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	:	Powerline Home Lan
MODEL/TYPE NO	:	XM100-01-U
FCC ID	:	PQVXUP
APPLICANT	:	Xeline Co., Ltd. 7F Chungjin Bldg., 475-22 Bangbae2-Dong, Seocho-Gu, Seoul, 137-062, Korea Attn. : Lee, Hong Seok / General Manager
FCC CLASSIFICATION	:	Part 15 Class B Digital Device : Carrier Current System & PC Peripheral Device(JBP)
FCC RULE PART(S)	:	FCC Part 15 Subpart B
FCC PROCEDURE	:	Certification
TRADE NAME	:	Xeline
TEST REPORT No.	:	E01.0430.FCC.186N
DATES OF TEST	:	May 31, 2001
DATES OF ISSUE	:	June 13, 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 powerline communication Home Lan XUP Model XM100-01-U 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

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 : Xeline Co., Ltd.

Address : 7F Chungjin Bldg., 475-22 Bangbae2-Dong, Seocho-Gu, Seoul, 137-062, Korea

Attention : Lee, Hong Seok / General Manager

- **EUT Type :** Powerline Home Lan
- **Model Number :** XM100-01-U
- **FCC Identifier :** PQVXUP
- **S/N :** Prototype
- **Freq. Range :** 6.0 MHz – 7.5 MHz
- **Modulation :** FSK
- **FCC Rule Part(s) :** Part 15 Subpart B Unintentional Radiators
- **Test Procedure :** ANSI C63.4-1992
- **FCC Classification :** Part 15 Class B Digital Device : Carrier Current System & PC Peripheral Device(JBP)
- **Dates of Tests :** May 31, 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. :** E01.0430.FCC.186.N

1. INTRODUCTION

The measurement test for radiated and conducted emission test were conducted at the open area test site of E-RAE Testing Laboratiry 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 Xeline Co.,Ltd. Powerline Communication Modem Model : XM100-01-U.

2. PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test(EUT) is the Xeline Co., Ltd.
XM100-01-U is enabling the data transmission over powerline. As powerline communications technology offers network by utilizing existing power lines at home or small office, therefore no additional cost is incurred for additional wiring. Xup brings networking solution with ease of installation and no special networking configuration work. It adds more convenience for PC with USB Interface as it does not require set up of LAN CARD.

2.2 General Specification

- Chassis Type	Plastic
- List of Each OSC. Or X-Tal. Freq.(>=1MHz)	X1: 28.0 MHz, X2 : 48.0 MHz
- RF Frequency	6 MHz – 7.5MHz
- Modulation Type	FSK
- Max. RF Output	0 dbm
- Signal level	Differential Signalling
- RF Impedance	50 Ω
- Tx Speed	1 Mbps
- Protocol	IEEE 802.3 Compatible
- PC Interface	USB
- Power Requirement	AC 120V , 60Hz
- Power Consumption	15W max
- Dimension(LxD)	184 x 136 x 43 mm

3. DESCRIPTION OF TESTS

3.1 Conducted Emission Measurement

Conducted emissions measurements were made in accordance with section 11, "Measurement of Information Technology Equipment" of ANSI C63.4-1992. 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 an bandwidth of 10KHz or for "quasi-peak" within a bandwidth of 9KHz.

The line-conducted emission test is conducted inside a shielded anechoic chamber room with 1m x 1.5m x 0.8m wooden table which is placed 40cm away from the vertical wall and 1.5m away from the side wall of the chamber 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 is 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. All interconnecting cables more than 1m were shortened by non-inductive bundling(serprntine fashion) to a 1m length. 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 the detector function set to the CISPR Quasi-Peak mode by manual, after scanned by automatic Peak mode from 0.45 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. Each emission was maximized by switching power lines, varying the mode of operation or resolution, clock or data exchange speed, if applicable, whichever determined the worst-case emission. Each emission reported was calibrated using self-calibrating mode. Photographs of the worst-case emission can be seen in photographs of conducted emission test setup.

3. DESCRIPTION OF TESTS

3.2 Radiated Emission Measurement

Preliminary measurements were made at indoors 3 meter semi EMC Anechoic Chamber using broadband antennas, broadband amplifier, and spectrum analyzer to determine the emission frequencies producing the maximum EME.
Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth with respect to the antenna were noted for each frequency found. The spectrum was scanned from 9kHz to 30 MHz using the magnetic loop antenna and 30 to 1000MHz using biconilog antenna. Emission level from the EUT with various configurations were examined on the spectrum analyzer connected with the RF amplifier and plotted graphically.

