

Electromagnetic Emission

FCC MEASUREMENT REPORT

CERTIFICATION OF COMPLIANCE

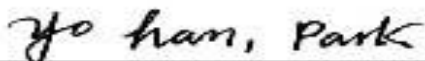
FCC Part 15 Certification Measurement

PRODUCT : Radar/Laser Detector
MODEL/TYPE NO : WT-1030
FCC ID : Q9QWT-1030
APPLICANT : WILLTRONICS. Co., Ltd.
631, Budae B Dong, Kwangmyung, Industrial Complex,
201, Han 3 Dong, Kwangmyung City, Kyungji, Korea. 423-063
Attn. : G.S. SONG / Project Manager
FCC CLASSIFICATION : Part 15 Subpart B Unintentional Radiators
Radar Detector – CRD
FCC RULE PART(S) : FCC Part 15 Subpart B
FCC PROCEDURE : Certification
TRADE NAME : Willtronics
TEST REPORT No. : E03.0625.FCC.372N
DATES OF TEST : June 23, 2003
DATES OF ISSUE : June 25, 2003
TEST LABORATORY : ETL Inc (FCC Registration Number : 95422)
#584 Sangwhal-ri, Kanam-myon, Yaju-kun, Kyounggi-do,
469-885, Korea
Tel : +82-31- 885-0072, 0073 Fax : +82-2-885-0074

This model WT-1030 of Willtronics. Co., Ltd. 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.



Name : Yo han, park

Title : Chief Engineer & Lab. Manager

E-RAE Testing Laboratory Inc.

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

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

Appendix G. Schematics

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 : WILLTRONICS. Co., Ltd.

Address : 631, Budaee B Dong, Kwangmyung, Industrial Complex

201, Han 3 Dong, Kwangmyung City, Kyungji, Korea. 423-063

Attn. : G.S. SONG / Project Manager

- **EUT Type** : Radar/Laser Detector
- **Model Number** : WT-1030
- **FCC Identifier** : Q9QWT-1030
- **S/N** : 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 Unintentional Radiators
- Radar Detector (CRD)
- **Dates of Tests** : June 23, 2003
- **Place of Tests** : ETL Inc
EMC Testing Lab (FCC Registration Number : 95422)
584, Sangwhal-Ri, Kanam-Myun, Yoju-Kun,
Kyounggi-Do, Korea
Tel : +82-31- 885-0072, 0073 Fax : +82-31-885-0074
- **Test Report No.** : E03.0625.FCC.372N

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, Kyounggi-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 WILLTRONICS. Co., Ltd. model WT-1030.

2. PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the Radar/Laser Detector WT-1030 of WILLTRONICS. Co., Ltd.
Please refer to Users manual

2.2 General Specification

- Chassis Type : Plastic Cover
- List of Each OSC. Or X-Tal. Freq. ($\geq 1\text{MHz}$) : X-TAL – 12.0MHz
- Chipset Brand & Part No. IC OTP : S3P8475XZZ-QZR5(SAMSUNG ELECT)
IC : BA10324AF/ROHM (ROHM) , IC : DKB4111S(DAE KWANG ELEC)
IC SMD : KIA78L05F(KEC), IC SMD: MC74HC02ADR2(MOTOROLA)
IC : 24LC02BT/SN (MICROCHIP/ATMEL) , IC : KIA7045F(KEC)
IC : MC7808CT (MOTOROLA) , IC: HMC1022 (HONEYWELL) ,IC : LMV324MTX(NATIONAL)
IC : LMV321M5X(NATIONAL) , IC SMD KIA78L05F(KEC)

- Number of Layers : Main board – 2Layers

• General

Dimensions:	65mm(W) x 118mm(L) x 32mm(H)
Weight:	148 g
Power Requirement:	12- 15V DC
Temperature Range:	Operating -20 ° C to +80 ° C Storage -40 ° C to +100 ° C

