

Electromagnetic Emission
FCC MEASUREMENT REPORT

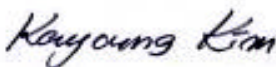
VERIFICATION OF COMPLIANCE
FCC Part 15 Certification Measurement

PRODUCT : 17" LCD MONITOR
MODEL/TYPE NO : ELM-170
FCC ID : OIOELM-170
APPLICANT : E-RAE Electronics Industry Co., Ltd.
#371-51 Kasan-Dong, Keumcheon-Ku, Seoul,
153-023, Korea
Attn. : Woon Seok, Yu / Q.A Dept, Deputy Manager
FCC CLASSIFICATION : Part 15 Class B Unintentional Radiators
Computing Device Peripheral(JBP)
FCC RULE PART(S) : FCC Part 15 Subpart B
FCC PROCEDURE : Certification
TRADE NAME : Slimart
TEST REPORT No. : E01.0928. FCC.383N
DATES OF TEST : September 25, 2001
DATES OF ISSUE : September 28, 2001
TEST LABORATORY : ETL Inc (FCC Registration Number : 95422)
371-51, Gasan-Dong, Geumcheon-Gu, Seoul, Korea
Tel : (031) 885-0072 Fax : (031) 885-0074

This 17" LCD MONITOR, Model ELM-170 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 : Unintentional Radiators.

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.



Name : Kayoung Kim

Title : Chief Engineer & Lab.Manager

E-RAE Testing Laboratory Inc.
371-51, Gasan-Dong, Geumcheon-Gu,
Seoul, 153-023, Korea

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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)

General Information

Applicant Name : E-RAE Electronics Industry Co., Ltd.

Address : 371-51Kasan-Dong, Keumcheon-Ku,
Seoul, 153-023, Korea

Attention : Woon Seok, Yu / Q.A Dept, Deputy Manager

- **EUT Type** : 17" LCD MONITOR
- **Model Number** : ELM-170
- **FCC Identifier** : OIOELM-170
- **S/N** : N/A
- **Freq. Range** : N/A
- **Modulation** : N/A
- **FCC Rule Part(s)** : Part 15 Subpart B Unintentional Radiators
- **Test Procedure** : ANSI C63.4-1992
- **FCC Classification** : Part 15 Class B Unintentional Radiators
Computing Device Peripheral(JBP)
- **Dates of Tests** : September 28, 2001
- **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.** : E01.0928.FCC.383N

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, Kyoungki-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 E-RAE Electronics Industry Co., Ltd. Model : ELM-170

2. PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test(EUT) is the E-RAE Electronics Industry Co., Ltd.

Please refer to Users manual

2.2 General Specification

- Chassis Type : Plastic
- List of Each OSC. Or : X-TAL – 27MHz
X-Tal. Freq. (≥ 1 MHz)
- Chipset Brand & Part No. : 74VC541AD – PHILIPS
: AD9884A – ANALOG DEVICES
: PW111-20Q – PIXEL WORKS
: 39VF400A – SST
: JM13AB – NATIONAL
: 2M13AD – NATIONAL
- Number of Layers : Main board – 1Layers, CRT board – 1 Layers, Front board – 1Layers
- Display Size : 337.9(H) X 270.3(V) 17.0 inch
- Scanning Frequency : Horizontal : 30KHz to 70KHz, Vertical : 50Hz to 150Hz
- Pixel Pitch : 0.264(H) X 0.264(W)
- Viewing angle : 65 ° (up), 60 ° (down), 75 ° 75 ° (left / right)
- Display Color : 16.2M
- Response Time : 25msec
- Brightness : 250cd/m²
- Contrast : 350:1
- Resolution : 1280 x 1024 60Hz
- H Frequency : 30KHz ~ 80KHz
- V Frequency : 56Hz ~ 75Hz
- Sync type : Separate
- Audio : 1W + 1W
- Impedance : 8
- AC (Adapter) : 110V ~ 240V, 50/60Hz
- DC(Monitor) : 12V, 3.6A
- Power Consumption : Max 40W, Standby 5W
- Monitor Size : 421 X 370 X 62 (Without stand), 421 X 415 X 170 (With stand)
- Weight : 6.2kg
- Tilt Angle : Up 45 ° Down 5 °
- Features : Graphic OSD, Auto-Adjustment

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 LISN are 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. 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

The EUT was operated with "H" pattern display for the following operating conditions. The worst case emission 1280 X 1024 64KHz, 60Hz

Video Resolution	H/V Frequency (KHz/Hz)	The worst operating condition
640 X 480	31.47 / 60	X
800 X 600	37.88 / 60	X
1024 X 768	48.36 / 60	X
1024 X 768	56.48 / 70	X
1280 X 1024	64 / 60	O