Final measurements were made outdoors open site at 3-meter test range using biconilog antenna and magnetic loop antenna. The output from the antenna was connected, via a preselector or a preamplifier, to the input of the EMI Measuring Receiver and Spectrum analyzer(for above 1GHz). The detector function was set to the quasi-peak or peak mode as appropriate. The measurement bandwidth on the Field strength receiver was set to at least 120kHz (1MHz for measurement above 1GHz), with all post-detector filtering no less than 10 times the measurement bandwidth. 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 preliminary measurement was examined and investigated as the same set up and configuration which produced the maximum emission The EUT , support equipment and interconnecting cables were configured to the set-up producing the maximum emission for the frequency and were placed on top of a 0.8-meter high non-metallic 1m x 1.5 meter table. The turntable containing the system was rotated and the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission.

Each emission was maximized by varying the mode of operating frequencies of the EUT. The worst case emissions are recorded in the data tables. If necessary, the radiated emission measurement could be performed at a closer distance to ensure higher accuracy and the results were extrapolated to the specified distance using an inverse linear distance extrapolation factor(20dB/decade) as per section 15.31(f).

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 EUT and the supported equipments were installed to meet FCC requirement and operated in a manner which tends to maximize its emission level in a typical application.

4.2 EUT operation

The EUT was set to the normal on-line communication mode with data transmitting during all the testing in a manner similar to a typical use.

4.3 Support Equipment Used

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

EUT – PowerLine HomeLan

FCC ID	: PQVXUP
Model Name	: XM100-01-U
Serial No.	: N/A
Manufacturer	: Xeline Co., Ltd.
Power Supply Type	: SMPS
Power Cord	: 1.5m
Data Cable	: USB 1.2m

Support Unit 1 – NoteBook PC(Compaq)

FCC ID	: DOC
Model Name	: ARMADA M300
Serial No.	: 287810028A
Manufacturer	: Compaq
Power Supply Type	: Switching ((Adaptor : Model : PPT003S, Dongguang Lite)
Power Cord	: Non-Shielded, Detachable, 1.2m
PORT	: Parallel : 1, PS/2 :1 , RS-232 : 1, Audio: 2 USB: 2, VGA: 1

Support Unit 2 - LCD MONITOR

FCC ID	: OIOELM-150
Model Name	: ELM-150A
Serial No.	: N/A
Manufacturer	: E-RAE Electronics Industry Co., Ltd.
Power Supply Type	: DC 12V From Adapter(Adapter - PSCV360101A:SAMSUNG)
Power Cord	: Non-Shielded, Un-Detachable, 1.5m
Data Cable	: Shield detacheable 15-pin D-sub and ferrite core on signal cable

4. TEST CONDITION

Support Unit 3 – Printer(H.P)

FCC ID	: B94C2164K
Model Name	: C4562B
Serial No.	: TH9411434G
Manufacturer	: H.P
Power Supply Type	: DC24V From Adapter (Adapter Type- C2182A: H.P)
Data Cable	: Shielded, 1.5m

Support Unit 4 – Serial Mouse(PETRA)

FCC ID	: JKGMU5S01
Model Name	: MUS5S
Serial No.	: E183027
Manufacturer	: PETRA
Power Supply Type	: N/A
Power Cord	: N/A
Data Cable	: Shielded, 1.2m

5. TEST RESULTS

5.1 Summary of Test Results

This equipment is classified as a Carrier current system that transmits radio frequency energy by conduction over the electric power lines to communicate and as a PC peripheral device. 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.

FCC Rule Parts	Measurement Required	Result
15.107(a)	Conducted Emissions Measurement	Passed by – 9.90 dB
15.107(c)	Conducted Emissions Measurement	Passed by – 4.75 dB
15.109(a)	Radiated Emissions Measurement	Passed by – 3.77 dB
15.109(e)	Radiated Emissions Measurement	Passed by – 2.60 dB

The data collected shows that the **Xeline Co.,Ltd. Powerline Communication Home LAN XM100-01-U** complies with technical requirements of the Part 15.107 and 109 of the FCC Rules.

