

# Electromagnetic Emission

## FCC MEASUREMENT REPORT

---

### CERTIFICATION OF COMPLIANCE

### FCC Part 15 Certification Measurement

**PRODUCT** : Smart-card Reader  
**MODEL/TYPE NO** : SSR120  
**FCC ID** : QGUSSR120  
**APPLICANT** : Smart System, Inc.  
365-1, GunHee Bldg, 2F. YangJae-Dong, Seocho-Gu,  
Korea, 137-898  
Attn. : Choi, Kwang-Joon / Director, R&D Div  
**FCC CLASSIFICATION** : Class B personal computers and peripherals  
**FCC RULE PART(S)** : FCC Part 15 Subpart B  
**FCC PROCEDURE** : Certification  
**TRADE NAME** : SMART-SYSTEM  
**TEST REPORT No.** : E02.0625.FCC.362N  
**DATES OF TEST** : June 17, 2002  
**DATES OF ISSUE** : June 25, 2002  
**TEST LABORATORY** : ETL Inc (FCC Registration Number : 95422)  
#584 Sangwhal-ri, Kanam-myon, Yaju-kun, Kyounggi-do,  
469-880, Korea  
Tel: (031) 885-0072 Fax: (031) 885-0074

This Smart-card Reader, Model SSR120 has been tested in accordance with the measurement procedures specified in ANSI C63.4-1992 at the ETL/EMC Test Laboratory and has been shown to be complied with the electromagnetic radiated emission limits specified in FCC Rule Part15 Subpart B Class B personal computers and peripherals.

I attest to the accuracy of data. All measurements 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.

*Yo Han, Park*

Name : Yo Han, Park

Title : Chief Engineer & Lab. Manager

**E-RAE Testing Laboratory Inc.**  
#584 Sangwhal-ri, Kanam-myon, Yaju-kun,  
Kyounggi-do, 469-880, Korea



## **Table of Contents**

### **FCC Measurement Report**

- 1. Introduction**
- 2. Product Information**
- 3. Description of Tests**
- 4. Test Condition**
- 5. Test Results**
  - 5.1 Summary of Test Results**
  - 5.2 Conducted Emissions Measurement**
  - 5.3 Radiated Emissions Measurement**
- 6. Sample Calculations**
- 7. List of test Equipment used for Measurement**

- Appendix A. FCC Label and Location**
- Appendix B. Test Setup Photographs**
- Appendix C. External Photographs**
- Appendix D. Internal Photographs**
- Appendix E. Block Diagram**
- Appendix F. Circuit Diagram**
- Appendix G. User' s Manual**

# 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)

## General Information

**Applicant Name** : Smart System, Inc.

**Address** : 365-1, GunHee Bldg, 2F. YangJae-Dong, Seocho-Gu,  
Seoul, Korea, 137-898

**Attention** : Choi, Kwang-Joon / Director, R&D Div

- **EUT Type** : Smart-card Reader
- **Model Number** : SSR120
- **FCC Identifier** : QGUSSR120
- **S/N** : N/A
- **FCC Rule Part(s)** : FCC Part 15 Subpart B
- **Test Procedure** : ANSI C63.4-1992
- **FCC Classification** : Class B computers and peripherals
- **Dates of Tests** : June 17, 2002
- **Place of Tests** : ETL Inc  
EMC Testing Lab (FCC Registration Number : 95422)  
584, Sangwhal-Ri, Kanam-Myun, Yoju-Kun,  
Kyounggi-Do, Korea  
Tel : (031) 885-0072 Fax : (031) 885-0074
- **Test Report No.** : E02.0625.FCC.362N



## 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, Kyounggi-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 meters 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 Smart System, Inc. Model: SSR120

## 2. PRODUCT INFORMATION

---

### 2.1 Equipment Description

The Equipment Under Test(EUT) is the Smart System, Inc. Smart-card Reader, SSR120  
Please refer to Users manual

