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	:	Wireless Karaoke Microphone
MODEL/TYPE NO	:	FX-9913
FCC ID	:	PK8FX-9913
APPLICANT	:	KORI TECH Co., Ltd. Rm .407, Daeryung Techno 2nd Town, 569-21 Kasan-Dong, Keumcheon-Ku, Seoul, Korea, Attn. : Kim, Kwang Yeoul
FCC CLASSIFICATION	:	Low Power Communication Device Transmitter : Intentional Radiator
FCC RULE PART(S)	:	FCC Part 15 Subpart C § 15.239
FCC PROCEDURE	:	Certification
TRADE NAME	:	Koritech
TEST REPORT No.	:	E01.0608.FCC.240.N
DATES OF TEST	:	May 25, 2001
DATES OF ISSUE	:	June 08, 2001
TEST LAB.		ETL Inc (FCC Registration Number : 95422) 371-51, Gasan-Dong, Geumcheon-Gu, Seoul, Korea Tel : (031) 885-0072 Fax : (031) 885-0074

This wireless karaoke microphone 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 C section15.239.
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,
Seoul, 153-023, Korea

This report only responds to the tested sample and may not be reproduced, except in full, without written approval of the ETL,Inc.

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 Radiated Emissions of RF Carrier frequency
   - 5.3 Out-of-band Radiated Emissions
   - 5.4 Emission Bandwidth Measurement
6. Antenna Requirement
7. Sample Calculations
8. 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. Operational Description
Appendix F. Block Diagram
Appendix G. Schematics
Appendix H. 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 : KORI TECH Co., Ltd.

Address : Rm .407, Daeryung Techno 2nd Town, 569-21 Kasan-Dong, Keumcheon-Ku, Seoul, Korea

Attention : Kim, Kwang Yeoul

- **EUT Type :** Wireless Karaoke Microphone
- **Model Number :** FX-9913
- **FCC Identifier :** PK8FX-9913
- **S/N :** Prototype
- **Freq. Range :** 106.2 MHz – 107.6 MHz
- **FCC Rule Part(s) :** Part 15 Subpart C Section 15.239
- **Test Procedure :** ANSI C63.4-1992t
- **FCC Classification :** DXX - Low Power Communication Device Transmitter : Intentional Radiator
- **Dates of Tests :** May 25, 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. :** E01.0608.FCC.240.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 KORI TECH Co.,Ltd. Wireless karaoke microphone Model : FX-9913.

2. PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test(EUT) is the KORI TECH Co., Ltd. Wireless karaoke microphone Model:FX-9913(FCC ID : PK8FX-9913). This microphone is powered by batteries of 4 x 1.5V AAA. This equipment is low power transmitter intended for wireless microphone with audio data stored in the karaoke DSP chip..
The wireless support with audio source for FM frequency band of 106.2 ~ 107.6 MHz and Voice support with dynamic microphone.

2.2 General Specification

- Chassis Type	Plastic (Internal copper coating)
- List of Each OSC. Or X-Tal. Freq.(>=1MHz)	X1:16MHz, X2: 21.4772MHz, Y1:9.6MHz
- IC PLL :	Motorola MC145170D
- RF Frequency Out	106.2MHz – 107.6MHz
- Antenna Type	Herix Antenna tunned to 90MHz
- Antenna Connector type	STUD
- Max. Audio Output	±4V
- RF Impedance	50 Ω
- I/O Cable(s)	Unshielded
- Power Requirement	AAA 1.5V x4
- Power Consumption	500mW max
- Dimension(LxD)	263.3 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 30 to 1000MHz using biconilog antenna and above 1000MHz, linearly polarized double ridge horn antennas were used. Above 1GHz, linearly polarized double ridge horn antennas were used. The measurements were performed with three frequencies which were selected as bottom, middle andtop frequency in the operating band. 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. 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 system was tested in all the three orthogonal planes and changing the polarity of the antenna. 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.

3. DESCRIPTION OF TESTS

3.3 Emission Bandwidth Measurement

Emissionjs from the intentional radiator shall be confined within a band 200 kHz wide centered on the operating frequency. The 200 kHz band shall lie wholly within the frequency range of 88 – 108 MHz. Position the EUT as shown in the radiated emission measurement and set it to any one measured frequency within its operating range and make sure sure the measuring instrument is operated in its linear range. Set both RBW and VBW of the spectrum analyzer to 10 kHz and 30 kHz respectively with a convenient frequency span including 200kHz bandwidth of the emission.
The bandwidth of emission shall be no wider than of 200kHz of the center frequency for EUT operating within 88.0 MHz to 108.0 MHz. The bandwidth is determined at the points 26dB down from the modulated carrier. Plot the graph on spectrum analyzer.

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.

Radiated Emission Test

Preliminary radiated emission tests were conducted using the procedure in ANSI C63.4/1992 Clause 8.3.1.1 to dertimine the worst operating condition. Final radiated emission tests were conducted at 3 meter open field test site.
To complete the test configuration required by the FCC, the EUT was tested in all three orthogonal planes. All testing was performed at 6VDC via internal battery.

