FCC TEST REPORT

For

Mamibot Manufacturing (Shanghai) Co., Ltd.

Robot Window Cleaner

Test Model: W120-DP

Additional Model No.: Please Refer to Page 6

Prepared for	:	Mamibot Manufacturing (Shanghai) Co., Ltd.
Address	:	North 21st FL, No.1 Building, LN1040 Caoyang Rd, Shanghai, P.R.C.
Prepared by	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Address	:	101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China
Tel	:	(+86)755-82591330
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Web	:	www.LCS-cert.com
Mail	:	webmaster@LCS-cert.com
Date of receipt of test sample	:	August 02, 2024
Number of tested samples	:	2
Sample No.	:	A240731077-1, A240731077-2
Serial number	:	Prototype
Date of Test	:	August 02, 2024 ~ August 22, 2024
Date of Report	:	January 16, 2025

FCC TEST REPORT
FCC CFR 47 PART 15 C(15.247)

Report Reference No. ..... :	**LCSA01085165EA**
Date of Issue ..... :	January 16, 2025
Testing Laboratory Name ..... :	**Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address ..... :	101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China
Testing Location Procedure ..... :	Full application of Harmonised standards ■ Partial application of Harmonised standards □ Other standard testing method □
Applicant's Name ..... :	**Mamibot Manufacturing (Shanghai) Co., Ltd.**
Address ..... :	North 21st FL, No.1 Building, LN1040 Caoyang Rd, Shanghai, P.R.C.
Test Specification	
Standard ..... :	FCC CFR 47 PART 15 C(15.247)
Test Report Form No. ..... :	TRF-4-E-145 A/0
TRF Originator ..... :	Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF ..... :	Dated 2011-03

EUT Description. ..... :	**Robot Window Cleaner**
Trade Mark ..... :	Mamibot
Test Model ..... :	W120-DP
Ratings ..... :	For AC Adapter: Input:100-240V~, 50/60Hz, 2.5A Output: 24V⎓3A DC 14.8V by Rechargeable Li-ion Battery, 600mAh
Result ..... :	**Positive**

Compiled by:	**Supervised by:**	**Approved by:**
Ling Zhu/ Administrator	Jack Liu/ Technique principal	Gavin Liang/ Manager

FCC -- TEST REPORT

Test Report No. : **LCSA01085165EA**	January 16, 2025 Date of issue

Test Model.....	:	W120-DP
EUT.....	:	Robot Window Cleaner
Applicant.....	**:**	**Mamibot Manufacturing (Shanghai) Co., Ltd.**
Address.....	:	North 21st FL, No.1 Building, LN1040 Caoyang Rd, Shanghai, P.R.C.
Telephone.....	:	/
Fax.....	:	/
	:	
Manufacturer.....	**:**	**Mamibot Manufacturing (Shanghai) Co., Ltd.**
Address.....	:	North 21st FL, No.1 Building, LN1040 Caoyang Rd, Shanghai, P.R.C.
Telephone.....	:	/
Fax.....	:	/
	:	
Factory.....	**:**	**Mamibot Manufacturing (Shanghai) Co., Ltd.**
Address.....	:	North 21st FL, No.1 Building, LN1040 Caoyang Rd, Shanghai, P.R.C.
Telephone.....	:	/
Fax.....	:	/

Test Result	**Positive**

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Revision History

Report Version	Issue Date	Revision Content	Revised By
000	January 16, 2025	Initial Issue	--
At the customer's request, the revised report was submitted to LCSA01085165EA applicant by quoting the test data of LCSA08014231EA original report.			

TABLE OF CONTENTS

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT	:	Robot Window Cleaner
Test Model	:	W120-DP
Additional Model No.	:	W120-DP PRO, W120-DPA, W120-DPB, W120-DPE, W120-DPF
Model Declaration	:	the manufacturer of the power adapter and battery is different, others are in the same.
Power Supply	:	For AC Adapter: Input:100-240V~, 50/60Hz, 2.5A Output: 24V⎓3A DC 14.8V by Rechargeable Li-ion Battery, 600mAh
Hardware Version	:	EGS-01-MAIN-VQ5
Software Version	:	EGS-01-R4Q3L2A-S010
Bluetooth		
Frequency Range	:	2402MHz-2480MHz
Bluetooth Channel Number	:	40 channels for Bluetooth V5.0 (DTS)
Bluetooth Channel Spacing	:	2MHz for Bluetooth V5.0 (DTS)
Bluetooth Modulation Type	:	GFSK for Bluetooth V5.0 (DTS)
Bluetooth Version	:	V5.0
Antenna Description	:	PCB Antenna, 2.5dBi (Max.)

