Electromagnetic Emission

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

VERIFICATION OF COMPLIANCE

FCC Part 15 Certification Measurement

PRODUCT	:	17" MONITOR
MODEL/TYPE NO	:	E17BL
FCC ID	:	OMNE17BL
APPLICANT	:	IMRI Co., Ltd. 270-2, Hunshin-Dong, Sangju-City, Kyungsangbuk-Do, Korea Attn. : Tae Moon, Choi / 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	:	IMRI
TEST REPORT No.	:	E01.0802. FCC.314N
DATES OF TEST	:	August 2, 2001
DATES OF ISSUE	:	August 4, 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" Color Monitor, Model E17BL 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.

Kayoung Kim

Name : Kayoung Kim

Title : Chief Engineer & Lab.Manager

E-RAE Testing Laboratory Inc.
371-51, Gasan-Dong, Geumcheon-Gu,
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Table of Contents

ATTACHMENT A: COVER LETTER(S)

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 ID Label and Location
Appendix B. Test Setup Photographs
Appendix C. External Photographs
Appendix D. Internal Photographs
Appendix E. Block Diagram
Appendix F. User 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 : IMRI Co., Ltd.

Address : 270-2, Hunshin-Dong, Sangju-City, Kyungsangbuk-Do, Korea

Attention : Tae Moon, Choi / Q.A Dept, Deputy Manager

- **EUT Type :** 17" MONITOR
- **Model Number :** E17BL
- **FCC Identifier :** OMNE17BL
- **S/N :** Prototype
- **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 :** Jul 13, 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. :** E01.0802.FCC.314N

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 IMRI Co., Ltd.
Model : E17BL

2. PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test(EUT) is the IMRI Co., Ltd.

2.2 General Specification

● Chassis Type	: Plastic
● List of Each OSC. Or X-Tal. Freq. (>=1MHz)	: X-TAL – 12MHz
● Chipset Brand & Part No.	: WT62P1 - WELTREND : TDA9109 - ST : TDA9210 – ST : MTV030N08 - MYSON
● Number of Layers	: Main board – 1Layers, CRT board – 1 Layers
● Active Display Area(4:#Ratio)	: Horizontal : 306mm±5mm : Vertical : 230mm±5mm
● Scanning Frequency	: Horizontal : 30KHz to 70KHz : Vertical : 50Hz to 150Hz
● Maximum Resolution	: Horizontal : 1280Dots : Vertical : 1024Dots
● Input Video Signal	: Analogue 0.714 Vp-p Positive at 75Ω
● Input Sync signal	: Separate Sync : TTL Level Positive / Negative : Composite Sync : TTL Level Positive / Negative
● Maximum Pixel Clock	: 110MHz (-3dB)
● Input Voltage	: 100V ~ 240V AC, 60/50Hz (PFC200V ~ 240V)
● Power Consumption	: 78Watts (Max)

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 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 was 1024x768 85Hz resolution.

Resolution	H/V Frequency	
640 X 480	43.269KHz / 85Hz	
800 X 600	46.875KHz / 75Hz	
1024 X 768	60KHz / 75Hz	
1024 X 768	68.677KHz / 85Hz	Worst case mode
1280 X 1024	63.98 kHz / 60 Hz	

4.3 Support Equipment Used

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

EUT – 17" MONITOR

FCC ID	: OMNE17BL
Model Name	: E17BL
Serial No.	: N/A
Manufacturer	: IMRI 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

4. TEST CONDITION

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 - SPEAKER (PC BANK)

FCC ID	: N/A
Model Name	: N/A
Serial No.	: N/A
Manufacturer	: PC BANK
Power Supply Type	: Linear
Power Cord	: Non-Shielded, Un-Detachable, 1.0m
Data Cable	: Audio Cable, 0.5m

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

5. TEST RESULTS

5.1 Summary of Test Results

This equipment, 17" CRT monitor, has various operating mode as described in the operating condition. The Conducted data and radiated emission test data were obtained in the worst case operating mode. 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 – 8.14 dB
15.109(e)	Radiated Emissions Measurement	Passed by – 3.59 dB