### 2.2 General Specification

- Chassis Type : Plastic
- List of Each OSC. Or X-Tal. Freq. ( $\geq 1$ MHz) : X-Tal. 3.579545MHz
- Chipset Brand & Part No. : ATMEL / AT89C51
- Card interface life : 100,000 mating cycles
- Contact material : gold plated brass
- Interface : PC, serial connection RS232, V.24
- Interface speed : 9600bps to 115200bps (PTS)
- Display : Red LED(power, P&P), Green LED(Card power ON)
- Protocols : T=0, T=1 Transparent Card interface
- Standards : ISO 7816-1,2,3,4 PC/SC
- Temperature range : -10 to +50
- Power supply : Power sharing from USB 5V DC
- Card current supply : 0 to 60 mA
- Connection cable : 150Cm, 9pin, SUB-D
- Demensions : 82mm X 67mm X 17mm
- Weight : 210 gram

### 3. DESCRIPTION OF TESTS

---

#### 3.1 Conducted Emission Measurement

Conducted emissions measurements were made in accordance with § 12.2 in ANSI C63.4-1992 "Measurement of Information Technology Equipment ". The measurement were performed over the frequency range of 0.15MHz to 30MHz using a 50 /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.

- Procedure of Test

The line-conducted facility is located inside a shielded room 1m X 1.5m wooden table 80cm high is placed 40cm away from the vertical wall and 1.5m away from the side wall of the shielded room. Two EMCO 3825/2 LISN are bonded to the shielded room. The EUT is powered from the EMCO LISN and the support equipment is powered from the another EMCO LISN. Power to the LISNs are 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 EMCO LISN. Non-inductive bundling to a 1m length shortened all interconnecting cables more than 1m. 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 to set 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.

### 3. DESCRIPTION OF TESTS

---

#### 3.2 Radiated Emission Measurement

Radiated emission measurements were in accordance with § 12.2 in ANSI C63.4-1992 "Measurement of Information Technology Equipment ". The measurements were performed over the frequency range of 30MHz to 1GHz using antenna as the input transducer to a Spectrum analyzer or a Field Intensity Meter. The measurements were made with the detector set for "Quasi-peak" within a bandwidth of 120KHz.

- Procedure of Test

Preliminary measurements were made at 3 meter using broadband antennas, and spectrum analyzer to determined the frequency producing the max. emission in shielded room. Appropriate precaution was taken to ensure that all emission from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth and height with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30 to 1000MHz using SchwarzBeck Log-Bicon antenna. Above 1GHz, linearly polarized double ridge horn antennas were used. Final measurements were made open site at 10-meters. The test equipment was placed on a wooden turn-table. 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 by manual. The detector function was set to CISPR Quasi-peak mode and the bandwidth of the receiver was set to 120kHz or 1MHz depending on the frequency of type of signal. The EUT, support equipment and interconnecting cables were re-configured to the set-up producing the max. emission for the frequency and were placed on top of a 0.8-meter high nonmetallic 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each emission. The turntable containing the system was rotated; the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the max. emission. Each emission was maximized by: varying the mode of operation to the EUT and/or support equipment and changing the polarity of the antenna, whichever determined the worst-case emission. Photographs of the worst-case emission can be seen in Photographs of the worst-case emission test setup can be seen in Appendix B.

## 4. TEST CONDITION

---

### 4.1 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.

### 4.2 EUT operation

Operating Mode	The worst operating condition
Stand by Mode	
Data Read & Write Mode	O

### 4.3 Support Equipment Used

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

#### EUT – Smart-card Reader

FCC ID : QGUSSR120  
Model Name : SSR120  
Serial No. : N/A  
Manufacturer : Smart System, Inc.  
Power Supply : DC 5V from USB of PC  
Power Cord : Shielded, Detachable, 1.5m(USB Cable)  
Data Cable : 1.5m Shielded 9pin D-SUB RS232 Cable

#### Support Unit 1-Persnal computer (DELL)

FCC ID : N/A (DoC)  
Model Name : MMP  
Serial No. : 2LL11S  
Manufacturer : DELL  
Power Supply Type : Switching  
Power Cord : Non-shielded, Detachable: 1.2m  
Data Cable : Shielded, Detachable 1.5m