• Laser Detector

Receiver Type	Pulse Laser Signal Receiver
Sensor Front End	Convex Condenser Lens
Detector Type	Pulse Width Discriminator
Receiver Bandwidth	30 MHz
Spectral Response	800- 1100 nm

• Radar Detector

Receiver Type	Double Conversion Superheterodyne
Detector Type	Scanning Frequency Discriminator
Antenna Type	Linear Polarization
Frequency of Operation	10.525 GHz $\pm$ 50 MHz (X Band) 24.150 GHz $\pm$ 100 MHz (K Band) 34.700 GHz $\pm$ 1300 MHz (Ka Band)

3. DESCRIPTION OF TESTS

3.1 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 Schwarz Beck Broad-band horn antennas were used. Final measurements were made open site at 3-meters. A search was made of spectrum from 30 to 1000MHz and from 11.7 to 12.2 GHz the measurements indicate that the unit meet the FCC requirements. Measurements in the 11.7 to 12.2GHz band were made with a Standard Gain Horn. The measurements in the 11.7 to 12.2GHz band represent the ambient noise levels. The attached plots were made with peak detector with the analyzer in a maximum hold for 2 minutes. 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 connected as user's guide. And during the test executed EUT is operating on the following Bands: 10.525GHz(X-Band), 24.150GHz(K-Band), 34.70GHz(Ka-Band)

Operating Mode	Worst case
Stand by	X
10.525GHz(X-Band),	O
24.150GHz(K-Band),	X
34.70GHz(Ka-Band)	X

O: Worst case investigated during the Test

4.3 Support Equipment Used

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

EUT – Radar Detector (WILLTRONICS. Co., Ltd.)

FCC ID : Q9QWT-1030
Model Name : WT-1030
Serial No. : N/A
Manufacturer : WILLTRONICS. Co., Ltd..
Power Supply Type : Supplied from vehicle cigarette lighter
Power Cord : Non-shielded, Detachable: 0.5m of Light Jack
Data Cable : External

Support Unit 1 – DC Power Supply (HANYOUNG)

FCC ID : N/A
Model Name : HYP-3030
Serial No. : N/A
Manufacturer : HANYOUNG
Power Supply Type : Linear
Power Cord : Non-Shielded, Detachable, 1.2m
Data cable : N/A

Support Unit 2 – LASER Module (WILLTRONICS)

FCC ID : N/A
Model Name : WL-1000
Serial No. : N/A
Manufacturer : WILLTRONICS
Power Supply Type : N/A
Power Cord : N/A
Data cable : 4m length

