Electromagnetic Emission

F C C M E A S U R E M E N T R E P O R T

CERTIFICATION OF COMPLIANCE
FCC Part 15 Certification Measurement

PRODUCT	:	LCD Monitor
MODEL/TYPE NO	:	ELM-1900BA
FCC ID	:	OIOELM-1900
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.	:	E03.0723.FCC.409N
DATES OF TEST	:	July 16 ~18, 2003
DATES OF ISSUE	:	July 23, 2003
TEST LABORATORY	:	ETL Inc (FCC Registration Number : 95422) #584 Sangwhal-ri, Kanam-myon, Yoju-kun, Kyounggi-do, 469-880, Korea Tel : (031) 885-0072 Fax : (031) 885-0074

This LCD Monitor, Model ELM-1900BA 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, Yoju-kun,
Kyounggi-do, 469-880, Korea

Table of Contents

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-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-1900BA
- **FCC ID :** OIOELM-1900
- **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 :** July 16, 2003
  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. :** E03.0723.FCC.409N

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-1900BA

2. PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test(EUT) is the E-RAE Electronics Industry Co., Ltd. LCD Monitor, ELM-1900BA

2.2 General Specification

● Chassis Type	: Plastic & Metal
● List of Each OSC. Or X-Tal. Freq. (>=1MHz)	: X-Tal: 14.31818MHz
● Number of Layers	: Main – 2Layer, Power – 1Layer, All other boards are 2Layer
● Display color	: 16.7M
● Response Time	: 25ms
● Brightness	: 250cd/m ^{2}
● Contrast	: 500:1
● Resolution	: 1280*1024 75Hz
● H frequency	: 31KHz ~ 79.98KHz
● V frequency	: 56Hz ~ 75Hz
● AC (Adaptor)	: 110V ~ 240V, 50/60Hz
● DC (Monitor)	: 12V, 3.5A
● Power Consumption	: max 37W, standby 2W

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 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 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 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 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	X
1280*1024 75Hz, Full " H" pattern display Mode	O

O : 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-1900
Model Name	: ELM-1900BA
Serial No.	: N/A
Manufacturer	: E-REA Electronics Industry Co., Ltd.
Power Supply Type	: Switching
Power Cord	: Non-Shielded, Detachable, 1.5m
Data Cable	: 1.2m Shielded 15pin D-sub 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	**: 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- 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 6- 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 7- Printer (N/A)

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**

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 by –7.83dB
15.109	Radiated Emissions Measurement	Passed by –3.80dB

The data collected shows that the **E-RAE Electronics Industry Co., Ltd. LCD Monitor, ELM-1900BA** 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-1900BA (SN:N/A)
Limit apply to	FCC Part 15. 107(CISPR Pub.22 Class B)
Test Date	July 16, 2003
Operating Condition	1280*1024 75Hz, Full " H" Pattern display Mode
Environment Condition	Humidity Level : 55 %RH, Temperature : 27°C
Result	Passed by –7.83dB

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	Q.Peak	Average
0.184	55.75	46.47	H	64.30	54.30	8.55	7.83
0.245	49.24	39.94	H	61.92	51.92	12.68	11.98
0.307	44.20	-	H	60.05	50.05	15.85	-
0.491	38.07	-	H	56.17	46.17	18.10	-
2.276	37.08	-	N	56.00	46.00	18.92	-
4.556	42.07	-	H			13.93	-
6.385	35.50	-	H	60.00	50.00	24.50	-
17.82	31.27	-	N			28.73	-
24.52	38.94	-	N			21.06	-
27.35	34.79	-	N			25.21	-

NOTES :

1. *** H : HOT Line , **N : Neutral Line**
2. **Margin value = Limit – Reading**
3. **Measurement were performed at the HOST AC Power Inlet in the frequency band of 150kHz ~ 30MHz according to the CISPR 22 Class B**
4. **If the Reading Quasi-Peak value is bellowed the Average Limit, Do not test Average Mode.**

Ho Jin, Kim

Test Engineer : H. J. Kim

5. TEST RESULTS

Line: HOT Line

ETL EMC Laboratory

Conducted Emission Test Result

EUT: ELM-1900BA
Manuf: ERAE
Op Cond:
Operator: Ho Jin, Kim
Test Spec:
Comment: HOT