The data collected shows that the IMRI Co., Ltd. 17" Color Monitor, E17BL complies with technical requirements of above rules part 15.107 and 15.109 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	17" MONITOR / E17BL(SN:N/A)
Limit apply to	15.107(e) : CISPR Pub.22(1997) Class B
Test Date	August 2, 2001
Operating Condition	" H " Pattern display with 1024x768 85Hz mode
Environment Condition	Humidity Level : 40 %RH, Temperature : 25℃
Result	Passed by – 13.45 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 [dBμV]		Phase (*H/**N)	Limit [dBμV]		Margin [dB]	
	Quasi-peak	Average		Quasi-peak	Average	Q.Peak	Average
0.152	46.10	-	H	65.88	55.88	19.78	-
0.194	48.52	-	N	63.86	53.86	15.34	-
0.375	36.12	-	N	58.38	48.38	22.26	-
0.633	33.15	-	N	56.00	46.00	22.85	-
0.889	35.42	-	N	56.00	46.00	20.58	-
1.052	40.17	-	N	56.00	46.00	15.83	-
7.090	42.15	-	N	60.00	50.00	17.85	-
9.912	43.27	-	N	60.00	50.00	16.73	-
20.06	40.77	-	N	60.00	50.00	19.23	-
21.67	46.55	-	N	60.00	50.00	13.45	-

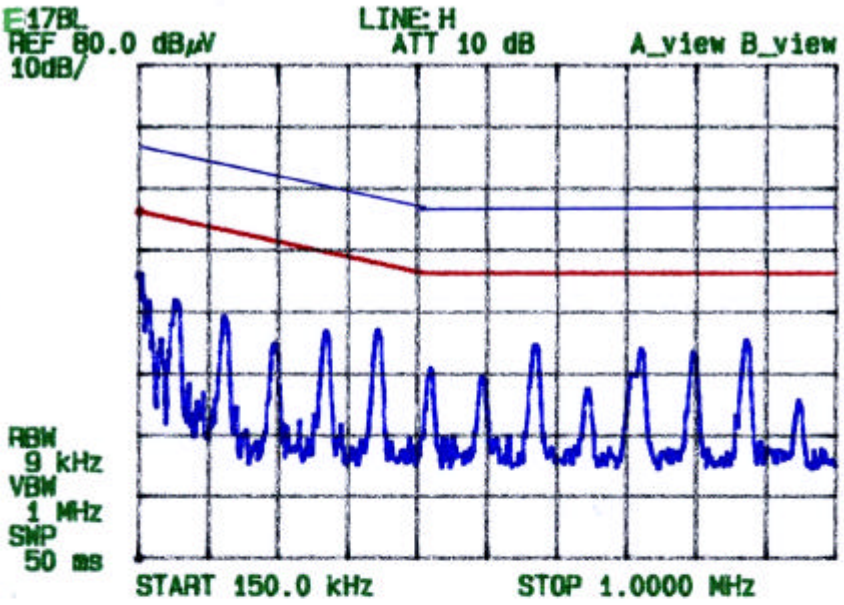
NOTES :