5. TEST RESULTS

5.1 Summary of Test Results

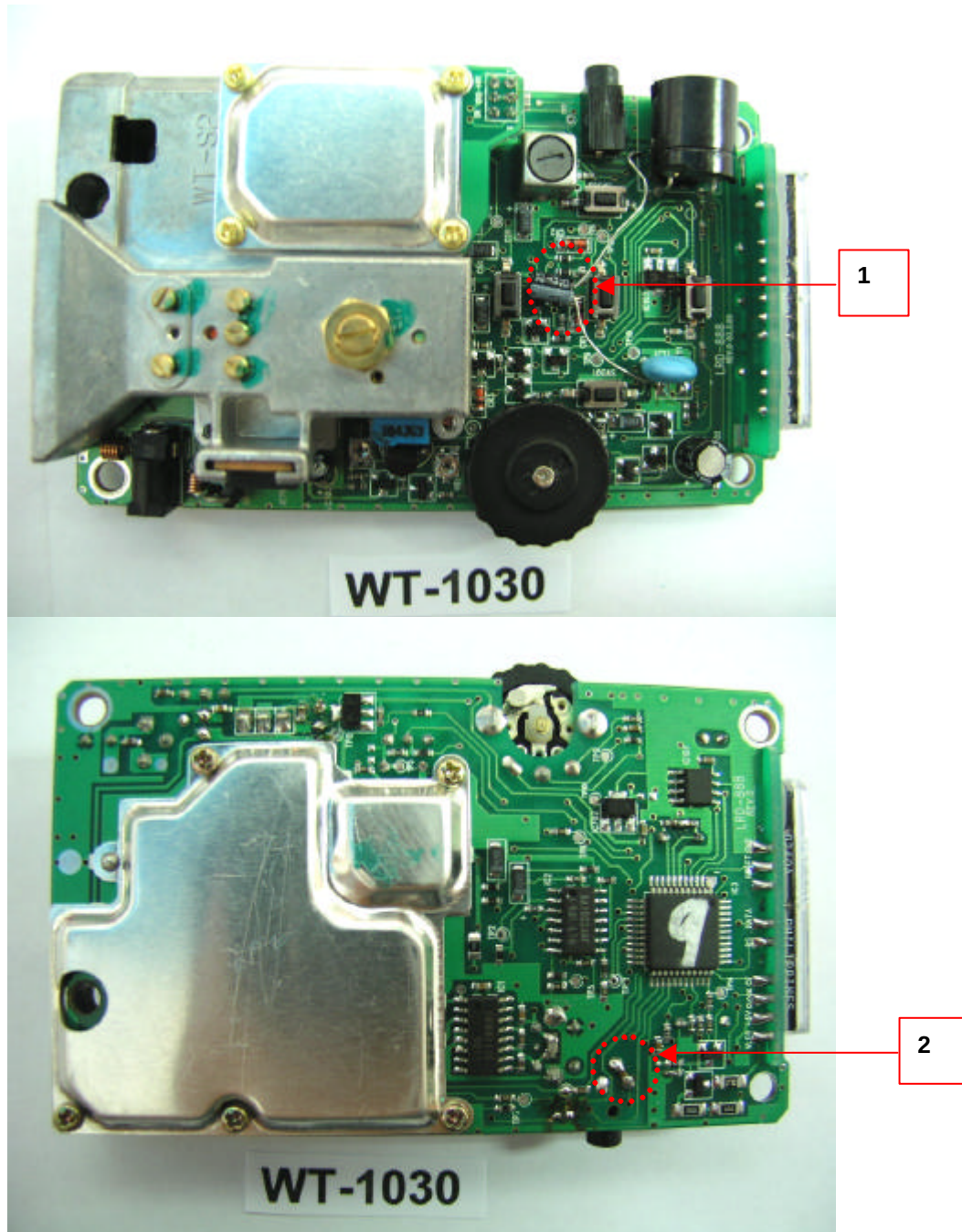
This equipment is Power Supply system from DC Power supply of DC 12V
The measurement results were obtained with the EUT tested in the conditions described in this report.
Detailed measurement data and plots showing the maximum emission of the EUT are reported.

Test Rule Parts	Measurement Required	Result
15.109(e)	Radiated Emissions Measurement	Passed By – 5.6dB
15.109(h)	Radiated Emissions Measurement	No Signal Detected

The data collected shows that the WILLTRONICS. Co., Ltd. Radar/Laser Detector, WT-1030 complies with technical requirements of above rules part 15.109(e) and 15.109(h).

This equipment is the operated device by DC12V. The Conducted emission measurement according to the section 15.207 is not applicable to this equipment,

The equipment is modified, mechanical or circuits to improve EMI status during a measurement.
EMI suppression device(s) was added and/or modified during testing.



1. 10uF 16V Electric capacitor added in Vcc-Ground line of Laser module port to reduced radiated emission.
2. 0.1uF capacitor added in Vcc-Ground line of Laser module port reduced radiated emission.