Model Declaration:

Item Name	Manufacturer	Model	Ratings
Adapter	FOSHAN SHUNDE GUANYUDA POWER SUPPLY CO.,LTD	GM70-240300-D	Input 100-240V~:50/60Hz. 2.5A Max
Battery pack	Dongguan Mangrove New Energy Co., Ltd	HSL 14500	14.8V, 600mAh, 8.8Wh

1.2. Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	Certificate
FOSHAN SHUNDE GUANYUDA POWER SUPPLY CO.,LTD	Power Adapter	GM70-240300-D	--	FCC

1.3. External IO Cable

IO Port Description	Quantity	Cable
Power Port	1	N/A

1.4. Description of Test Facility

NVLAP Accreditation Code is 600167-0.

FCC Designation Number is CN5024.

CAB identifier is CN0071.

CNAS Registration Number is L4595.

Test Firm Registration Number: 254912.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.4:2014 and CISPR 16-1-4:2010 SVSWR requirement for radiated emission above 1GHz.

1.5. Statement of the Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the LCS quality system acc. To DIN EN ISOIEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

1.6. Measurement Uncertainty

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	±3.10dB	(1)
		30MHz~200MHz	±2.96dB	(1)
		200MHz~1000MHz	±3.10dB	(1)
		1GHz~26.5GHz	±3.80dB	(1)
		26.5GHz~40GHz	±3.90dB	(1)
Conduction Uncertainty	:	150kHz~30MHz	±1.63dB	(1)
Power disturbance	:	30MHz~300MHz	±1.60dB	(1)
Output power	:	1GHz-40GHz	±0.57dB	(1)
Power Spectral Density	:	1GHz-40GHz	±1.2dB	(1)
Occupied Channel Bandwidth	:	1GHz-40GHz	±5%	(1)
Conducted RF Spurious Emission	:	9kHz-40GHz	±1.80dB	(1)
Emissions in Restricted Bands	:	1GHz-40GHz	±2.47dB	(1)

(1). This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

1.7. Description of Test Modes

The EUT has been tested under operating condition.

This test was performed with EUT in X, Y, Z position and the worst case was found when EUT in Y position.

AC conducted emission pre-test at both at AC 120V/60Hz and AC 240V/50Hz modes, recorded worst case at AC120V/60Hz.

Worst-case mode and channel used for 150 KHz-30 MHz power line conducted emissions was determined to be BT LE mode (1Mbps-Low Channel).

Worst-case mode and channel used for 9 KHz-1000 MHz radiated emissions was determined to be BT LE mode (1Mbps-Low Channel).

Worst-Case data rates were utilized from preliminary testing of the Chipset, worst-case data rates used during the testing are as follows:
BT LE: 1 Mbps, GFSK.
BT LE: 2 Mbps, GFSK.

BT LE

Frequency Band	Channel No.	Frequency(MHz)	Channel No.	Frequency(MHz)
2402~2480MHz	0	2402	20	2442
	1	2404	--	--
	2	2406	--	--
	--	--	37	2476
	--	--	38	2478
	19	2440	39	2480

2. TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

The radiated testing was performed at an antenna-to-EUT distance of 3 meters. All radiated and conducted emissions measurement was performed at Shenzhen LCS Compliance Testing Laboratory Ltd.

2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2. EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to FCC's request, Test Procedure KDB558074 D01 15.247 Meas Guidance v05r02 is required to be used for this kind of FCC 15.247 digital modulation device.

According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.205, 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

2.3. General Test Procedures

2.3.1 Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

2.3.2 Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane below 1GHz and 1.5 m above gro und plane above 1GHz. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10-2013.

2.4. Test Sample

The application provides 2 samples to meet requirement;

Sample Number	Description
Sample 1(A240731077-1)	Engineer sample – continuous transmit
Sample 2(A240731077-2)	Normal sample – Intermittent transmit

3. SYSTEM TEST CONFIGURATION

3.1. Justification

The system was configured for testing in a continuous transmits condition.

3.2. EUT Exercise Software

The system was configured for testing in a continuous transmits condition and change test channels by software provided by application.

3.3. Special Accessories

NA.

