

Electromagnetic Emission

FCC MEASUREMENT REPORT

CERTIFICATION OF COMPLIANCE

FCC Part 15 Certification Measurement

PRODUCT : LCD Monitor
MODEL/TYPE NO : ELM-1900ND
FCC ID : OIOELM-19ND
APPLICANT : E-RAE Electronics Industry Co., Ltd.
#371-51, Kasan-Dong, Keumcheon-Ku, Seoul, 153-023, Korea
Attn.: Woon Seok, Yu / Deputy General Manager
FCC CLASSIFICATION : Class B personal computers and peripherals
FCC RULE PART(S) : FCC Part 15 Subpart B
FCC PROCEDURE : Certification
TRADE NAME : E-RAE
TEST REPORT No. : E04.0830.FCC.491N
DATES OF TEST : August 27 ~ 30, 2004
DATES OF ISSUE : August 30, 2004
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 LCD Monitor Model ELM-1900ND 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 :

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.

Yo Han, Park

Yo Han, Park / Chief Engineer

ETL Inc.

**#584 Sangwhal-ri, Kanam-myon, Yaju-kun,
Kyounggi-do, 469-880, Korea**



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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-REA Electronics Industry Co., Ltd.

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

Attention : Woon Seok, Yu / Deputy General Manager

- **EUT Type** : LCD Monitor
- **Model Number** : ELM-1900ND
- **FCC ID** : OIOELM-19ND
- **S/N** : N/A
- **FCC Rule Part(s)** : FCC Part 15 Subpart B
- **Test Procedure** : ANSI C63.4-1992
- **FCC Classification** : Class B personal computers and peripherals
- **Dates of Tests** : August 30, 2004
ETL Inc.
EMC Testing Lab. (FCC Registration Number : 95422)
- **Place of Tests** : 584, Sangwhal-Ri, Kanam-Myun, Yoju-Kun,
Kyounggi-Do, Korea
Tel : (031) 885-0072 Fax : (031) 885-0074
- **Test Report No.** : E04.0830.FCC.491N

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 9 kHz to 40 GHz (ANSI C.63.4-1992) was used in determining radiated and conducted emissions from the E-RAE Electronics Industry Co., Ltd., Model: ELM-1900ND

2. PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the E-RAE Electronics Industry Co., Ltd., LCD Monitor, ELM-1900ND. The tested model is "ELM-1900ND". Model "ELM-1900N*" is same as model "ELM-1900ND" and "ELM-1900NA" for model designation and signal input port. The differences between two models are only signal port set equipment, model designation. The "*" in the designation model names are "D" and "A" denoting a signal input port equipment. "ELM-1900ND" equip Analog RGB & DVI ports and "ELM-1900NA" equip only Analog RGB port.

2.2 General Specification

** Display portion

Screen	376.32(H) * 301.056(V), 19.0 inch
Pixel pitch	0.294(H) * 0.294(W)
Maximum visual periphery	85. / 85. / 85. / 85.
Display colors	16.7M
Response speed	25msec
Brightness	250cd/m ²
Contrast	500:1
Recommended resolution	1280 * 1024 (60Hz)
Horizontal frequency	31 kHz - 79.98 kHz
Vertical frequency	56 Hz – 75 Hz
Signal input	Analog RGB (15Pin D-sub)
AC (Adaptor)	110V - 240V, 50Hz / 60Hz
DC (Monitor)	12V, 3.5A
Power	Maximum power use 42W, power save mode 2W
Excluding stand	431.2 * 364 * 55.9
Including stand	431.2 * 443.8 * 190
Weight	6.4 kg
Stand adjustment angles upward	up 30. , down 5.
Features	Graphic OSD, automatic adjustment

** Network

Support port	1*PS/2 Keyboard port, 1*PS/2 Mouse port, 1*SPEAKER port, 1*RJ-45 LAN port
Protocol	WoIP(Windows over IP), TCP/IP
Support OS	Windows XP Home / Pro., Windows 2000 Pro.

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 0.15 MHz to 30 MHz 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 10 kHz or for "quasi-peak" within a bandwidth of 9 kHz.

