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	:	PLC Modem
MODEL/TYPE NO	:	MM-202BX
FCC ID	:	PQVMM-202BX
APPLICANT / ADDRESS	:	Xeline Co., Ltd. 5F Seowon Bldg., 1515-4 Seocho3-dong, Seocho-gu, Seoul, 137-871, Korea Attn.: IL-Soo, Kim / Senior Manager
Manufacture / Address		Same as applicant
FCC CLASSIFICATION	:	Class B personal computers and peripherals
FCC RULE PART(S)	:	FCC Part 15 Subpart B
FCC PROCEDURE	:	Certification
TRADE NAME	:	N/A
TEST REPORT No.	:	E05.1124.FCC.743N
DATES OF TEST	:	November 07 - November 24, 2005
DATES OF ISSUE	:	November 24, 2005
TEST LABORATORY	:	ETL Inc. (FCC Registration Number: 95422) #584 Sangwhal-ri, Kanam-myon, Yoju-kun, Kyounggi-do, 469-885, Korea Tel: (031) 885-0072 Fax: (031) 885-0074

This is PLC Modem, Model: MM-202BX has been tested in accordance with the measurement procedures specified in ANSI C63.4-2001 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 here in was performed by me or was made under my supervision and is 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.

Hyung Seok, Lee / Chief Engineer

ETL Inc.

#584 Sangwhal-ri, Kanam-myon, Yoju-kun,
Kyounggi-do, 469-885, Korea

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FCC TEST 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 : 5F Seowon Bldg., 1515-4 Seocho3-dong, Seocho-gu, Seoul, 137-871, Korea

Attention : IL-Soo, Kim / Senior Manager

- **EUT Type:** PLC Modem
- **Model Number:** MM-202BX
- **FCC ID:** PQVMM-202BX
- **S/N:** N/A
- **FCC Rule Part(s):** FCC Part 15 Subpart B
- **Test Procedure:** ANSI C63.4-2001
- **FCC Classification:** Class B personal computers and peripherals
- **Dates of Tests:** November 07 – November 24, 2005
- **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.:** E05.1124.FCC.743N

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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, Kanam-myun, Youju-kun, Kyounggi-do, Korea. The site is constructed in conformance with the requirements of the ANSI C63.4-2001 and CISPR Publication 16. The ETL has site descriptions on file with the FCC for 3 and 10meter 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 C63.4-2001 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.63.4-2001) was used in determining radiated and conducted emissions from the Xeline Co., Ltd., Model: MM-202BX.

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2. PRODUCT INFORMATION

2.1 General Remarks

2.2 Equipment Description

The Equipment Under Test (EUT) is the Xeline Co., Ltd., PLC Modem, MM-202BX

2.3 General Specification

	Specifications	Remarks
Data rates	Up to 24Mbps	Fundamental Carrier 24 MHz
Interface	RJ-45 Ethernet 2 port	For connection with backbone
	RJ-45 UART 1 port	Optional use
	RJ-11 PLC 2 port	For connection with CU-100A
Power	AC 110V - 240V, 0.5A, 50/60Hz	
Dimensions	260mm × 154mm × 35mm	(W x D x H)
Weight	505g	
operational temperature	40 °C	

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3. DESCRIPTION OF TESTS

3.1 Conducted Emission Measurement

Conducted emissions measurements were made in accordance with § 12.2 in ANSI C63.4-2001 "Measurement of Information Technology Equipment ". The measurement were performed over the frequency range of 0.15 MHz 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 9 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. 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 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 ESPI EMI Test Receiver to determine the frequency producing the max. emission from the EUT. The frequency producing max. level was reexamined using to set Quasi-Peak mode by manual, after scanned by automatic Peak mode from 0.535 MHz to 1.705 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.

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3. DESCRIPTION OF TESTS

3.2 Radiated Emission Measurement

Radiated emission measurements were in accordance with § 12.2 in ANSI C63.4-2001 "Measurement of Information Technology Equipment ". The measurements were performed over the frequency range of 30 MHz to 1 GHz and 9 kHz to 30 MHz 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 or 9 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 9 kHz to 30 MHz using EMCO Magnetic loop antenna and 30 MHz to 1 GHz using SchwarzBeck Log-Bicon antenna. Above 1 GHz, linearly polarized double ridge horn antennas were used. Final measurements were made open site at 3-meters. The test equipment was placed on a wooden turntable. 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 200 Hz, 9 kHz, 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.

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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
Communication network monitoring mode	O

O: Worst case investigated during the Test : Test has been conducted with the fundamental carrier of 24 MHz.