4.3 Support Equipment Used

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

EUT – 17" LCD MONITOR

FCC ID : OIOELM-170A
Model Name : ELM-170A
Serial No. : N/A
Manufacturer : E-RAE Electronics Industry Co., Ltd.
Power Supply Type : Switching
Power Cord : Non-shielded, Detachable: 1.2m
Data Cable : 1.5 m Shielded and ferrite core on RGB Cable

Support Unit 1 - Personal 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
Port : Parral: 1, USB: 2, Keyboard: 1, Mouse: 1, RS-232: 2, Video: 1
RJ-45: 1, Speaker: 2, MIC: 1

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 : Shielded, 1.2m



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 : Shielded, 1.2m

Support Unit 4 – Ear Mic (ETL)

FCC ID : N/A
Model Name : N/A
Serial No. : N/A
Manufacturer : ETL
Power Supply Type : N/A
Power Cord : N/A
Data Cable : Audio & MIC Cable, 1.0m

Support Unit 5 – Serial Mouse (PETRA)

FCC ID : JKGMUS5S01
Model Name : MUS5S
Serial No. : E183027
Manufacturer : PETRA
Power Supply Type : N/A
Power Cord : N/A
Data Cable : Un-Shielded, 1.2m

Support Unit 6 – Printer (H.P)

FCC ID : B94C2164X
Model Name : C4562B
Serial No. : TH9411434G
Manufacturer : H.P
Power Supply Type : DC24V From Adapter (C2182A/H.P)
Power Cord : Non-Shielded
Data Cable : Shielded, 1.5m

Support Unit 7 – USB Mouse

FCC ID : DOC
Model Name : MUS5U
Serial No. : N/A
Manufacturer : Logitech
Power Supply Type : N/A
Power Cord : N/A
Data Cable : Shielded, 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 – 14.18 dB
15.109(e)	Radiated Emissions Measurement	Passed by – 3.45 dB

The data collected shows that the E-RAE Electronics Industry Co., Ltd. 17" LCD MONITOR, ELM-170 complies with technical requirements of the CISPR 22 Class B

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	17" LCD MONITOR / ELM-170 (SN:N/A)
Limit apply to	15.107(e) : CISPR Pub.22(1997) Class B
Test Date	September 26, 2001
Operating Condition	" H " Pattern Display with 1280 X 1024 64KHz / 60Hz mode
Environment Condition	Humidity Level : 38 %RH, Temperature : 24
Result	Passed by – 14.18 dB

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 μ V]		Phase (*H/**N)	Limit [dB μ V]		Margin [dB]	
	Quasi-peak	Average		Quasi-peak	Average	Q.Peak	Average
0.154	51.60	24.65	H	65.78	55.78	14.18	
0.463	33.47	-	H	56.63	46.63	23.16	-
0.532	31.15	-	N	56.00	46.00	24.85	-
0.747	32.15	-	H			23.85	-
0.873	31.07	-	N			24.93	-
2.20	34.40	-	H			21.60	-
3.53	36.50	-	N			19.50	-
9.29	28.90	-	N	60.00	50.00	31.10	-
15.79	36.60	-	N			23.40	-
20.06	31.52	-	H			28.48	-
23.70	40.55	-	H			19.45	-

NOTES :