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	Powerline Home Lan XM100-01-U(SN:Prototype)
Limit apply to	FCC Part15 Subpart B Section 15.107(a) / CISPR 22 Class B
Test Date	May 31, 2001
Operating Condition	On-line Communication mode with data transmit
Environment Condition	Humidity Level : 37 %RH, Temperature : 22℃
Result	Passed by – 9.9 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	56.00	-	N	65.9	55.9	9.9	-
0.207	49.70	-	N	62.3	52.3	12.6	-
0.321	42.30	-	N	59.7	49.7	17.4	-
0.418	40.17	-	N	57.5	47.5	17.3	-
0.578	33.22	-	N	56.0	46.0	22.8	-
0.743	34.55	-	H	56.0	46.0	21.5	-
3.360	38.87	-	N	56.0	46.0	17.1	-
4.310	40.15	-	H	60.0	50.0	19.9	-
9.740	36.67	-	N	60.0	50.0	23.3	-
12.820	36.85	-	H	60.0	50.0	23.2	-
24.200	34.50	-	H	60.0	50.0	25.5	-

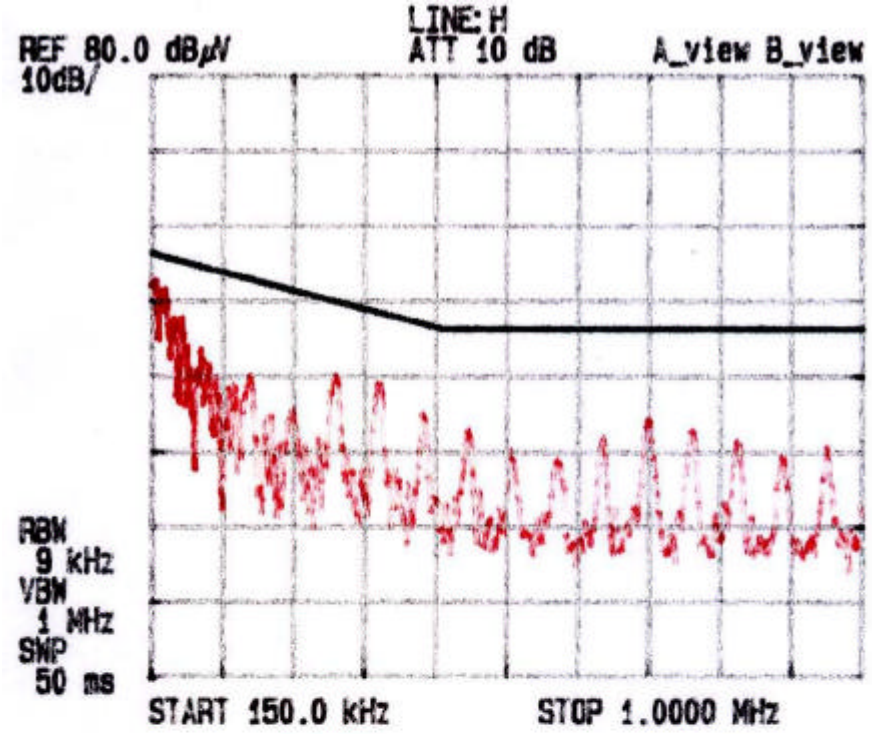
NOTES :

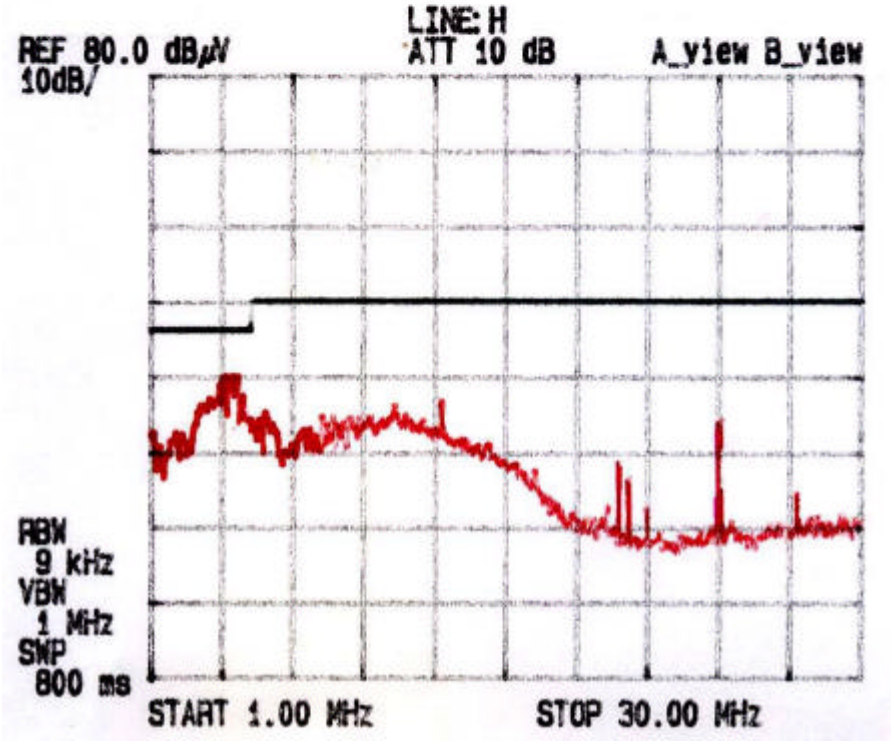
1. **** H : Horizontal polarization , ** V : Vertical polarization***
2. ***Emission Level = Reading + Antenna factor + Cable loss***
3. ***Margin value = Limit - Emission Level***
4. ***Measurement were performed at the HOST PC AC Power Inlet in the frequency band of 450kHz ~ 30MHz according to the section 15.107(a).***