**Support Unit 2-KeyBoard (DELL)**

FCC ID : N/A (DoC)  
Model Name : SK-8000  
Serial No. : 2965  
Manufacturer : DELL  
Power Supply Type : N/A  
Power Cord : N/A  
Data Cable : None-Shielded, 1.5m

**Support Unit 3-Mouse (LOGITECH)**

FCC ID : DZL211029  
Model Name : M-S34  
Serial No. : LZC01002314  
Manufacturer : LOGITECH  
Power Supply Type : N/A  
Power Cord : N/A  
Data Cable : None-Shielded, 1.2m

**Support Unit 4- EAR- MIC (JETECH)**

FCC ID : N/A  
Model Name : JE101  
Serial No. : N/A  
Manufacturer : JETECH  
Power Supply Type : N/A  
Power Cord : N/A  
Data Cable : Shielded, 1.5m

**Support Unit 5- Printer (H.P)**

FCC ID : N/A  
Model Name : COLOR CAP 330  
Serial No. : 11-03098  
Manufacturer : LEZMARK INTERNATIONAL INC.  
Power Supply Type : Switching  
Power Cord : Non-shielded, Detachable: 1.2m  
Data Cable : Shielded, Detachable 1.5m

**Support Unit 6- Monitor (E-RAE)**

FCC ID : OIOELM-150  
Model Name : ELM-150B  
Serial No. : N/A  
Manufacturer : E-RAE Electronics Industry Co., Ltd.  
Power Supply Type : DC12V From Adaptor  
Power Cord : Non-shielded, Detachable: 1.2m  
Data Cable : Shielded 15pin D-sub, 1.5m



## 5. TEST RESULTS

---

### 5.1 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.

Test Rule Parts	Measurement Required	Result
15.107(e)	Conducted Emissions Measurement	Passed by -4.18dB
15.109(g)	Radiated Emissions Measurement	Passed by -3.70dB

The data collected shows that the **Smart System, Inc. Smart-card Reader, SSR120** complies with technical requirements of above rules part 15.107(e) and 15.109(g) CISPR 22 Class B Limits

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.

## 5. TEST RESULTS

### 5.2 Conducted Emissions Measurement

EUT	Smart-card Reader / SSR120 (S/N:NONE)
Limit apply to	FCC Part 15. 107(e) CISPR 22 CLASS B
Test Date	June 17, 2002
Operating Condition	Data Read & Write Mode
Environment Condition	Humidity Level : 48%RH, Temperature : 30
Result	Passed by -4.18dB

#### Conducted Emission Test Data

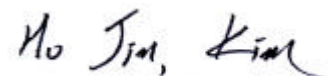
The following table shows the highest levels of conducted emissions on both polarization of live and neutral line.

Detector mode : CISPR Quasi-Peak mode ( 6dB Bandwidth : 9 KHz )

Frequency [MHz]	Reading [dB $\mu$ V]		Phase (*H/**N)	Limit [dB $\mu$ V]		Margin [dB]	
	Quasi-peak	Average		Quasi-peak	Average	Q.Peak	Average
0.150	47.62	-	H	66.00	56.00	18.38	-
0.176	45.60	-	H	64.67	54.67	19.07	-
0.586	40.77	-	N	56.00	46.00	15.23	-
0.738	40.30	-	N			15.70	-
1.870	44.92	41.82	H			11.08	4.18
2.110	42.49	-	N			13.51	-
15.96	37.82	-	N	60.00	50.00	22.18	-
23.99	38.35	-	N			21.65	-
28.76	35.01	-	N			24.99	-
29.75	33.57	-	H			26.43	-