3.4. Block Diagram & Schematics

Please refer to the related document

3.5. Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

3.6. Test Setup

Please refer to the test setup photo.

4. SUMMARY OF TEST RESULTS

Applied Standard: FCC Part 15 Subpart C				
FCC Rules	Description of Test	Test Sample	Result	Remark
§15.247(b)	Maximum Peak Conducted Output Power	Sample 1	Compliant	Note 1
§15.209, §15.247(d)	Radiated Spurious Emissions	Sample 1 Sample 2	Compliant	Note 1
§15.207(a)	Conducted Emissions	Sample 2	Compliant	Note 1

Remark:
1. Note 1 – Test results inside test report;
2. Note 2 – Test results in other test report (RF Exposure Evaluation);

5. TEST RESULT

5.1. Radiated Emissions Measurement

5.1.1. Standard Applicable

15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
\1\ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293.	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(\2\)
13.36-13.41			

\1\ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

\2\ Above 38.6

According to §15.247 (d): 20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (microvoltsmeter)	Measurement Distance (meters)
0.009~0.490	2400F(KHz)	300
0.490~1.705	24000F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

5.1.2. Measuring Instruments and Setting

Please refer to equipment list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB VB (Emission in restricted band)	1MHz 1MHz for Peak, 1 MHz 1B kHz for Average
RB VB (Emission in non-restricted band)	1MHz 1MHz for Peak, 1 MHz 1B kHz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz RBVB 200Hz1KHz for QPAVG
Start ~ Stop Frequency	150kHz~30MHz RBVB 9kHz30KHz for QPAVG
Start ~ Stop Frequency	30MHz~1000MHz RBVB 120kHz1MHz for QP

5.1.3. Test Procedures

1) Sequence of testing 9 kHz to 30 MHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna height is 1.0 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

2) Sequence of testing 30 MHz to 1 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 3 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

3) Sequence of testing 1 GHz to 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

4) Sequence of testing above 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

Premeasurement:

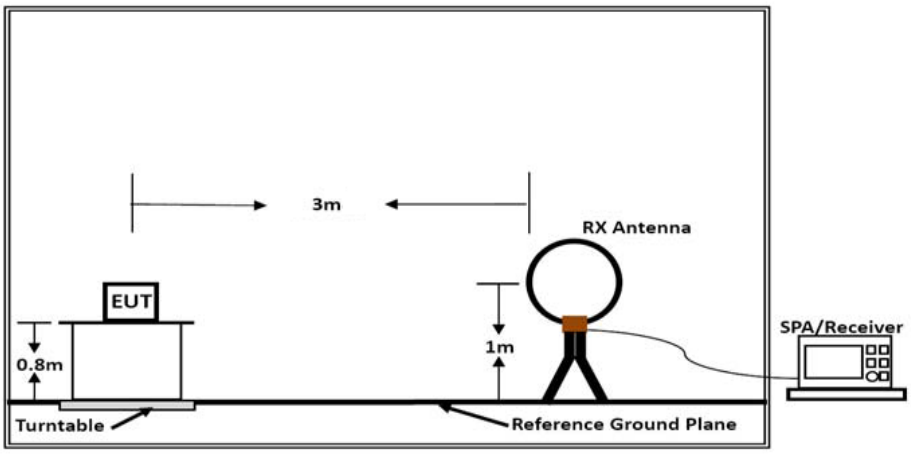
--- The antenna is moved spherical over the EUT in different polarizations of the antenna.

Final measurement:

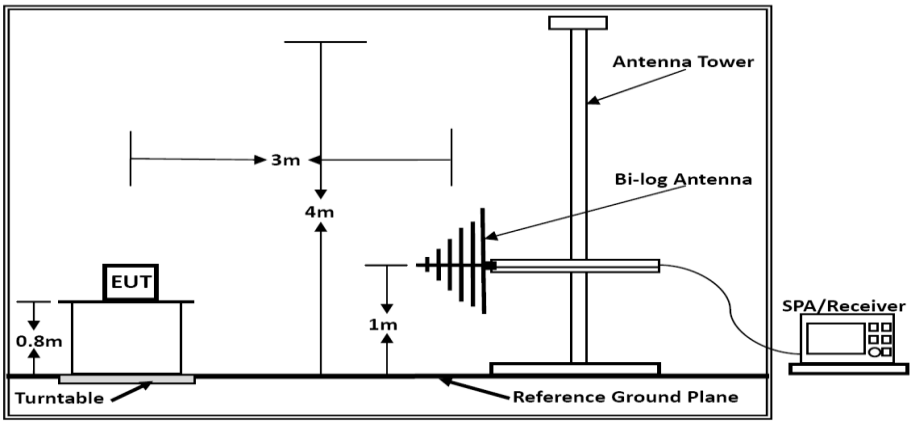
--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