Yo han, Park

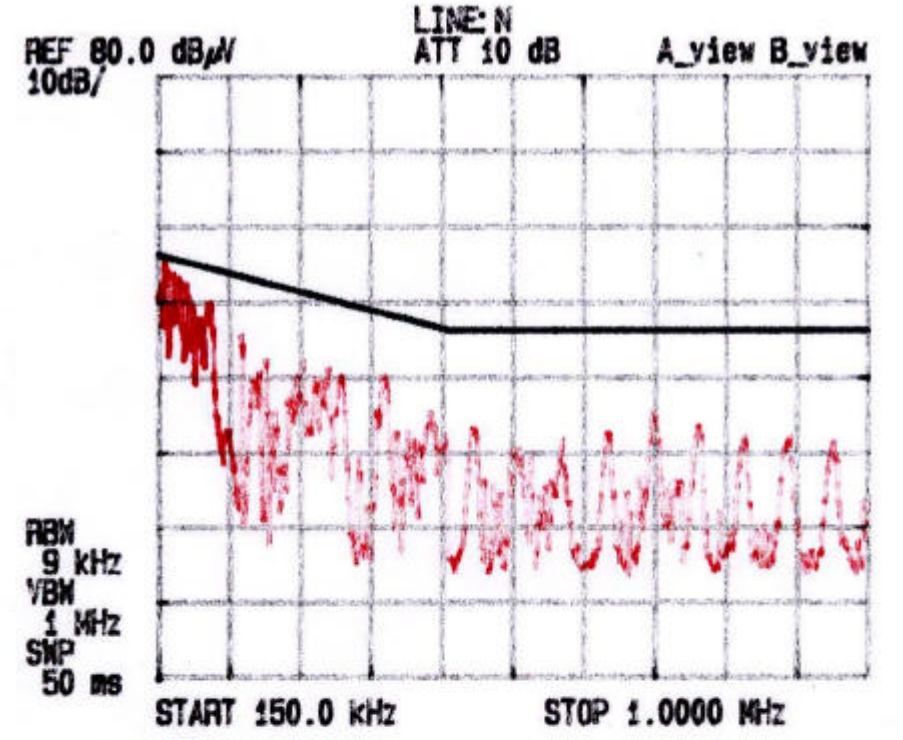
Test Engineer : Y. H, Park

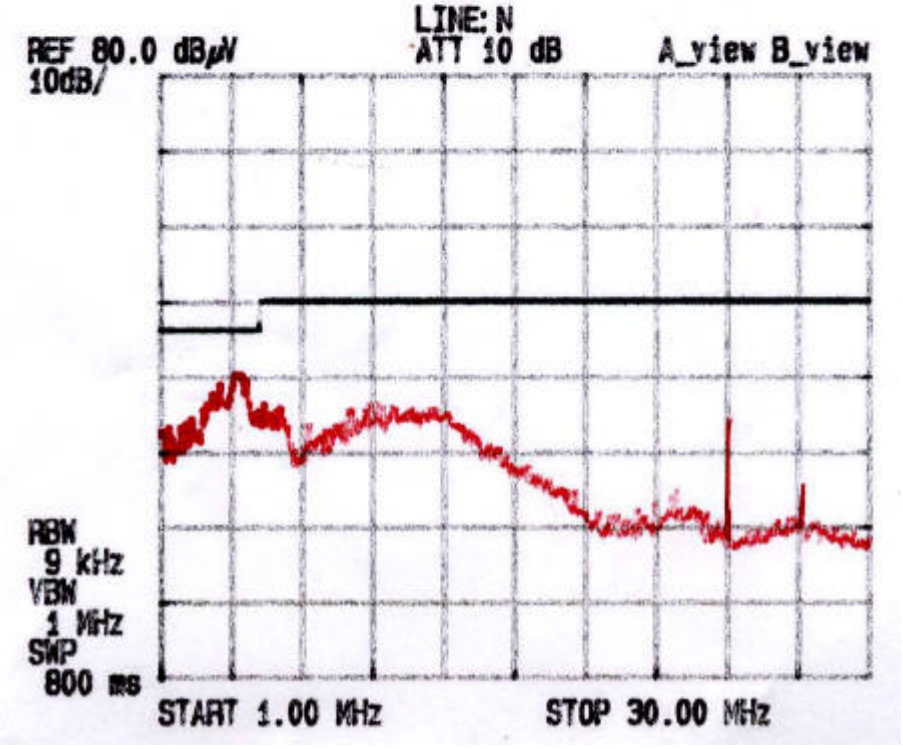
5. TEST RESULTS





5. TEST RESULTS





5. TEST RESULTS

EUT	Powerline Home Lan XM100-01-U(SN:Prototype)
Limit apply to	FCC Part15 Subpart B Section 15.107(c)
Test Date	May 31, 2001
Operating Condition	On-line Communication mode with data transmit
Environment Condition	Humidity Level : 37 %RH, Temperature : 22℃
Result	Passed by – 4.75dB

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 (*L/**N)	Limit [dBμV]		Margin [dB]	
	Quasi-peak	Average		Quasi-peak	Average	Q.Peak	Average