4.3 Support Equipment Used

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

EUT – PLC Modem

FCC ID	**: PQVMM-202BX**
Model Name	**: MM-202BX**
Serial No.	**: N/A**
Manufacturer	**: Xeline Co., Ltd.**
Power Supply Type	**: Switching**
Power Cord	**: Non-shielded, Detachable: 1.2m**
Data Cable	**: Non-shielded Cable: 1.5m**

Support Unit 1-Persnal computer (DELL)

FCC ID	**: DOC**
Model Name	**: DHM**
Serial No.	**: FNTGB1S**
Manufacturer	**: Dell Asia Pacific Sdn.**
Power Supply Type	**: Switching**
Power Cord	**: Non-shielded, Detachable: 1.2m**
Data Cable	**: Shielded Detachable: 1.2m**

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Support Unit 2-Keyboard (COMPAQ)

FCC ID	: 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-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-USB Mouse (LOGITECH)

FCC ID	: HLA311001
Model Name	: 311011
Serial No.	: HL08011837
Manufacturer	: LOGITECH
Power Supply Type	: N/A
Power Cord	: N/A
Data Cable	: Shielded, 1.2m

Support Unit 5- Serial Mouse (PETRA)

FCC ID	: JKGMUS5S01
Model Name	: MUS5S01
Serial No.	: E183027
Manufacturer	: PETRA
Power Supply Type	: N/A
Power Cord	: N/A
Data Cable	: Shielded, 1.2m

Support Unit 6- Monitor (E-RAE)

FCC ID	: OIOELM-150A
Model Name	: ELM-150A
Serial No.	: N/A
Manufacturer	: E-RAE Electronics Industrial Co., Ltd.
Power Supply Type	: Power Supply from DC12V of AC/DC Adapter
Power Cord	: Shielded, Detachable: 1.2m
Data Cable	: Shielded, 1.2m

Support Unit 7- Ear Phone (JE-TECH)

FCC ID	: N/A
Model Name	: N/A
Serial No.	: N/A
Manufacturer	: JE-TECH
Power Supply Type	: N/A
Power Cord	: N/A
Data Cable	: Shielded, 1.2m

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5. TEST RESULTS

5.1 Summary of Test Results

Test Rule Parts	Measurement Required	Result
15.107(c)	Conducted Emissions Measurement	Passed by 14.70 dB
15.109(a)	Radiated Emissions Measurement	Passed by 3.60 dB
15.109(e)	Radiated Emissions Measurement	Passed by 8.70 dB

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.

The data collected shows that the **Xeline Co., Ltd. PLC Modem, MM-202BX** complies with technical requirements of above rules part 15.107(c) and 15.109(a)(e) 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.

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5. TEST RESULTS

5.2.2 Conducted Emissions Measurement

EUT	PLC Modem / MM-202BX (SN: N/A)
Limit apply to	FCC Part 15. 107(c)
Test Date	November 07, 2005
Operating Condition	Communication network monitoring mode
Environment Condition	Humidity Level : 32 %RH, Temperature : 19℃
Result	Passed by 14.70 dB

Conducted Emission Test Data

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

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

Frequency [MHz]	Result [dBμV]	Phase (*H/**N)	Limit [dBμV]	Margin [dB]
	Quasi-peak		Quasi-peak	Q.Peak
0.560	40.30	N	60.00	19.70
0.736	42.80	N		17.20
0.836	45.10	N		14.90
0.942	45.10	N		14.90
1.052	43.50	H		16.50
1.262	41.90	H		18.10
1.318	43.30	H		16.70
1.471	45.30	H		14.70

NOTES:

1. *** H: HOT Line, **N: Neutral Line**
2. **Margin value = Limit – Result**
3. **Measurement were performed at the EUT AC power line in the frequency band of 535 kHz – 1705 kHz According to the section 15.107(c)**