- Procedure of test

The line-conducted facility is located inside a shielded room 1 m X 1.5 m wooden table 80 cm high is placed 40 cm away from the vertical wall and 1.5 m away from the side wall of the shielded room. Ground of two EMCO 3825/2 LISN are bonded to the reference horizontal ground. The EUT is powered from the EMCO LISN and the support equipment is powered from the other 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 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 ESHS30 EMI Test Receiver 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 30 MHz. The bandwidth of the spectrum analyzer was set to 9 kHz. 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 30 MHz to 1 GHz 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 120 kHz.

- 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 1000 MHz using SchwarzBeck Log-Bicon antenna. Above 1 GHz, 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 120 kHz 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	X
1280 * 1024 Vf = 75Hz	
Full "H" pattern display mode	
Networking mode	

: Worst case investigated during the test.

4.3 Support Equipment Used

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

EUT – LCD Monitor

FCC ID : OIOELM-19ND
Model Name : ELM-1900ND
Serial No. : N/A
Manufacturer : E-REA Electronics Industry Co., Ltd.
Power Supply Type : Switching
Power Cord : Non-Shielded, Detachable : 1.2m
Data Cable : RGB In : 1, DVI In : 1, RJ-45 In : 1, Keyboard In : 1, Mouse In : 1, SPEAKER Out : 1

Support Unit 1 – Personal computer (DELL)

FCC ID : N/A (DoC)
Model Name : DHM
Serial No. : H9MB71S
Manufacturer : DELL
Power Supply Type : Switching
Power Cord : Non-Shielded, Detachable: 1.2m
Data Port : RGB out:1, DVI out:1, Parallel:1, RS-232:1, PS/2: 2, USB: 4, RJ-45:1
Audio in:1, Audio out:1, MIC in:1

Support Unit 2 –Keyboard 1 (COMPAQ)

FCC ID : N/A (DoC)
Model Name : KB-9963
Serial No. : B26960GBUKO13F
Manufacturer : COMPAQ
Power Supply Type : N/A
Power Cord : N/A
Data Cable : Shielded, 1.5m

Support Unit 3 –Keyboard 2 (COMPAQ)

FCC ID : N/A (DoC)
Model Name : KB-9963
Serial No. : B26960GBUKO13F
Manufacturer : COMPAQ
Power Supply Type : N/A
Power Cord : N/A
Data Cable : Shielded, 1.5m

Support Unit 4 – Mouse 1 (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 5 – Mouse 2 (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 6- USB Mouse (N/A)

FCC ID : N/A
Model Name : HL898W
Serial No. : HL08011837
Manufacturer : N/A
Power Supply Type : N/A
Power Cord : N/A
Data Cable : None-Shielded, 1.2m

Support Unit 7 – 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 : Shielded, 1.2m

Support Unit 8 – Printer (SINDO RICOH)

FCC ID : N/A
Model Name : Color cap 330
Serial No. : 11-03098
Manufacturer : LEXMARK INTERNATIONAL INC.
Power Supply Type : AC 110V~220V
Power Cord : Non-Shield, 1.5m
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	Conducted emissions measurement	Passed
15.109	Radiated emissions measurement	Passed

The data collected shows that the **E-RAE Electronics Industry Co., Ltd. / LCD Monitor / ELM-1900ND** complies with technical requirements of above rules part 15.107 and 15.109 Class B Limits and CISPR Publication 22.

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	LCD Monitor / ELM-1900ND (SN: N/A)
Limit apply to	FCC Part 15. 107(CISPR Pub.22 Class B)
Test Date	August 27, 2004
Operating Condition	1280 * 1024 Vf = 75Hz, Full "H" pattern display mode, Networking mode
Environment Condition	Humidity Level : 32 %RH, Temperature : 24
Result	Passed by 16.5dB

Conducted Emission Test Data

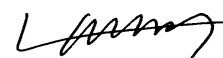
The following table shows the highest levels of conducted emissions on both polarization of hot and neutral line.