0.697	52.15	-	N	60.0	-	7.85	-
0.731	50.02	-	N			9.98	-
0.792	51.25	-	H			8.75	-
0.811	50.85	-	H			9.15	-
1.105	46.60	-	H			13.40	-
1.249	56.05	-	N			3.95	-
1.301	49.17	-	N			10.83	-
1.630	50.95	-	N			9.05	-
1.702	55.25	-	H			4.75	-

NOTES :

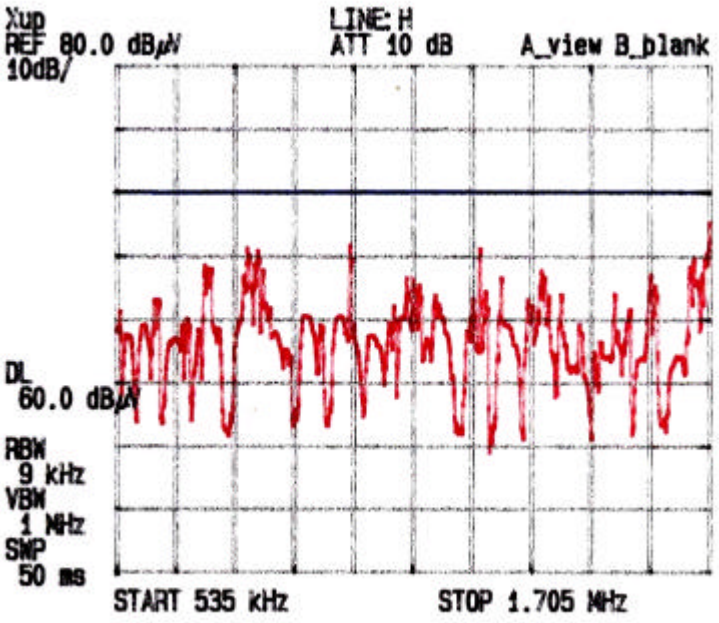
5. **** H : Horizontal polarization , ** V : Vertical polarization***
6. ***Emission Level = Reading + Antenna factor + Cable loss***
7. ***Margin value = Limit - Emission Level***
8. ***Measurement were performed at the EUT AC Power Inlet in the frequency band of 535kHz ~ 1705kHz according to the section 15.107(c) (2).***