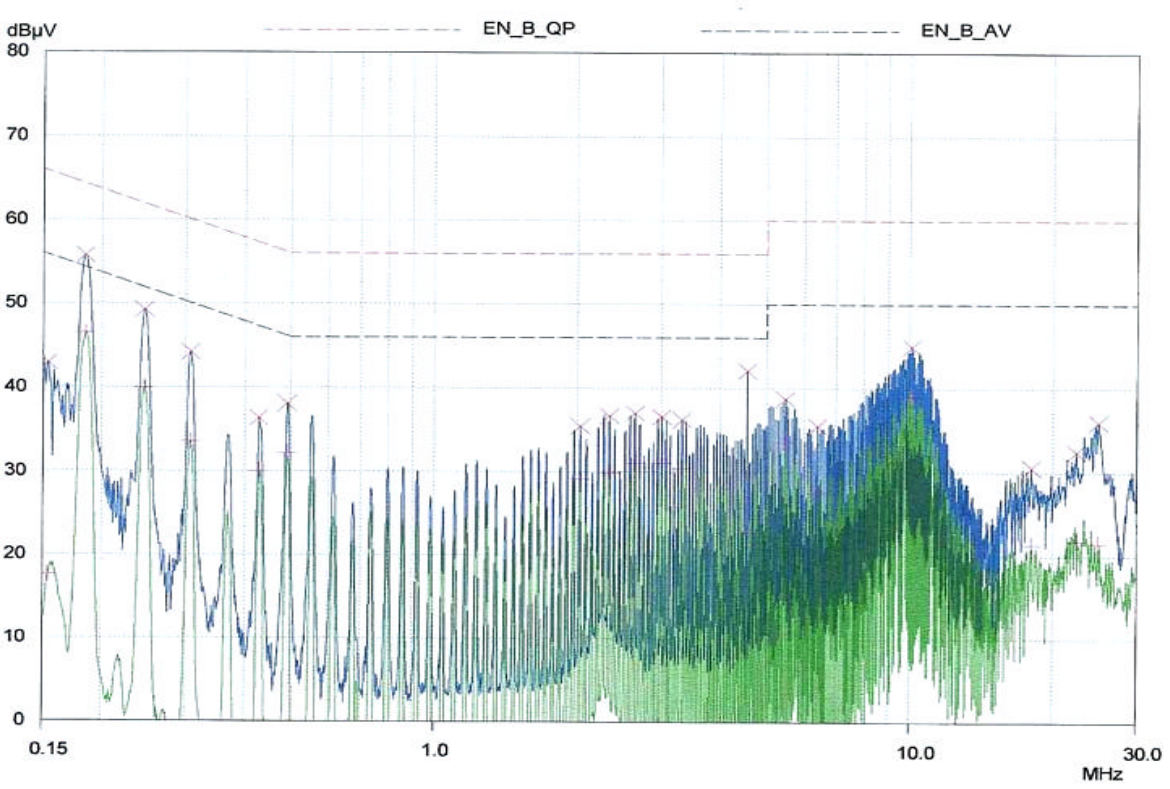
Result File: 1900BAH.dat : ELM-1900BA HOT

Scan Settings (3 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	5MHz	1000Hz	10kHz	PK+AV	10msec	Auto	OFF	60dB
5MHz	10MHz	5kHz	10kHz	PK+AV	10msec	Auto	OFF	60dB
10MHz	30MHz	10kHz	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: 16
Acc Margin: 10 dB