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

Frequency [MHz]	Reading [dBμV]		Phase (*H/**N)	Limit [dBμV]		Margin [dB]	
	Quasi-peak	Average		Quasi-peak	Average	Quasi-peak	Average
0.151	43.9	—	H	65.9	55.9	22.0	—
0.241	36.7	—	N	62.1	52.1	25.4	—
0.367	34.8	—	N	58.6	48.6	23.8	—
0.425	37.9	—	H	57.3	47.3	19.4	—
0.487	39.7	—	N	56.2	46.2	16.5	—
0.548	36.0	—	N	56.0	46.0	20.0	—
0.670	34.2	—	H			21.8	—
0.730	35.6	—	H			20.4	—
0.792	32.0	—	H			24.0	—
2.740	29.1	—	N			26.9	—
14.620	34.7	—	H	60.0	50.0	25.3	—
19.240	41.1	—	N			18.9	—
23.075	41.2	—	N			18.8	—
27.030	40.1	—	N			19.9	—
29.000	38.6	—	H			21.4	—

NOTES : * H : HOT Line , **N : Neutral Line

1. Margin value = Limit – Reading
2. Measurement were performed at the AC power inlet in the frequency band of 150 kHz ~ 30 MHz according to the CISPR 22 Class B
3. If the reading Quasi-Peak value is bellowed the average limit, Do not test average mode.



Test Engineer: H. S. Lee

5. TEST RESULTS

Line: HOT Line

ETL EMC Laboratory

Conducted Emission Test Result

EUT: ELM-1900ND
 Manuf: erae
 Op Cond:
 Operator:
 Test Spec: CISPR 22 Class B
 Comment: Hot

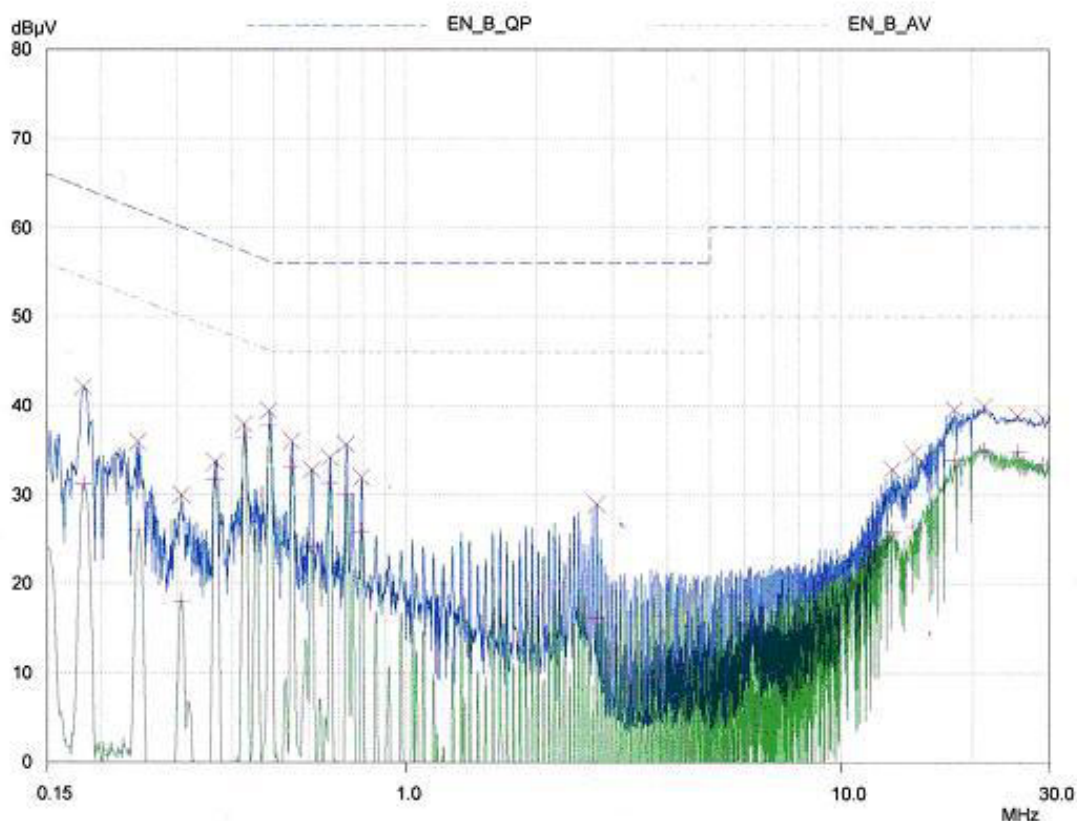
Result File: elm19ndh.dat : erae / ELM-1900ND / Hot

Scan Settings (3 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	1000kHz	1000Hz	10kHz	PK+AV	10msec	Auto	OFF	60dB
1000kHz	5MHz	2kHz	10kHz	PK+AV	10msec	Auto	OFF	60dB
5MHz	30MHz	5kHz	10kHz	PK+AV	10msec	Auto	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	9kHz	30MHz	Factor