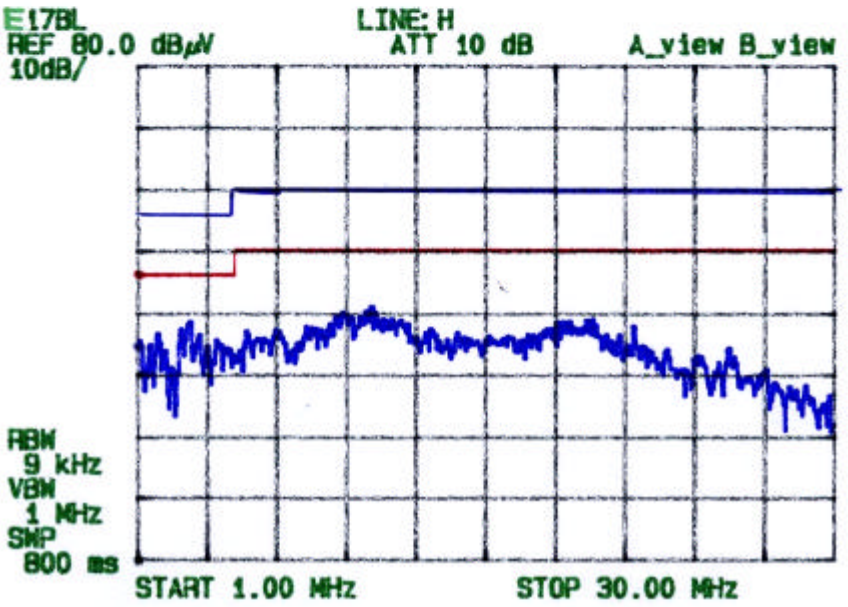
1. ** H : HOT Line , **N : Neutral Line*
2. *Margin value = Limit – Reading*
3. *Measurement were performed at the EUT AC Power Inlet in the frequency band of 150kHz~30MHz.*
4. *If the Reading Quasi-Peak value is bellow the Average Limit, Do not test Average Mode.*

