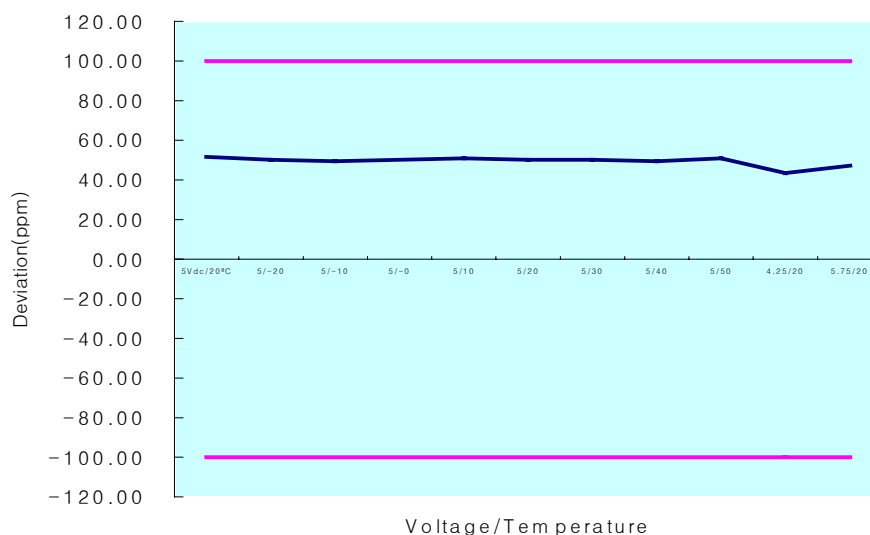
## 6.4 Frequency tolerance

Test Standard : FCC Part15 Subpart C Section 15.225(e)  
 Operating Condition : The EUT was operated at transmitting condition continuously during the test.  
 Temperature/Humidity : 26.2 °C/ 67 %

Voltage (%)	Power Supply (Vdc)	Temperature (°C)	Frequency (Hz)	Deviation	PPM
100	5	20	13559300	700	51.62
100	5	-20	13559320	680	50.15
100	5	-10	13559330	670	49.41
100	5	0	13559320	680	50.15
100	5	10	13559310	690	50.88
100	5	20	13559320	680	50.15
100	5	30	13559320	680	50.15
100	5	40	13559330	670	49.41
100	5	50	13559310	690	50.88
85	4.25	20	13559410	590	43.51
115	5.75	20	13559360	640	47.20

Note :

1. The worst-case temperature & voltage deviation was recorded.
2. Frequency drift of this unit dose not happen.



## 7. TEST EQUIPMENTS LIST

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

	EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date
1	Receiver	FSPI	ROHDE & SCHWARZ	100012	02/23/07
2	Receiver	ESVS10	ROHDE & SCHWARZ	863247/019	11/15/06
3	Turn Table	OSC-30	N/A	BWS-01	N/A
4	ANTENNA MAST	JAC-3	DAIL EMC	N/A	N/A
5	Temperature & Humidity chanber	EN-GLMP-3000	ENEX	MY41018053	03/23/07
6	Bilog Antenna	VULB9160	SCHWARZBECK	VULB9160-3122	12/16/06
7	Power supply	IPS-30B03DD	INTERACT	42052	03/10/07-
8	Loop Antenna	HFH2-Z2	ROHDE&SCHWARZ	881068/6	08/19/06
10	LISN	L1-115	Com-Power	241017	11/11/06
11	LISN	L1-115	Com-Power	241018	11/02/06
12	EMC RECEIVER	ESPI	ROHDE&SCHWARZ	100063	12/12/06
13	Conducted Cable	N/A	N/A	N/A	N/A