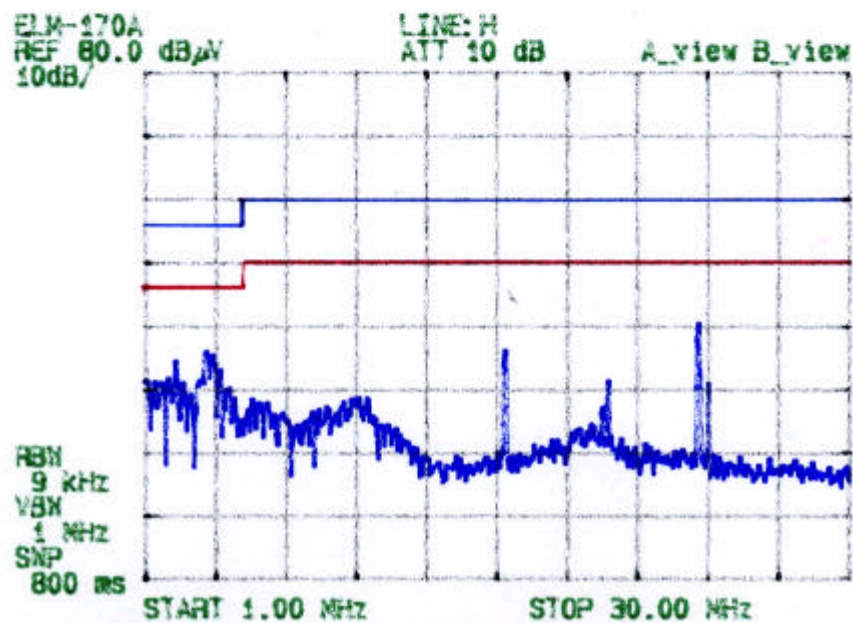
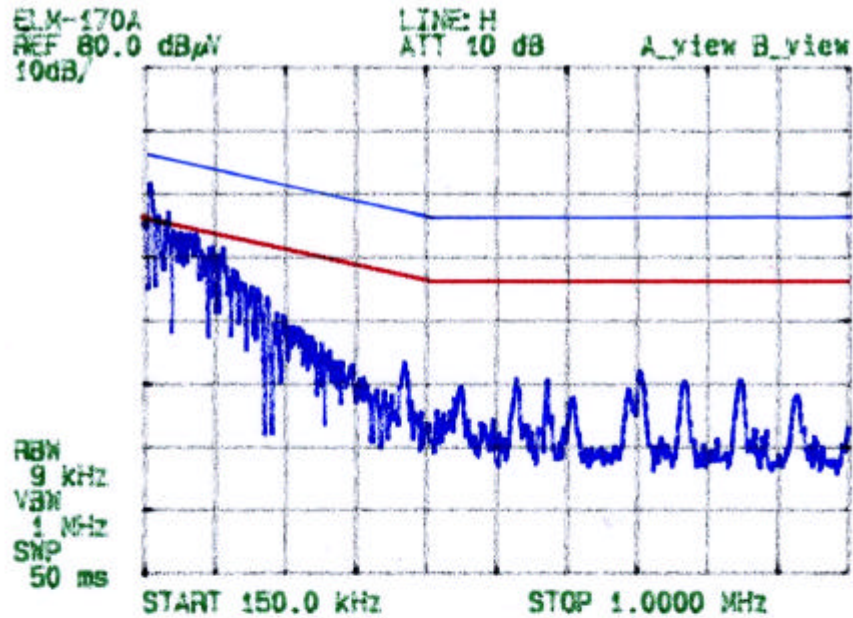
- * H : HOT Line , **N: Neutral Line
- Margin value = Limit – Reading
- If the Reading Quasi-Peak value is bellow the Average Limit, Do not test Average Mode.
- The measurement was performed for the frequency range 150KHz ~ 30MHz according to the CISPR 22 Class B



Test Engineer : C. S. Kim

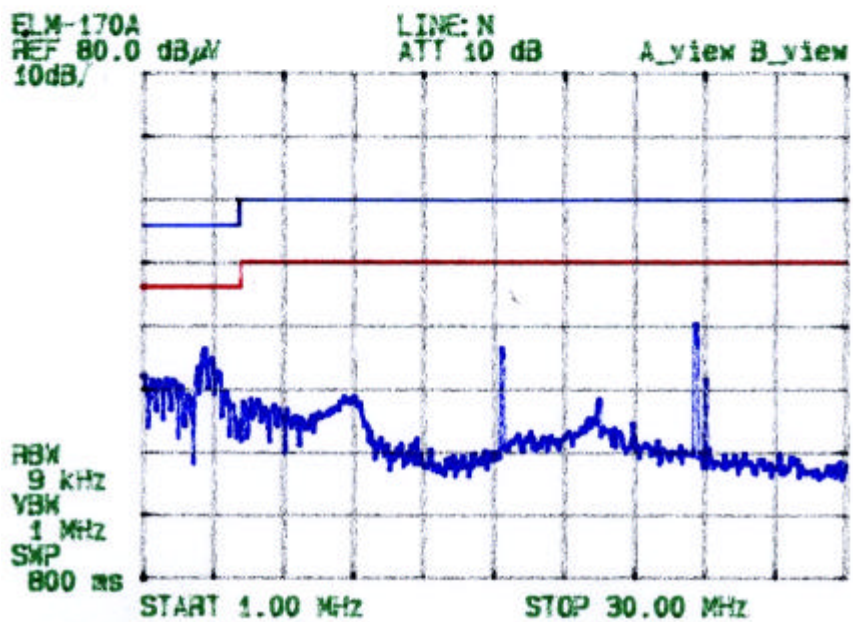
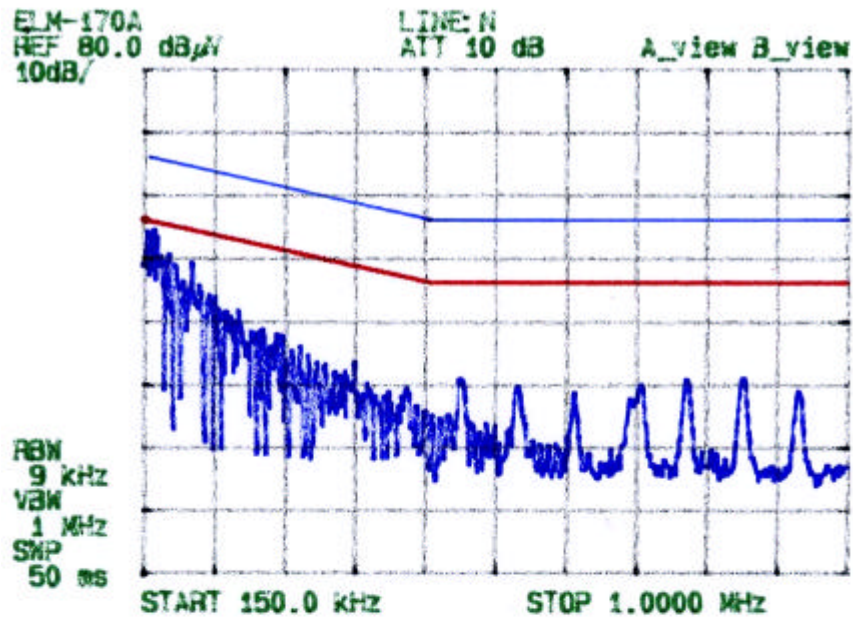
5. TEST RESULTS