Test Engineer : C. S. Kim

5. TEST RESULTS

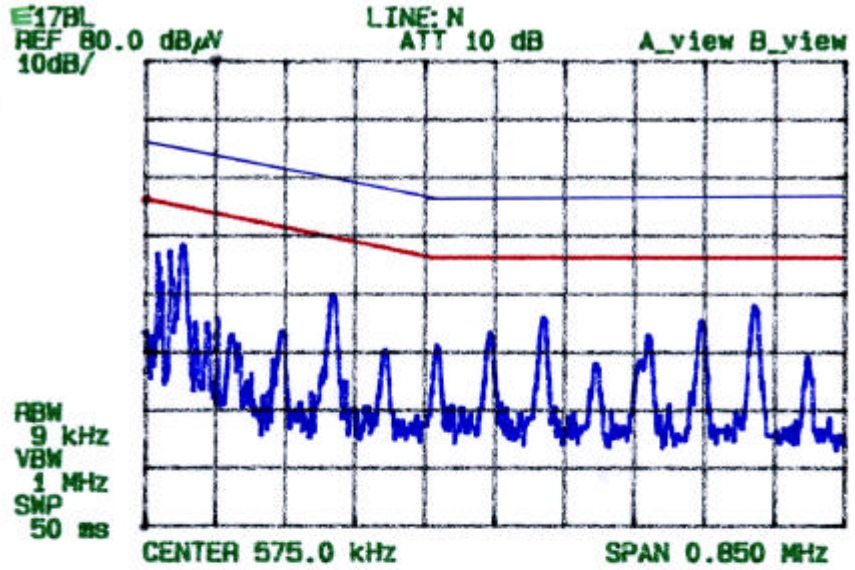
Line: HOT Line

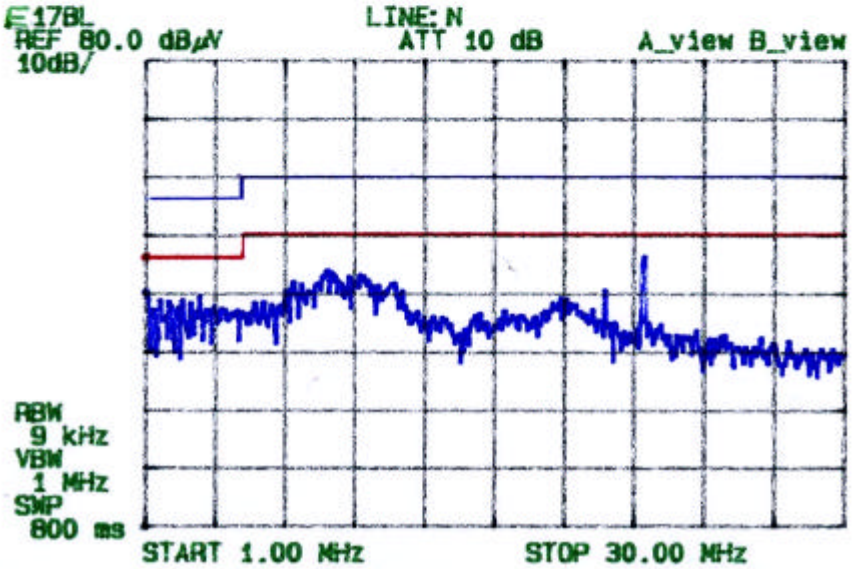




5.TEST RESULTS

Line: Neutral Line





5. TEST RESULTS

5.3 Radiated Emissions Measurement

EUT	17" MONITOR / E17BL(SN:N/A)
Limit apply to	15.109(e) : CISPR Pub.22(1997) Class B
Test Date	August 02, 2001
Operating Condition	" H " Pattern display with 1024x768 85Hz mode
Environment Condition	Humidity Level : 41 %RH, Temperature : 25℃
Result	Passed by – 5.57dB

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 [dBμV]	Polarization (*H/**V)	Ant. Factor [dB]	Cable Loss [dB]	Emission Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]
47.257	9.32	V	13.02	1.70	24.04	30.0	5.96
56.707	9.96	V	11.88	1.90	23.74	30.0	6.26
73.407	12.23	V	9.83	2.20	24.26	30.0	5.74
122.857	9.33	V	11.40	2.80	23.53	30.0	6.47
207.912	11.02	H	9.51	3.90	25.43	30.0	5.57
217.362	10.75	H	9.37	4.00	25.12	30.0	5.88
226.838	10.12	H	10.00	4.00	24.12	30.0	5.88
302.438	10.82	H	12.77	4.60	28.19	37.0	8.81
311.914	11.57	H	12.77	4.60	28.94	37.0	8.06
321.390	7.38	H	12.77	4.60	24.75	37.0	12.25
330.866	9.03	H	13.18	4.70	26.91	37.0	10.09
340.342	8.24	H	13.18	4.70	26.12	37.0	10.88

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.*

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(μV/m) = 20 $\log_{10}$ (μV /m) : Equation 1
dBμV = dBm + 107 : Equation 2

Example 1 : @ 21.67 MHz

Class B Limit = 1000 uV = 60.00 dBuV

Reading = 46.55 dBuV

Convert to uV = 212.5 uV

Margin = 46.55 – 60.00 = -13.45

= -13.45 dB below Limit

Example 2 : @207.912 MHz

Class B Limit = 31.7 uV = 30.0 dBuV/m

Reading = 11.02 dBuV

Antenna Factor + Cable Loss = 13.41 dB

Total = 24.43 dBuV/m

Margin = 24.43 – 30.0 = -5.57

= -5.57 dB below Limit

7. TEST EQUIPMENT LIST

List of Test Equipments Used for Measurements

Test Equipment		Model	Mfg.	Serial No.	Cal. Due Date
☒	Spectrum Analyzer	R3261A	Advantest	21720033	01-10-08
☐	Spectrum Analyzer	ESA-L1500A	H.P	US37360920	01-10-20
☒	Receiver	ESVS 10	R & S	835165/001	02-04-06
☒	Spectrum Analyzer	R3265A	Advantest	45060321	02-02-28
☒	Preamplifier	HP8447D	HP	2944A07626	02-01-10
☐	Preamplifier	HP 8347A	HP	2834A00544	01-05-23
☒	TriLog Antenna	VULB9160	Schwarz Beck	3082	02-05-08
☐	LogBicon	VULB9165	Schwarz Beck	2023	02-05-08
☐	Dipole Antenna	VHAP	Schwarz Beck	964	02-05-03
☐	Dipole Antenna	VHAP	Schwarz Beck	965	02-05-03
☐	Dipole Antenna	UHAP	Schwarz Beck	949	02-05-03
☐	Dipole Antenna	UHAP	Schwarz Beck	950	02-05-03
☐	Double Ridged Horn	3115	EMCO	9809-2334	01-09-20
☐	Magnetic Loop Antenna	6502	EMCO	9810-2111	01-12-11
☒	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	01-09-22
☒	Thermo Hygrograph	3-3122	ISUZU	3312201	01-12-20
☒	BaroMeter	-	Regulus	-	-