5. TEST RESULTS

5.1 Radiated Emissions Measurement of 30 ~ 1000MHz

EUT	Radar/Laser Detector / WT-1030 (SN:N/A)
Limit apply to	Part 15.109
Test Date	June 23, 2003:
Operating Condition	Operating on the following Bands 10.525GHz(X-Band), 24.150GHz(K-Band), 34.70GHz(Ka-Band)
Environment Condition	Humidity Level : 40 %RH, Temperature : 26
Result	Passed by 5.6 dB margin

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 [dB μ V]	Polarization (*H/**V)	Ant. Factor [dB]	Cable Loss [dB]	Emission Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]
35.400	17.06	V	11.64	1.50	30.2	40.0	9.8
48.225	20.70	V	11.94	1.76	34.4	40.0	5.6
75.525	23.41	V	8.39	2.20	34.0	40.0	6.0
96.825	25.34	V	8.66	2.40	36.4	43.5	7.1
121.125	21.29	H	11.30	2.81	35.4	43.5	8.1
169.050	18.51	V	12.07	3.43	34.0	43.5	9.5

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 FCC Part 15



Test Engineer : C. S. Kim

5. TEST RESULTS

5.2 Radiated Emissions Measurement of 11.7 ~ 12.2GHz

EUT	Radar/Laser Detector / WT-1030 (SN:N/A)
Limit apply to	15.109(h)
Test Date	June 23, 2003
Operating Condition	Operating on the following Bands
	10.525GHz(X-Band), 24.150GHz(K-Band), 34.70GHz(Ka-Band)
Environment Condition	Humidity Level : 40 %RH, Temperature : 26
Result	No signal detected

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 : 1 MHz)

Measurement Distance : 3 meters

Frequency [MHz]	Reading [dB μ V]	Polarization (*H/**V)	Ant. Factor [dB]	Cable Loss [dB]	Emission Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]

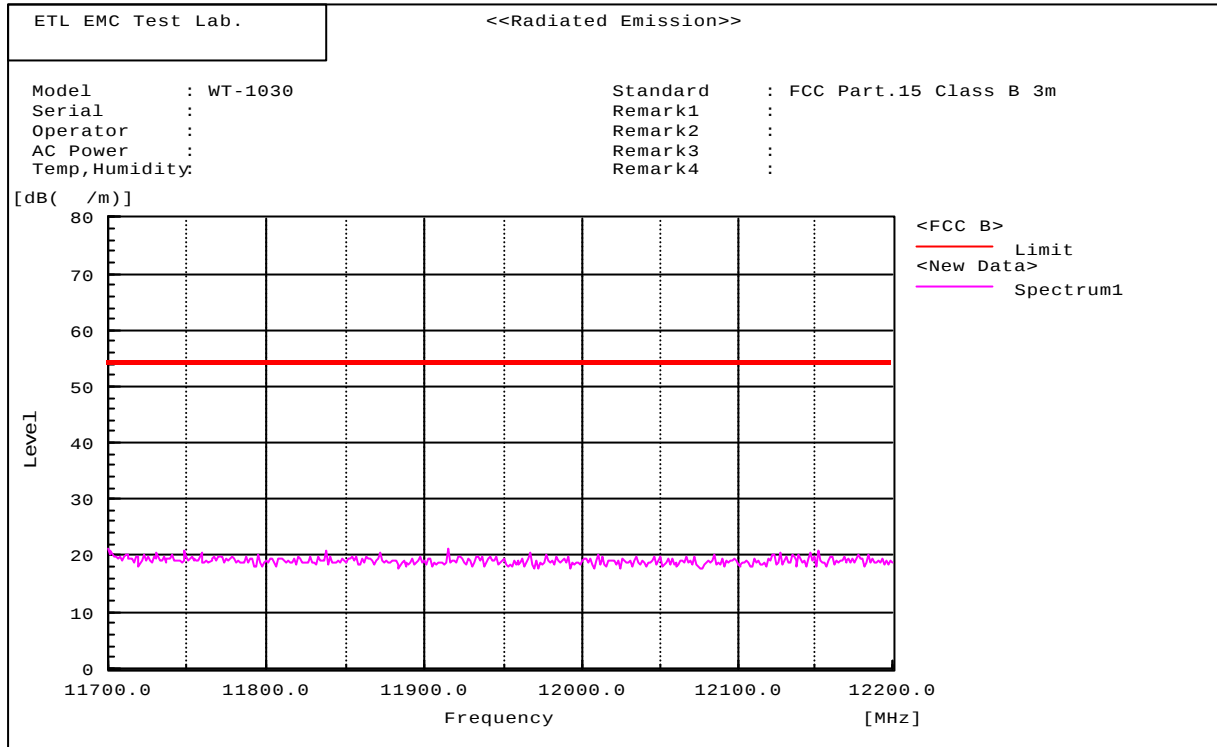
NOTES :