Line: HOT Line



5.TEST RESULTS

Line: Neutral Line



5. TEST RESULTS

5.3 Radiated Emissions Measurement

EUT	17" LCD MONITOR / ELM-170 (SN:N/A)
Limit apply to	15.109(e) : CISPR Pub.22(1997) Class B
Test Date	September 25, 2001
Operating Condition	" H " Pattern Display 1280 X 1024 64KHz / 60Hz mode
Environment Condition	Humidity Level : 38 %RH, Temperature : 24
Result	Passed by - 3.45dB

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 [dBb μ V/m]	Limit [Db μ V/m]	Margin [dB]
108.01	13.00	V	10.00	2.40	25.40	30.0	4.60
151.21	8.27	H	12.76	3.00	24.03		5.97
194.43	12.71	H	9.93	3.80	26.44		3.56
216.00	13.18	H	9.37	4.00	26.55		3.45
340.70	12.33	H	13.18	4.70	30.21	37.0	6.79
405.03	12.96	H	15.02	5.40	33.38		3.62
669.61	6.30	H	19.73	7.10	33.13		3.87
756.03	1.87	H	21.25	7.60	30.72		6.28

NOTES :

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



Test Engineer : C. S. 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 : @ 0.154 MHz

Class B Limit	=	1945 uV = 65.78 dBuV
Reading	=	51.60 dBuV
Convert to uV	=	380 uV
Margin	=	51.60 - 65.78 = -14.18
	=	-14.18 dB below Limit

Example 2 : @216 MHz

Class B Limit	=	31.7 uV = 30.0 dBuV/m
Reading	=	13.18 dBuV
Antenna Factor + Cable Loss	=	13.37 dB
Total	=	26.55 dBuV/m
Margin	=	26.55 - 30.0 = -3.45
	=	-3.45 dB 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	01-10-08
<input type="checkbox"/>	Spectrum Analyzer	ESA-L1500A	H.P	US37360920	01-10-20
<input checked="" type="checkbox"/>	Receiver	ESVS 10	R & S	835165/001	02-04-06
<input checked="" type="checkbox"/>	Spectrum Analyzer	R3265A	Advantest	45060321	02-02-28
<input checked="" type="checkbox"/>	Preamplifier	HP8447D	HP	2944A07626	02-01-10
<input type="checkbox"/>	Preamplifier	HP 8347A	HP	2834A00544	01-05-23
<input checked="" type="checkbox"/>	TriLog Antenna	VULB9160	Schwarz Beck	3082	02-05-08
<input type="checkbox"/>	LogBicon	VULB9165	Schwarz Beck	2023	02-05-08
<input type="checkbox"/>	Dipole Antenna	VHAP	Schwarz Beck	964	02-05-03
<input type="checkbox"/>	Dipole Antenna	VHAP	Schwarz Beck	965	02-05-03
<input type="checkbox"/>	Dipole Antenna	UHAP	Schwarz Beck	949	02-05-03
<input type="checkbox"/>	Dipole Antenna	UHAP	Schwarz Beck	950	02-05-03
<input type="checkbox"/>	Double Ridged Horn	3115	EMCO	9809-2334	01-09-20
<input type="checkbox"/>	Magnetic Loop Antenna	6502	EMCO	9810-2111	01-12-11
<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 checked="" 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	01-09-22
<input checked="" type="checkbox"/>	Thermo Hygrograph	3-3122	ISUZU	3312201	01-12-20
<input checked="" type="checkbox"/>	BaroMeter	-	Regulus	-	-