#### NOTES :

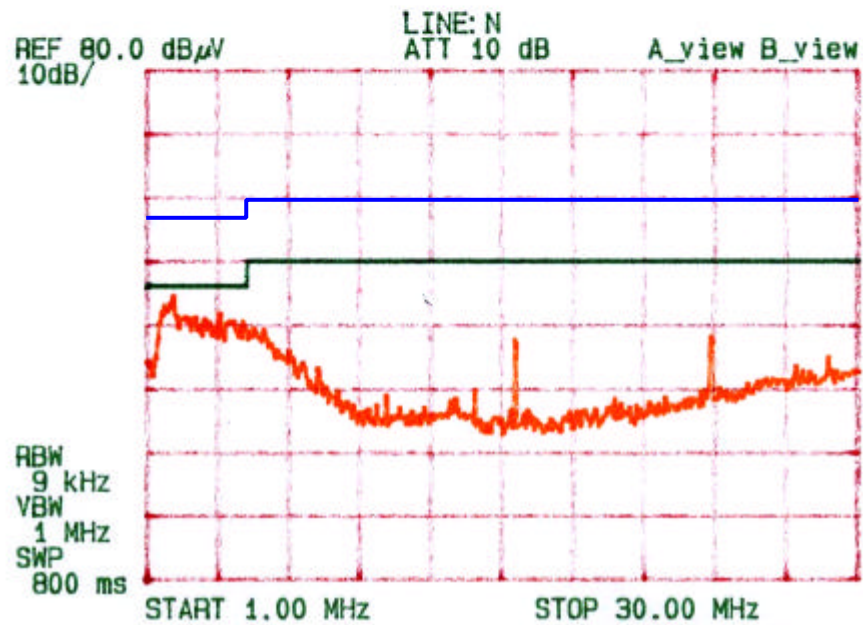
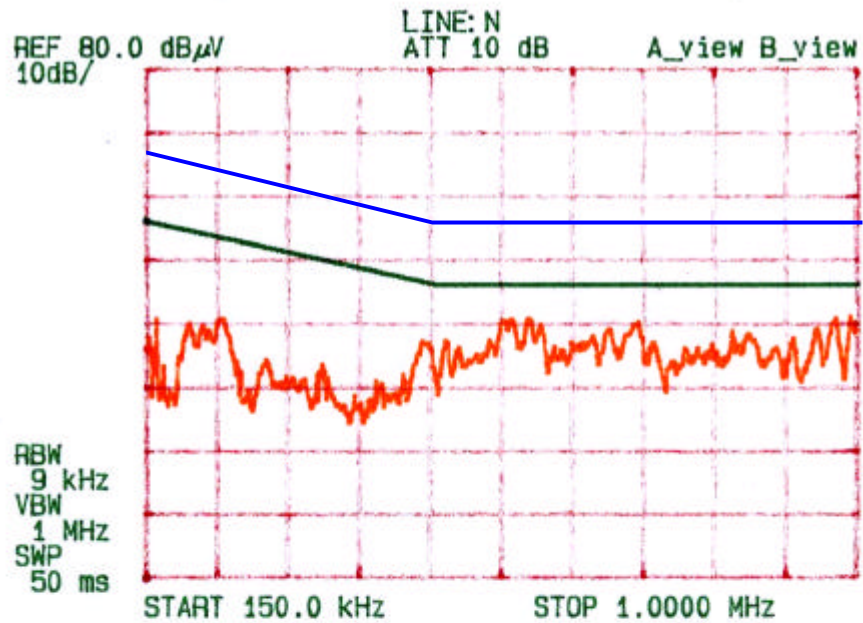
1. \* H : HOT Line , \*\*N : Neutral Line
2. Margin value = Limit - Reading
3. Measurement were performed at the AC/DC Power Inlet in the frequency band of 150kHz ~ 30MHz according to the CISPR 22 CLASS B