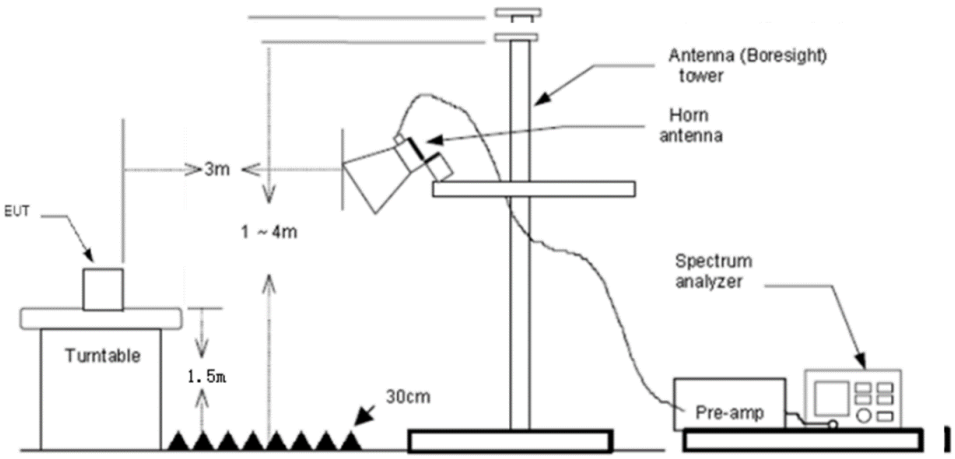
5.1.4. Test Setup Layout



Below 30MHz



Below 1GHz



Above 18 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dBdecade form 3m to 1m.

5.1.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.1.6. Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS (dBuV/m) = RA (dBuV) + AF (dB/m) + CL (dB) – AG (dB)

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

5.1.7. Results of Radiated Emissions (9 KHz~30MHz)

Temperature	23.8℃	Humidity	52.1%
Test Engineer	Jerry Chu	Configurations	BT LE, 1 Mbps

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Over Limit (dBuV)	Remark
-	-	-	-	See Note

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

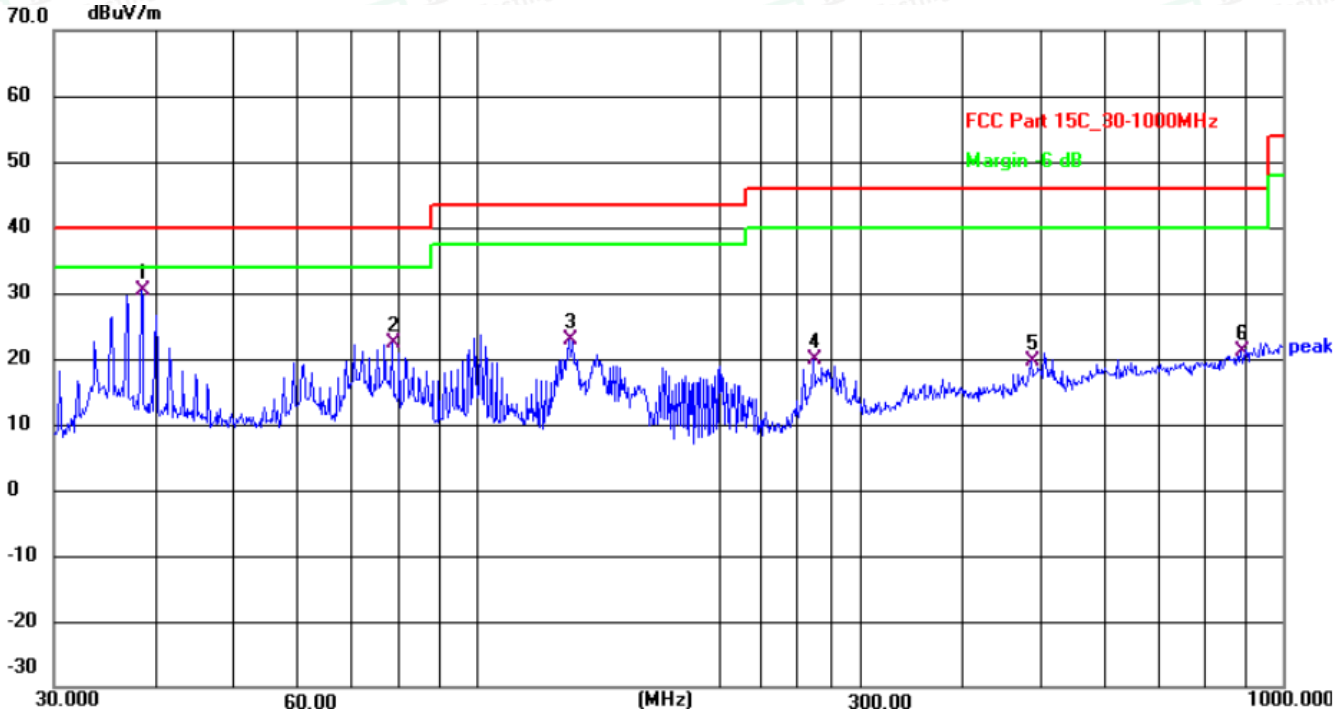
Distance extrapolation factor = 40 log (specific distance test distance) (dB);
Limit line = specific limits (dBuV) + distance extrapolation factor.