4.2 EUT operation

The EUT was set to the normal audio transmitting mode in a FM band with karaoke music sound play during all the testing in a manner similar to a typical use. For the EUT operation, the LCD caption unit and song catridge was used.

4.3 Support Equipment Used

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

EUT- Wireless karaoke microphone

FCC ID	: PK8FX-9913
Model Name	: FX-9913
Serial No.	: Prototype
Manufacturer	: KORI TECH Co.,Ltd.
PowerSupply Type	: 1.5 V AAA batteries x 4
Power Cord	: N/A
Antenna	:

Support Unit 1 – LCD Caption Unit (Option to the EUT)

FCC ID	: N/A
Model Name	: -
Serial No.	: Prototype
Manufacturer	: KORI TECH Co.,Ltd.
Power Supply Type	: N/A
Interface cable	: Non shielded , non detachable interface cable , 1.8m

Support Unit 2 – Song Catridge (Option to the EUT)

FCC ID	: N/A
Model Name	: -
Serial No.	: Prototype
Manufacturer	: KORI TECH Co.,Ltd.
Power Supply Type	: N/A
Power Cord	: N/A

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.

FCC Rule Parts	Measurement Required	Result
15.207	Conducted Emission	N/A
15.239(b)	Radiated Emissions of RF Carrier frequency	Passed by – 4.98 dB
15.239(c)	Out-of-band Radiated Emissions	Passed by – 3.96 dB
15.239(a)	Emission Bandwidth Measurement	Passed

The data collected shows that the **KORI TECH Co.,Ltd. Wireless Karaoke Microphone FX-9913** complies with technical requirements of the Part 15.239 of the FCC Rules.

This equipment is battery only operated device. The Conducted emission measurement according to the section 15.207 is not applicable to this equipment,

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 Radiated Emissions of RF Carrier frequency

EUT	Wireless Karaoke Microphone FX-9913(SN:Prototype)
Limit apply to	FCC Part15 Subpart C Section 15.230(b)
Test Date	May 2, 2001
Operating Condition	RF transmit with karaoke music play mode
Environment Condition	Humidity Level : 37 %RH, Temperature : 22℃
Result	Passed by – 4.98dB

The following table shows the highest levels of radiated emissions on both polarization of horizontal and vertical.
Detector mode : Peak mode
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]
106.2	30.98	V	10.00	2.40	43.38	68.0	24.62
106.9	30.73	V	10.00	2.40	43.13	68.0	24.87
107.6	31.60	V	10.00	2.40	44.00	68.0	24.00

Detector mode : Average mode
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]
106.2	30.62	V	10.00	2.40	43.02	48.0	4.98
106.9	30.46	V	10.00	2.40	42.86	48.0	5.14
107.6	30.89	V	10.00	2.40	43.29	48.0	4.71

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 three frequencies as bottom, middle and top of the operating frequency range.***
5. ***The EUT was tested in all the three orthogonal planes and the worst case emissions was vertical axes.***

Yo han, Park

Tested by : Y. H, Park / Test Engineer

5. TEST RESULTS

5.3 Out-of-band Radiated Emissions

EUT	Wireless Karaoke Microphone FX-9913(SN:Prototype)
Limit apply to	FCC Part15 Subpart C Section 15.230(b)
Test Date	May 2, 2001
Operating Condition	RF transmit with karaoke music play mode
Environment Condition	Humidity Level : 37 %RH, Temperature : 22℃
Result	Passed by – 3.96dB

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]
45.51	20.75	V	13.02	1.70	35.47	40.0	4.53
64.11	19.48	V	11.28	2.00	32.76	40.0	7.24
80.00	22.99	V	8.53	2.20	33.72	40.0	6.28
88.20	22.56	V	9.21	2.30	34.07	43.5	9.43
120.17	13.27	V	11.40	2.80	27.47	43.5	16.03
168.00	14.06	V	12.24	3.30	29.60	43.5	13.90
189.59	20.55	V	10.88	3.70	35.13	43.5	8.37
208.17	20.12	V	9.51	3.90	33.53	43.5	9.97
213.37	26.11	V	9.37	4.00	39.48	43.5	4.03
256.00	26.46	V	11.38	4.20	42.04	46.0	3.96
264.26	25.50	V	11.63	4.30	41.43	46.0	4.57
384.30	21.14	H	14.32	5.30	40.76	46.0	5.24
461.10	15.91	H	16.03	5.70	37.64	46.0	8.36
653.19	13.28	H	19.73	7.10	40.11	46.0	5.89

NOTES :

1. **** H : Horizontal polarization , ** V : Vertical polarization***
2. ***Emission Level = Reading + Antenna factor + Cable loss***
3. ***Margin value = Limit - Emission Level***
4. ***All other emissions not reported were more than 25dB below the permitted limit.***
5. ***The EUT was tested in all the three orthogonal planes and the worst case emissions was vertical axes.***

Yo han, Park

Tested by : Y. H. Park / Test Engineer

5. TEST RESULTS

5.4 Emission Bandwidth Measurement

EUT	Wireless Karaoke Microphone FX-9913(SN:Prototype)
Limit apply to	FCC Part15 Subpart C Section 15.230(b)
Test Date	May 2, 2001
Operating Condition	RF transmit with karaoke music play mode
Environment Condition	Humidity Level : 37 %RH, Temperature : 22℃
Result	Passed