- * H : Horizontal polarization , ** V : Vertical polarization
- Emission Level = Reading + Antenna factor + Cable loss
- Margin value = Limit - Emission Level
- The measurement was performed for the frequency range 11.7GHz ~ 12.2GHz according to the FCC Part 15.109 (h)
- No signal detected of 11.7GHz ~ 12.2GHz, Refer to plot data.



Test Engineer : C. S. Kim

Plot data (Radiated Emissions Measurement of 11.7 ~ 12.2GHz)



Spectrum Selection

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

$$\text{dB}(\mu\text{V}/\text{m}) = 20 \log_{10} (\mu\text{V} / \text{m}) : \text{Equation 1}$$

$$\text{dB}\mu\text{V} = \text{dBm} + 107 : \text{Equation 2}$$

Example 1 : @ 48.225 MHz

$$\text{Class B Limit} = 100 \mu\text{V} = 40.0 \text{ dBuV/m}$$

$$\text{Reading} = 20.70 \text{ dBuV}$$

$$\text{Antenna Factor + Cable Loss} = 11.94 \text{ dB}$$

$$\text{Total} = 1.76 \text{ dBuV/m}$$

$$\text{Margin} = 40.0 - 34.4 = 5.6$$

$$= 5.6 \text{ dB below Limit}$$

7. TEST EQUIPMENT LIST

List of Test Equipments Used for Measurements

	Test Equipment	Model	Mfg.	Serial No.	Cal. Date
☒	Spectrum Analyzer	R3261A	Advantest	21720033	03-10-25
☒	Receiver	ESVS 10	R & S	835165/001	03-03-21
☒	Receiver	ESI40	R & S	8315647003	02-11-16
☒	Receiver	ESHS30	R & S	84190/002	03-01-24
☒	Spectrum Analyzer	E7405A	HP	US39110107	02-11-24
☒	LISN	3825/2	EMCO	9208-1995	02-12-27
☒	LISN	3825/2	EMCO	9006-1669	02-12-28
☒	Preamplifier	HP8447D	HP	2944A07626	03-01-10
☒	Preamplifier	AMF-4D-001180-26-CP	MIDEQ	67009	02-11-25
☐	Preamplifier	HP 8347A	HP	2834A00544	03-05-23
☒	TriLog Antenna	VULB9160	Schwarz Beck	3082	03-06-19
☐	LogBicon	VULB9165	Schwarz Beck	2023	03-05-28
☒	Dipole Antenna	VHAP	Schwarz Beck	964	03-05-04
☐	Dipole Antenna	VHAP	Schwarz Beck	965	03-05-04
☒	Dipole Antenna	UHAP	Schwarz Beck	949	03-05-04
☐	Dipole Antenna	UHAP	Schwarz Beck	950	03-05-04
☒	Broad-band Horn Antenna	BBHA 9120D	Schwarz Beck	227	03-03-15
☐	Magnetic Loop Antenna	6502	EMCO	9810-2111	02-12-11
☒	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
☒	Thermo Hygrograph	3-3122	ISUZU	3312201	03-01-10
☒	BaroMeter	-	Regulus	-	-