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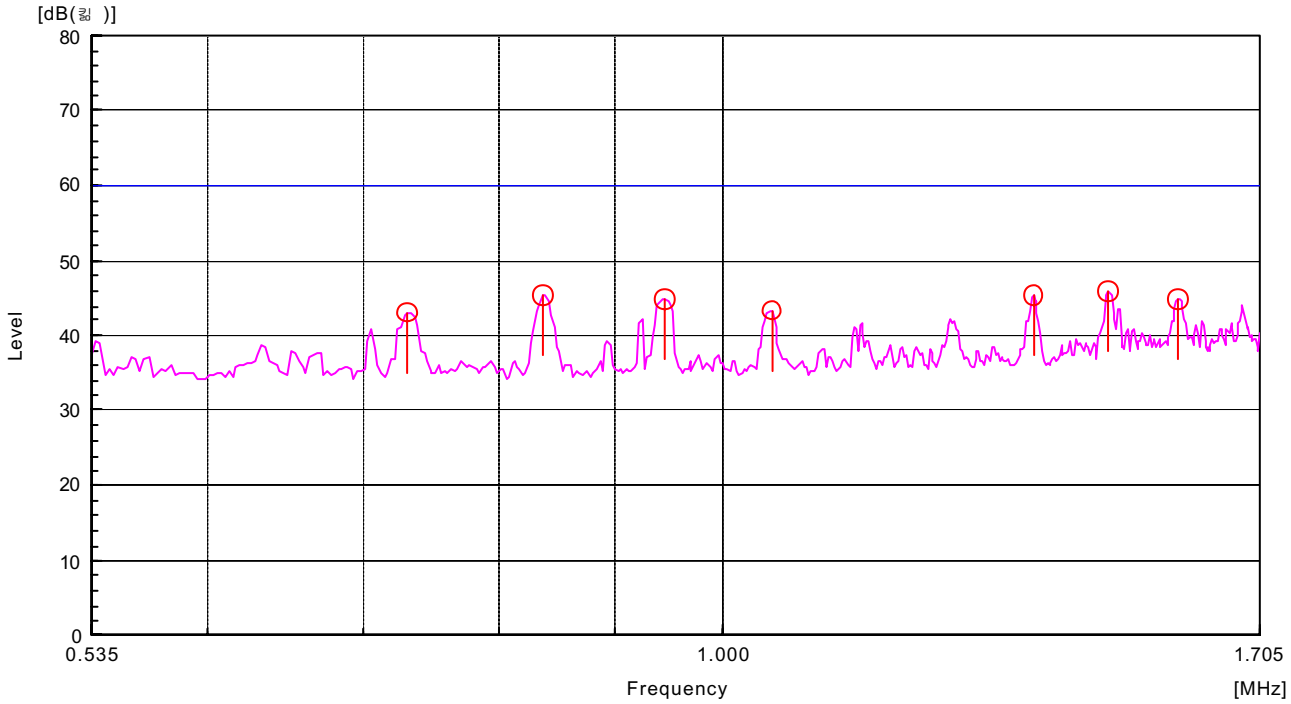
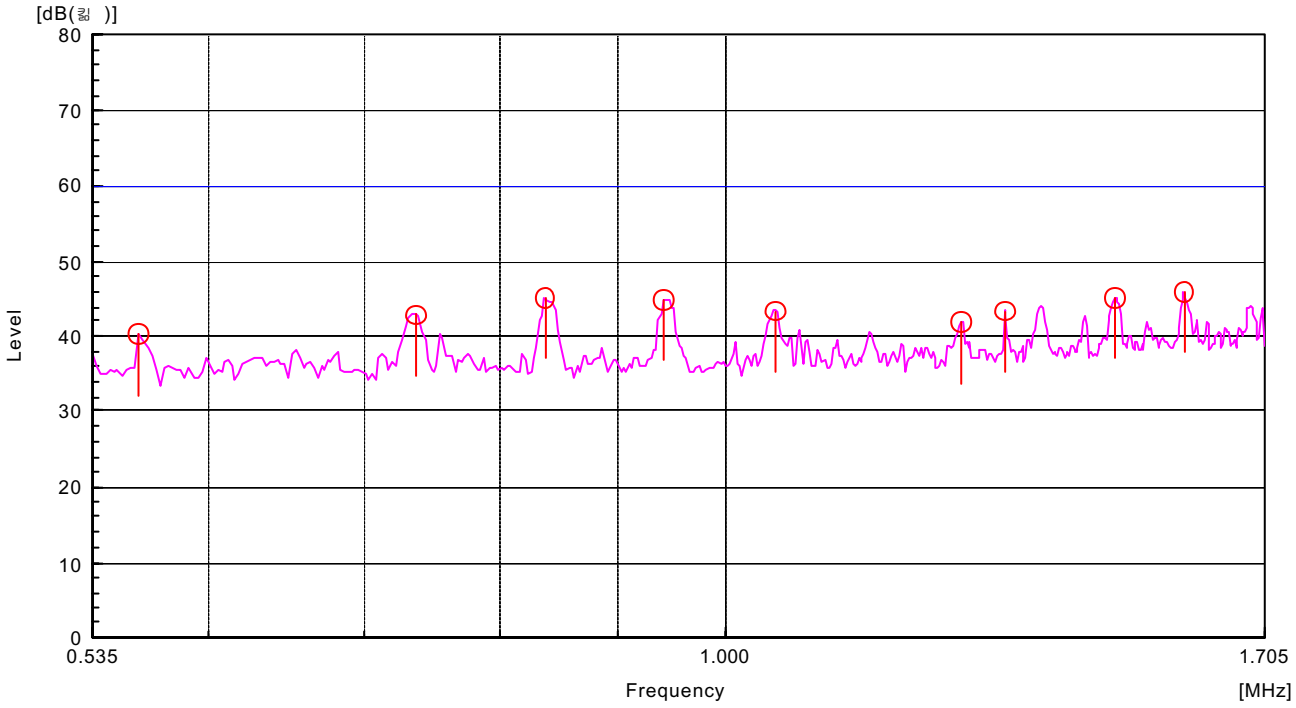
5. TEST RESULTS