Measurement Data

Emission Frequency [MHz]	Emission Bandwidth [kHz]	Limit [kHz]	Remark
106.9	100	200	

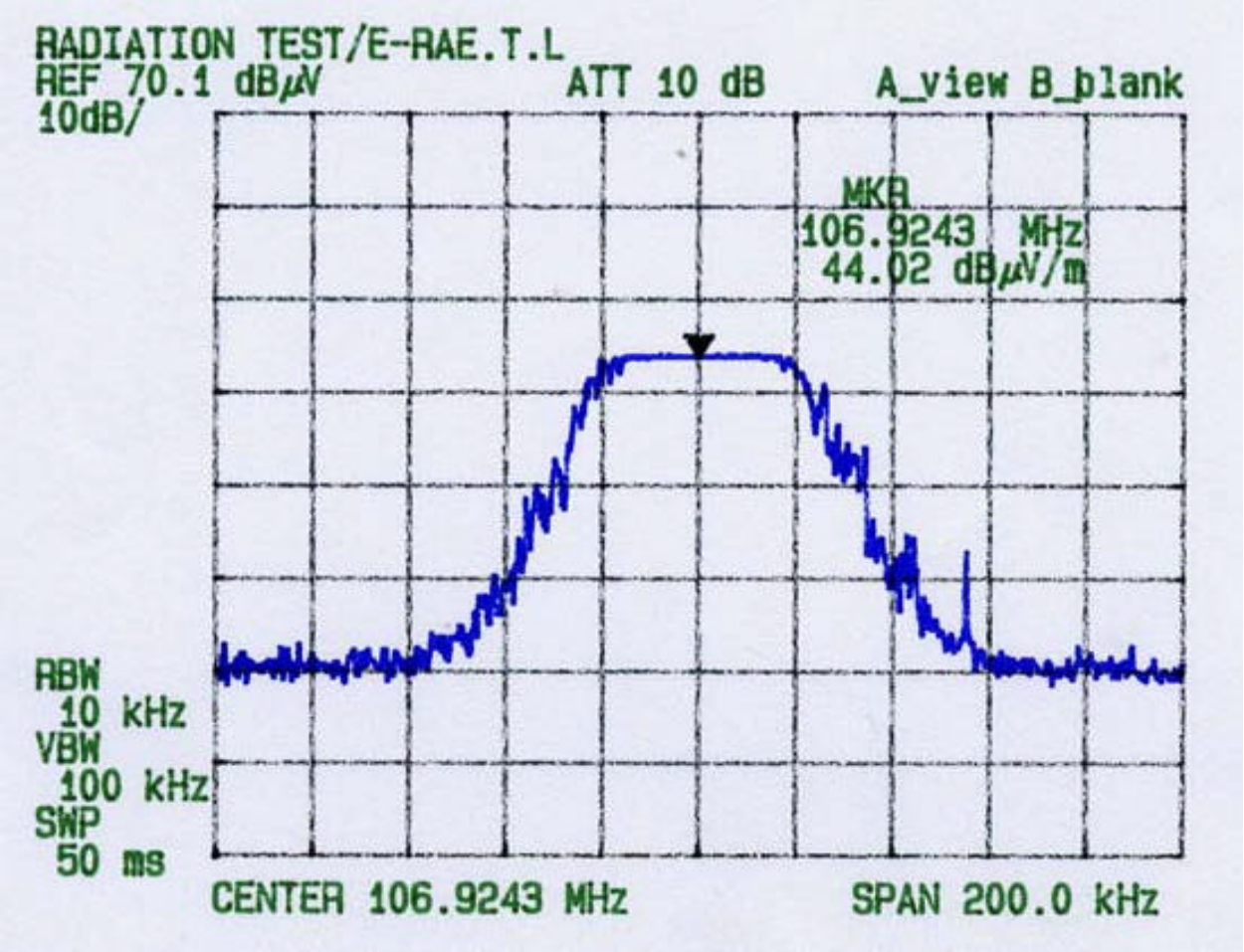
NOTES :

1. ***Please see the measured bandwidth plot in next page.***
2. ***The emission bandwidth shall be no wider than 200kHz of the center frequency of the equipment operating within 88.0 MHz to 108,00 MHz. The bandwidth is determined at the points 26Db down from the modulated carrier.***
3. ***Spectrum analyzer settings***
   Resolution bandwidth : 10 kHz
   Video bandwidth : 30 kHz
   Feruency span : 300 kHz

Yo han, Park

Tested by : Y. H. Park / Test Engineer

5. TEST RESULTS



6. ANTENNA REQUIREMENT

6.1 Antenna Requirement

According to the section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to be complied.

6.2 Antenna Construction

The antenna used for the EUT is so designed that antenna other than that furnished by the manufacturer shall not be used with this device. The antenna supplied is a unique coupling to this wireless karaoke microphone. The detailed design specification is attached to this report Appendix.G Schematics.

7. 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 : @ 0.218 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

8. 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
☐	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	-	-