Prescan Measurement: Detectors: X PK / + AV
 Meas Time: see scan settings
 Peaks: 8
 Acc Margin: 10 dB



5. TEST RESULTS

Line: Neutral Line

ETL EMC Laboratory

Conducted Emission Test Result

EUT: ELM-1900ND

Manuf: erae

Op Cond:

Operator:

Test Spec: CISPR 22 Class B

Comment: Neutral

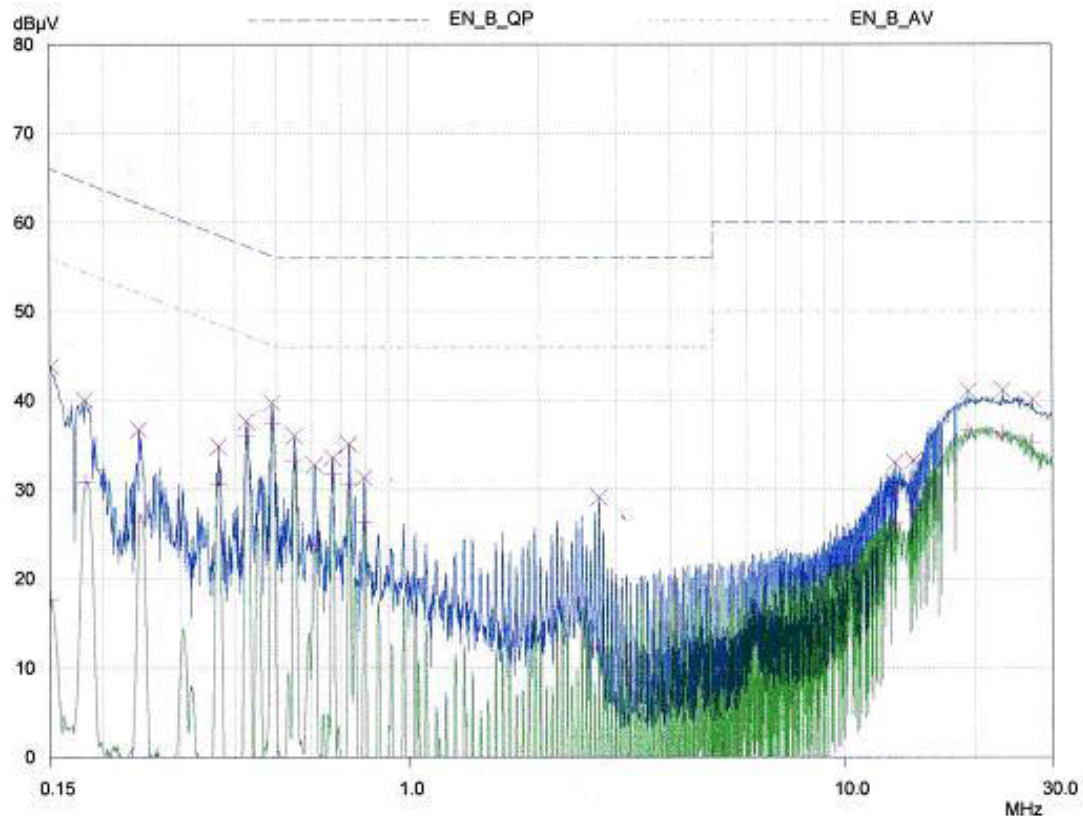
Result File: elm19ndn.dat : erae / ELM-1900ND / Neutral

Scan Settings (3 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	1000kHz	1000Hz	10kHz	PK+AV	10msec	Auto	OFF	60dB
1000kHz	5MHz	2kHz	10kHz	PK+AV	10msec	Auto	OFF	60dB
5MHz	30MHz	5kHz	10kHz	PK+AV	10msec	Auto	OFF	60dB

Transducer	No.	Start	Stop	Name
	1	9kHz	30MHz	Factor

Prescan Measurement: Detectors: X PK / + AV
 Meas Time: see scan settings
 Peaks: 8
 Acc Margin: 10 dB



5. TEST RESULTS

5.3 Radiated Emissions Measurement

EUT	LCD Monitor / ELM-1900ND (SN: N/A)
Limit apply to	FCC Part 15. 107(CISPR Pub.22 Class B)
Test Date	August 28, 2004
Operating Condition	1280 * 1024 Vf = 75Hz, Full "H" pattern display mode, Networking mode
Environment Condition	Humidity Level : 32 %RH, Temperature : 24
Result	Passed by 5.58dB

Radiated Emission Test Data

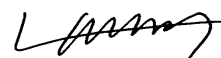
The following table shows the highest levels of radiated emissions on both polarization of horizontal and vertical.