5.1.8. Results of Radiated Emissions (30MHz~1GHz)

Temperature	23.8℃	Humidity	52.1%
Test Engineer	Jerry Chu	Configurations	BT LE, 1 Mbps

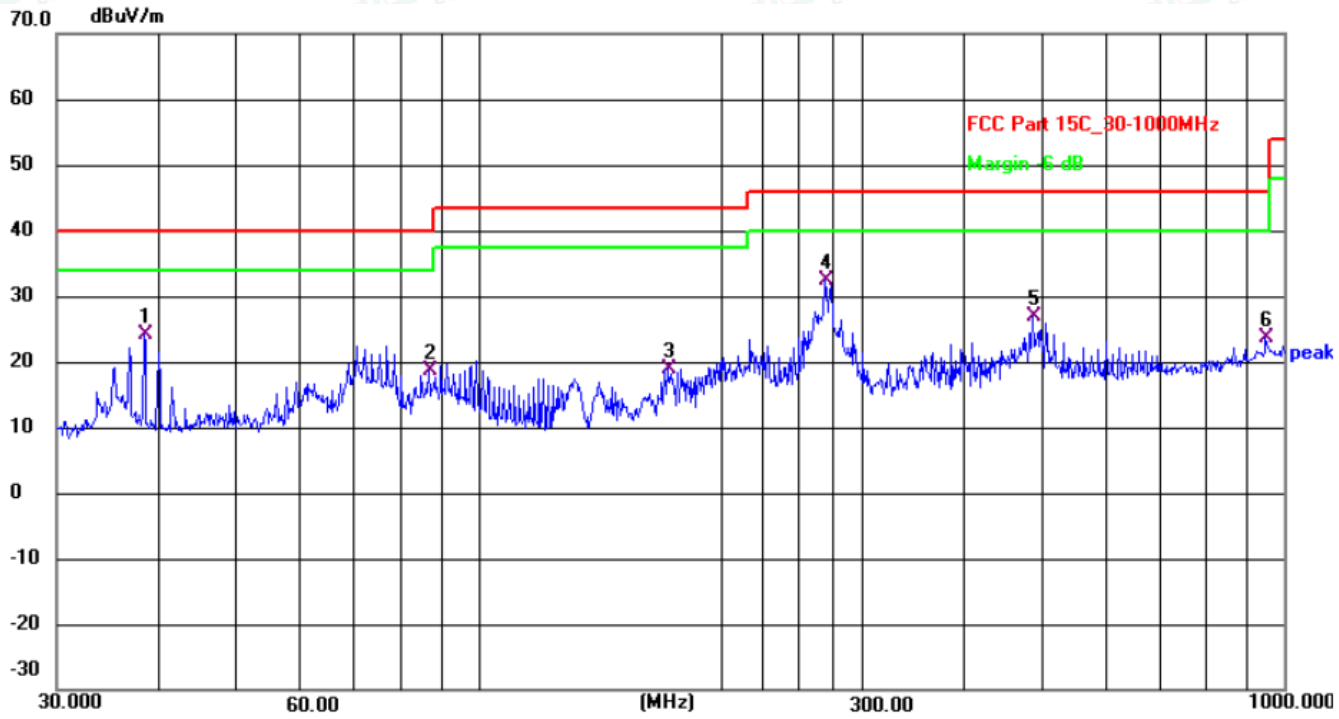
Test result for BT LE mode (1Mbps-Low Channel)