Test Engineer : H. J. Kim

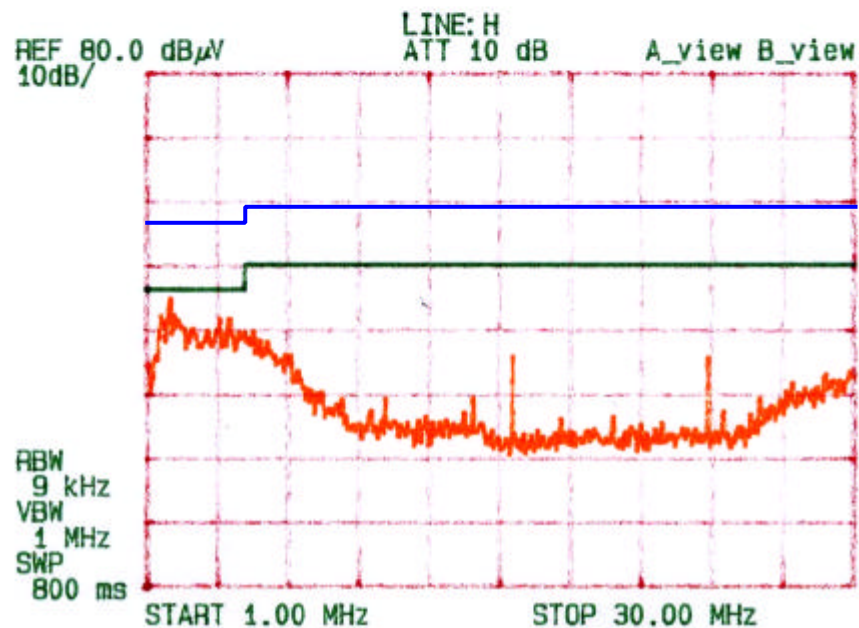
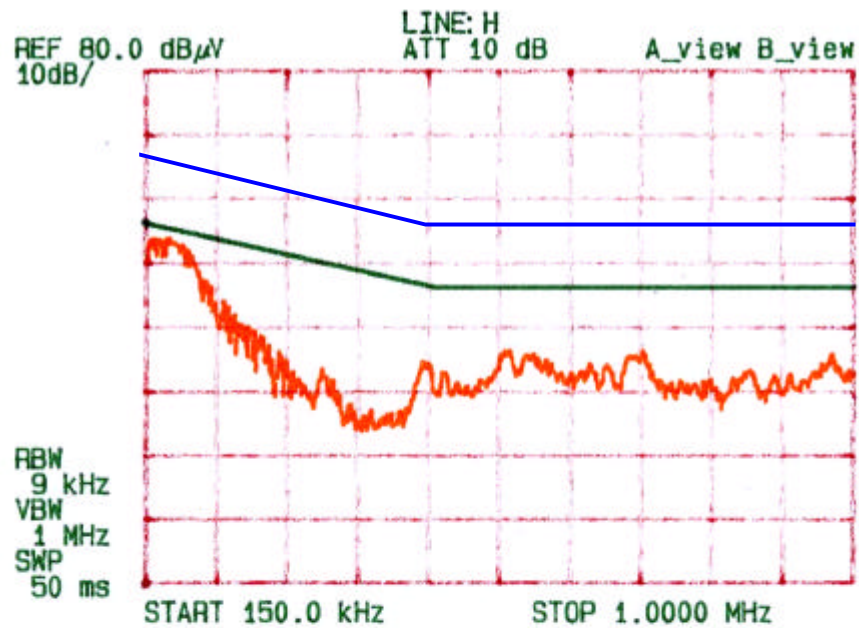
## 5. TEST RESULTS

### Line: NETURAL Line



## 5. TEST RESULTS

### Line: HOT Line



## 5. TEST RESULTS

### 5.3 Radiated Emissions Measurement

EUT	Smart-card Reader / SSR120 (S/N:NONE)
Limit apply to	FCC Part 15. 109(g) CISPR 22 CLASS B
Test Date	June 17, 2002
Operating Condition	Data Read & Write Mode
Environment Condition	Humidity Level : 48%RH, Temperature : 30
Result	Passed by -3.70dB

### Radiated Emission Test Data

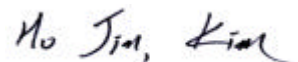
The following table shows the highest levels of radiated emissions on both polarization of horizontal and vertical.