Line: HOT



Line: Neutral



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Form No.: ETL(E) 004A4001201-0

5. TEST RESULTS

5.3.1 Radiated Emissions Measurement

EUT	PLC Modem / MM-202BX (SN: N/A)
Limit apply to	FCC Part 15. 109 (a)
Test Date	November 08, 2005
Operating Condition	Communication network monitoring mode
Environment Condition	Humidity Level : 31 %RH, Temperature : 18℃
Result	Passed by 3.60 dB

Radiated Emission Test Data

The following table shows the highest levels of radiated emissions on both polarizations 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 [dB]	Result [dBμV/m]	Limit [dBμV/m]	Margin [dB]
40.13	20.54	V	11.98	2.60	35.12	40.0	4.88
77.93	23.57	V	8.71	3.06	35.34	40.0	4.66
84.68	24.74	V	8.47	3.19	36.40	40.0	3.60
111.00	20.19	V	11.05	3.67	34.90	43.5	8.60
150.15	17.07	V	13.33	4.10	34.50	43.5	9.00

All other frequencies are has 15dB margin at least.

NOTES:

1. *** H: Horizontal polarization, ** V: Vertical polarization**
2. **Result = Reading + Antenna factor + Cable loss**
3. **Margin value = Limit - Result**

Test Engineer: K. K. Yoon

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5.3.2 Radiated Emissions Measurement

EUT	PLC Modem / MM-202BX (SN: N/A)
Limit apply to	FCC Part 15. 109 (e)
Test Date	November 17, 2005
Operating Condition	Communication network monitoring mode
Environment Condition	Humidity Level : 30 %RH, Temperature : 17℃
Result	Passed by 8.70 dB

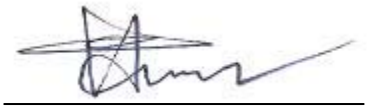
Radiated Emission Test Data

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical. Detector mode: CISPR Quasi-Peak mode.

Frequency [MHz]	Reading [dBμV]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB]	Result [dBμV/m]	Limit [dBμV/m]	Margin [dB]
12.01	20.88	V	11.85	0.59	33.32	49.50	16.18
24.03	29.05	V	11.06	0.69	40.80		8.70

NOTES:

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



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6. SAMPLE CALCULATION

Sample of 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 : @ 84.68 MHz

Class B Limit = 40.00dBμV/m

Reading = 24.74dBμV

Antenna Factor + Cable Loss = 11.66dBμV/m

Total = 36.40dBμV/m

Margin = 40.00 − 36.40 = 3.60dB

= 3.60dB below Limit

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7. List of Test Equipments Used for Measurements

Test Equipment		Model	Mfg.	Serial No.	Cal. Due Date
☒	Spectrum Analyzer	E7402A	H.P	US39110107	06-10-18
☒	Receiver	ESVS 10	R & S	835165/001	06-04-07
☒	EMI TEST Receiver	ESPI	R & S	100478	06-10-17
☐	EMI TEST Receiver	ESHS30	Rohde & Schwarz	0401901/002	06-10-17
☐	Preamplifier	HP 8347A	HP	2834A00544	06-04-07
☒	LISN	3825/2	EMCO	9006-1669	06-04-06
☒	LISN	3825/2	EMCO	9208-1995	06-04-07
☒	TriLog Antenna	VULB9160	Schwarz Beck	3082	06-07-27
☒	Magnetic Loop Antenna	AL-130	Com-Power	17100	06-10-13
☐	LogBicon	VULB9165	Schwarz Beck	2023	06-07-05
☐	Dipole Antenna	VHAP	Schwarz Beck	964	06-06-24
☐	Dipole Antenna	VHAP	Schwarz Beck	965	06-07-05
☐	Dipole Antenna	UHAP	Schwarz Beck	949	06-06-24
☐	Dipole Antenna	UHAP	Schwarz Beck	950	06-07-05
☐	Broad-band Horn Antenna	BBHA 9120D	Schwarz Beck	227	06-04-04
☒	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
☐	Thermo Hygrograph	3-3122	ISUZU	3312201	06-04-13
☐	BaroMeter	-	Regulus	-	06-03-15

End of test report

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