Yo han, Park

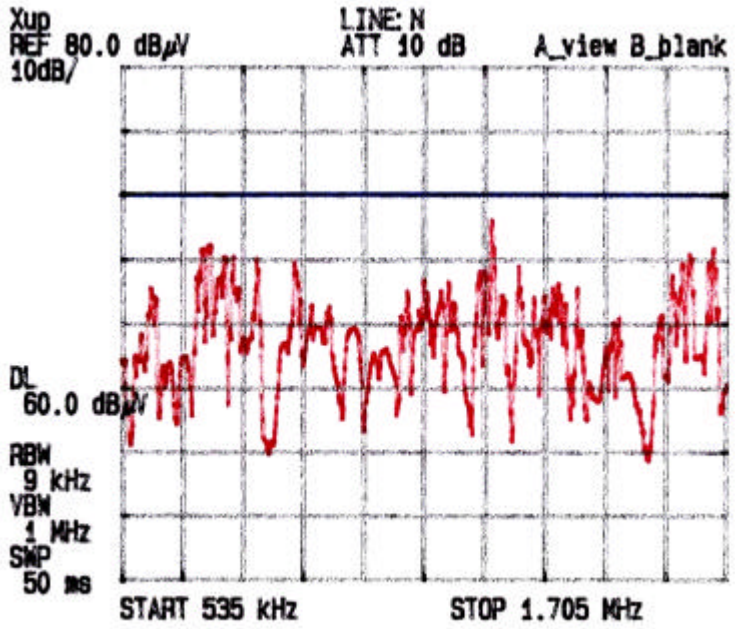
Test Engineer : Y. H, Park

5. TEST RESULTS

Line Polarization : Hot



Line Polarization : Neutral



5. TEST RESULTS

5.3 Radiated Emissions Measurement

EUT	Powerline Home Lan XM100-01-U(SN:Prototype)
Limit apply to	FCC Part15 Subpart B Section 15.109(a)
Test Date	May 31, 2001
Operating Condition	On-line Communication mode with data transmit
Environment Condition	Humidity Level : 37 %RH, Temperature : 22℃
Result	Passed by – 3.77dB

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]
48.0	21.49	H	13.02	1.7	36.21	40.0	3.79
84.0	25.07	H	8.53	2.0	35.80	40.0	4.20
140.0	20.76	H	12.37	3.0	36.13	43.5	7.37
308.0	24.27	H	12.77	4.6	41.64	46.0	4.36
336.0	22.23	H	13.18	4.7	40.11	46.0	5.89
476.0	18.74	H	16.49	6.2	41.43	46.0	4.57
504.0	18.94	H	16.99	6.3	42.23	46.0	3.77
532.0	18.45	H	17.31	6.3	42.06	46.0	3.94
588.0	16.95	H	18.38	6.7	42.03	46.0	3.97
644.0	13.07	H	19.45	6.9	39.42	46.0	6.58

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 section 15.109(a).***

Yo han, Park
Test Engineer : Y. H. Park

5. TEST RESULTS

EUT	Powerline Home Lan XM100-01-U(SN:Prototype)
Limit apply to	FCC Part15 Subpart B Section 15.209
Test Date	May 31, 2001
Operating Condition	On-line Communication mode with data transmit
Environment Condition	Humidity Level : 37 %RH, Temperature : 22℃
Result	Passed by – 3.77dB

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 : 9 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]
7.44	34.10	V	10.6	-	44.70	49.5	4.8
8.09	36.40	V	10.5	-	46.90	49.5	2.6
9.10	34.64	V	10.4	-	45.04	49.5	4.5
12.30	34.78	V	10.2	-	44.98	49.5	4.5
13.27	34.80	V	10.2	-	45.00	49.5	4.5
15.93	31.54	V	10.0	-	41.54	49.5	7.9

NOTES :

1. ***H : Horizontal polarization , ** V : Vertical polarization***
2. ***Emission Level = Reading + Antenna factor + Cable loss***
3. ***Margin value = Limit - Emission Level***
4. ***The measurementwas performed for the frequency range of 9kHz ~ 30 MHz according to the section 15.109(e) requirement.***
5. ***The loop antenna was positioned with its plane vertical at 3m from the EUT and rotated about its vertical axis for maximum emission at each azimuth about the EUT.***

Yo han, Park

Test Engineer : Y. H. Park

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 : @ 0.218 MHz

Class B Limit = 441.063 uV = 52.89 dBuV
Reading = 48.45dBuV
Convert to uV = 264.55uV
Margin = 48.45 – 52.89 = -4.44
= -4.44dB below Limit

Example 2 : @664.64 MHz

Class B Limit = 70.79 uV = 37.0 dBuV/m
Reading = 7.38dBuV
Antenna Factor + Cable Loss = 25.14 dB
Total = 32.52 dBuV/m
Margin = 32.52 – 37.0 = -4.48
= -4.48dB 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	-	-