Detector mode : CISPR Quasi-Peak mode ( 6dB Bandwidth : 120 kHz )

Frequency [MHz]	Reading [dB $\mu$ V]	Polarization (*H/**V)	Ant. Factor [dB]	Cable Loss [dB]	Emission Level [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]
39.38	10.96	V	11.64	1.50	24.10	30.0	5.90
46.53	10.61	V	12.09	1.70	24.40	30.0	5.60
50.11	12.61	V	11.89	1.80	26.30	30.0	3.70
53.69	9.31	V	11.89	1.80	23.00	30.0	7.00
57.26	11.02	V	11.88	1.90	24.80	30.0	5.20
60.87	9.16	V	11.04	2.00	22.20	30.0	7.80
64.42	10.26	V	11.04	2.00	23.30	30.0	6.70
254.16	4.81	V	11.00	4.20	20.01	37.0	16.99
286.32	5.32	H	12.19	4.50	22.01	37.0	14.99
300.64	4.24	H	12.68	4.60	21.52	37.0	15.48

#### NOTES :

- \* H : Horizontal polarization , \*\* V : Vertical polarization
- Emission Level = Reading + Antenna factor + Cable loss
- Margin value = Limit - Emission Level
- The measurement was performed for the frequency range 30MHz ~ 1000MHz according to the CISPR 22 CLASS B



Test Engineer : H. J. Kim

## 6. SAMPLE CALCULATION

---

### 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

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

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

Example 1 : @ 1.870MHz

Class B Limit	=	199.5 $\mu\text{V}$	=	46 dB $\mu\text{V}$
Reading	=	41.82 dB $\mu\text{V}$		
Convert to uV	=	123.3 $\mu\text{V}$		
Margin	=	41.82 - 46.0	=	-4.18 dB $\mu\text{V}$
	=	-4.18dB $\mu\text{V}$		below Limit

Example 2 : @ 50.11 MHz

Class B Limit	=	31.62 $\mu\text{V}$	=	30dB $\mu\text{V}$
Reading	=	12.61 dB $\mu\text{V}$		
Antenna Factor + Cable Loss	=	11.89 dB $\mu\text{V}$	+	1.80 dB $\mu\text{V}$
Total	=	13.69 dB $\mu\text{V}$		
Margin	=	26.30 - 30.00	=	-3.70 dB $\mu\text{V}$
	=	-3.70 dB $\mu\text{V}$		below Limit

## 7. TEST EQUIPMENT LIST

### List of Test Equipments Used for Measurements

	Test Equipment	Model	Mfg.	Serial No.	Cal. Due Date
<input checked="" type="checkbox"/>	Spectrum Analyzer	R3261A	Advantest	21720033	02-10-26
<input checked="" type="checkbox"/>	Receiver	ESVS 10	R & S	835165/001	03-04-06
<input checked="" type="checkbox"/>	Preamplifier	HP8447D	HP	2944A07626	03-01-10
<input checked="" type="checkbox"/>	LISN	3825/2	EMCO	9006-1669	02.12.27
<input checked="" type="checkbox"/>	LISN	3825/2	EMCO	9208-1995	02.12.27
<input checked="" type="checkbox"/>	TriLog Antenna	VULB9160	Schwarz Beck	3082	02-06-19
<input type="checkbox"/>	LogBicon	VULB9165	Schwarz Beck	2023	02-06-19
<input type="checkbox"/>	Dipole Antenna	VHAP	Schwarz Beck	964	03-05-03
<input type="checkbox"/>	Dipole Antenna	VHAP	Schwarz Beck	965	03-05-03
<input type="checkbox"/>	Dipole Antenna	UHAP	Schwarz Beck	949	03-05-03
<input type="checkbox"/>	Dipole Antenna	UHAP	Schwarz Beck	950	03-05-03
<input type="checkbox"/>	Broad band Horn Antenna	BBHA 9120 D	Schwarz Beck	277	02-11-03
<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 type="checkbox"/>	Impedance Matching Pad	6001.01.A	SUNNER	3252	02-09-22
<input type="checkbox"/>	Thermo Hygrograph	3-3122	ISUZU	3312201	02-12-20
<input type="checkbox"/>	BaroMeter	-	Regulus	-	-