5. TEST RESULTS

Line: Neutral Line

ETL EMC Laboratory

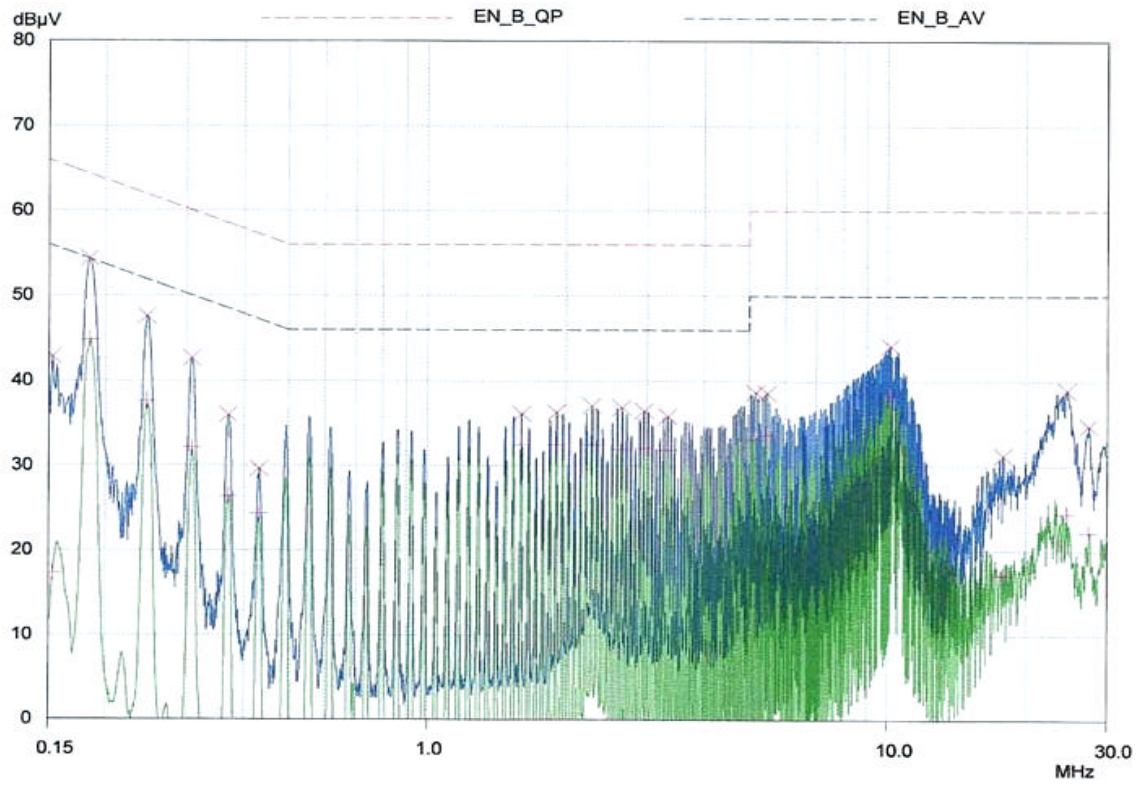
Conducted Emission Test Result

EUT:	ELM-1900BA
Manuf:	ERAE
Op Cond:	
Operator:	Ho Jin, Kim
Test Spec:	
Comment:	NEUTRAL
Result File:	1900BAN.dat : ELM-1900BA NEUTRAL
Scan Settings	(3 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	5MHz	1000Hz	10kHz	PK+AV	10msec	Auto	OFF	60dB
5MHz	10MHz	5kHz	10kHz	PK+AV	10msec	Auto	OFF	60dB
10MHz	30MHz	10kHz	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:	16
	Acc Margin:	10 dB



5. TEST RESULTS

5.3 Radiated Emissions Measurement

EUT	LCD Monitor / ELM-1900BA (SN:N/A)
Limit apply to	FCC Part 15. 109(CISPR Pub.22 Class B)
Test Date	July 16, 2003
Operating Condition	1280*1024 Full " H" Pattern display Mode
Environment Condition	Humidity Level : 55 %RH, Temperature : 27℃
Result	Passed by 3.80dB

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]	Cable Loss [dB]	Emission Level [DbμV/m]	Limit [dBμV/m]	Margin [dB]
142.43	10.19	V	12.54	3.00	25.73	30.0	4.27
161.25	7.51	V	13.00	3.23	23.73	30.0	6.27
215.00	11.08	H	9.86	4.00	24.93	30.0	5.07
322.50	13.80	H	13.13	4.69	31.62	37.0	5.38
376.25	9.07	V	14.36	5.31	28.73	37.0	8.27
430.00	6.91	H	15.91	5.54	28.36	37.0	8.64
537.48	2.24	H	17.52	6.35	26.11	37.0	10.89
703.76	4.13	H	20.19	7.42	31.74	37.0	5.26
752.50	3.35	H	21.35	7.64	32.34	37.0	4.66
859.99	2.48	V	22.24	8.48	33.20	37.0	3.80

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**

Ho Jin, Kim

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

$dB(\mu V/m) = 20 \log_{10} (\mu V /m)$: Equation 1
$dB\mu V = dBm + 107$: Equation 2

Example 1 : @ 0.184 MHz

Class A Limit = 518.80 μV = 54.30 dBμV
Reading = 46.47 dBμV
Convert to μV = 518.80 μV
Margin = 46.47 – 54.30 = -7.83 dBμV
= -7.83 dBμV below Limit

Example 2 : @ 89.995MHz

Class A Limit = 70.79 μV = 37 dBμV
Reading = 6.00 dBμV
Antenna Factor + Cable Loss = 18.42 + 8.78 = 17.20 dBμV
Total = 33.20dBμV
Margin = 33.20 – 37.0 = -3.80 dBμV
= -3.80 dBμV below Limit

7. TEST EQUIPMENT LIST

List of Test Equipments Used for Measurements

Test Equipment		Model	Mfg.	Serial No.	Cal. Due Date
☒	Spectrum Analyzer	E7405A	H.P	US411160290	04-05-21
☒	Receiver	ESVS 10	R & S	835165/001	04-03-22
☒	EMI TEST Receiver	ESHS30	Rohde & Schwarz	0401901/002	04-03-19
☐	Preamplifier	HP 8347A	HP	2834A00544	04-03-19
☒	LISN	3825/2	EMCO	9006-1669	03-12-27
☒	LISN	3825/2	EMCO	9208-1995	03-12-27
☒	TriLog Antenna	VULB9160	Schwarz Beck	3082	04-06-19
☐	LogBicon	VULB9165	Schwarz Beck	2023	04-05-08
☐	Dipole Antenna	VHAP	Schwarz Beck	964	04-05-03
☐	Dipole Antenna	VHAP	Schwarz Beck	965	04-05-03
☐	Dipole Antenna	UHAP	Schwarz Beck	949	04-05-03
☐	Dipole Antenna	UHAP	Schwarz Beck	950	04-05-03
☐	Double Ridged Horn	3115	EMCO	9809-2334	03-09-20
☒	Turn-Table	DETT-03	Daeil EMC	-	N/A
☒	Antenna Master	DEAM-03	Daeil EMC	-	N/A
☐	Plotter	7440A	H.P	2725A 75722	N/A
☒	Chamber	DTEC01	DAETONG	-	N/A
☐	Impedance Matching Pad	6001.01.A	SUNNER	3252	04-04-24
☐	Thermo Hygrograph	3-3122	ISUZU	3312201	03-12-20
☐	BaroMeter	-	Regulus	-	-