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

Frequency [MHz]	Reading [dBμV]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dBμV]	Emission Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]
45.87	5.85	V	12.17	2.02	20.04	30.0	9.96
137.20	6.54	V	13.25	3.36	23.15		6.85
147.88	5.74	V	13.30	3.52	22.56		7.44
203.97	7.49	V	10.17	4.10	21.76		8.24
210.96	7.69	V	10.36	4.27	22.32		7.68
228.55	5.50	H	10.78	4.59	20.87		9.13
250.00	6.83	H	11.51	4.85	23.19	37.0	13.81
270.01	7.36	H	12.29	5.15	24.80		12.20
280.13	10.40	H	12.58	5.30	28.28		8.72
375.21	6.89	H	14.70	6.35	27.94		9.06
432.36	6.36	H	16.52	6.99	29.87		7.13
501.72	6.54	H	17.25	7.63	31.42		5.58

NOTES : * H : Horizontal polarization , ** V : Vertical polarization

1. Emission Level = Reading + Antenna factor + Cable loss
2. Margin value = Limit - Emission Level
3. The measurement was performed for the frequency range 30 MHz ~ 1000 MHz according to the CISPR 22 Class B



Test Engineer: H. S. Lee

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 : @ 2.040 MHz

Class B Limit	=	646 μV	=	56.2 dB μV
Reading	=	39.7 dB μV		
Convert to μV	=	96.7 μV		
Margin	=	56.2 – 39.7 = 16.5dB μV		
	=	16.5 dB μV	below Limit	

Example 2 : @ 200.10MHz

Class B Limit	=	70.8 μV	=	37 dB μV
Reading	=	6.54 dB μV		
Antenna Factor + Cable Loss	=	17.25 + 7.63 = 24.88 dB μV		
Total	=	31.42 dB μV		
Margin	=	37 – 31.42 = 5.58 dB μV		
	=	5.58 dB μV	below Limit	

7. TEST EQUIPMENT LIST

List of Test Equipments Used for Measurements

	Test Equipment	Model	Mfg.	Serial No.	Cal. Due Date
<input type="checkbox"/>	Spectrum Analyzer	E7402A	H.P	US39110107	05-06-07
<input checked="" type="checkbox"/>	Receiver	ESVS 10	R & S	835165/001	05-04-12
<input checked="" type="checkbox"/>	EMI TEST Receiver	ESHS30	Rohde & Schwarz	0401901/002	05-03-29
<input type="checkbox"/>	Preamplifier	HP 8347A	HP	2834A00544	05-04-12
<input checked="" type="checkbox"/>	LISN	3825/2	EMCO	9208-1995	05-01-29
<input checked="" type="checkbox"/>	LISN	3825/2	EMCO	9006-1669	05-04-13
<input checked="" type="checkbox"/>	TriLog Antenna	VULB9160	Schwarz Beck	3082	05-07-27
<input checked="" type="checkbox"/>	LogBicon	VULB9165	Schwarz Beck	2023	05-07-06
<input type="checkbox"/>	Dipole Antenna	VHAP	Schwarz Beck	964	05-06-10
<input type="checkbox"/>	Dipole Antenna	VHAP	Schwarz Beck	965	05-07-09
<input type="checkbox"/>	Dipole Antenna	UHAP	Schwarz Beck	949	05-07-09
<input type="checkbox"/>	Dipole Antenna	UHAP	Schwarz Beck	950	05-06-10
<input type="checkbox"/>	Broad band Horn Antenna	BBHA 9120D	Schwarz Beck	227	05-05-02
<input 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 type="checkbox"/>	Chamber	DTEC01	DAETONG	-	N/A
<input type="checkbox"/>	Thermo Hygrograph	3-3122	ISUZU	3312201	05-04-16
<input checked="" type="checkbox"/>	BaroMeter	-	Regulus	-	-