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	38.4809	47.89	-17.62	30.27	40.00	-9.73	QP
2	78.6888	42.15	-19.83	22.32	40.00	-17.68	QP
3	130.3789	43.47	-20.58	22.89	43.50	-20.61	QP
4	261.9753	35.25	-15.48	19.77	46.00	-26.23	QP
5	487.3151	33.40	-13.82	19.58	46.00	-26.42	QP
6	887.6099	29.63	-8.49	21.14	46.00	-24.86	QP

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	38.4809	41.28	-17.13	24.15	40.00	-15.85	QP
2	86.8068	38.25	-19.71	18.54	40.00	-21.46	QP
3	171.9946	38.96	-20.08	18.88	43.50	-24.62	QP
4	269.4284	49.00	-16.50	32.50	46.00	-13.50	QP
5	487.3151	39.75	-12.86	26.89	46.00	-19.11	QP
6	948.7610	30.48	-6.79	23.69	46.00	-22.31	QP

Note:

1). Pre-scan all modes and recorded the worst case results in this report BT LE mode (1Mbps-Low Channel).

2). Emission level (dBuVm) = 20 log Emission level (uVm).

3). Level = Reading + Factor, Margin = Level – Limit, Factor = Antenna Factor + Cable Loss - Preamp Factor

5.1.9. Results for Radiated Emissions (1 GHz – 26.5 GHz)

worst case: BT LE, 1 Mbps

Channel 0 2402 MHz

Freq. MHz	Reading dBuv	Ant. Fac. dBm	Pre. Fac. dB	Cab. Loss dB	Measured dBuvm	Limit dBuvm	Margin dB	Remark	Pol.
4804.00	55.92	33.06	35.04	3.94	57.88	74.00	-16.12	Peak	Horizontal
4804.00	41.86	33.06	35.04	3.94	43.82	54.00	-10.18	Average	Horizontal
4804.00	56.55	33.06	35.04	3.94	58.51	74.00	-15.49	Peak	Vertical
4804.00	42.07	33.06	35.04	3.94	44.03	54.00	-9.97	Average	Vertical

Channel 19 2440 MHz

Freq. MHz	Reading dBuv	Ant. Fac. dBm	Pre. Fac. dB	Cab. Loss dB	Measured dBuvm	Limit dBuvm	Margin dB	Remark	Pol.
4880.00	55.49	33.16	35.15	3.96	57.46	74.00	-16.54	Peak	Horizontal
4880.00	40.56	33.16	35.15	3.96	42.53	54.00	-11.47	Average	Horizontal
4880.00	58.08	33.16	35.15	3.96	60.05	74.00	-13.95	Peak	Vertical
4880.00	45.08	33.16	35.15	3.96	47.05	54.00	-6.95	Average	Vertical

Channel 39 2480 MHz

Freq. MHz	Reading dBuv	Ant. Fac. dBm	Pre. Fac. dB	Cab. Loss dB	Measured dBuvm	Limit dBuvm	Margin dB	Remark	Pol.
4960.00	60.48	33.26	35.14	3.98	62.58	74.00	-11.42	Peak	Horizontal
4960.00	43.22	33.26	35.14	3.98	45.32	54.00	-8.68	Average	Horizontal
4960.00	55.03	33.26	35.14	3.98	57.13	74.00	-16.87	Peak	Vertical
4960.00	43.35	33.26	35.14	3.98	45.45	54.00	-8.55	Average	Vertical

Notes:

1). Measuring frequencies from 9 KHz~10th harmonic or 26.5GHz (which is less), at least have 20dB margin found between lowest internal used generated frequency to 30MHz.
2). Radiated emissions measured in frequency range from 9 KHz~10th harmonic or 26.5GHz (which is less) were made with an instrument using Peak detector mode.
3). Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
4). Measured Level = Reading Level + Factor, Margin = Measured Level – Limit,
Factor = Antenna Factor + Cable Loss - Preamp Factor

5.2. AC Power line conducted emissions

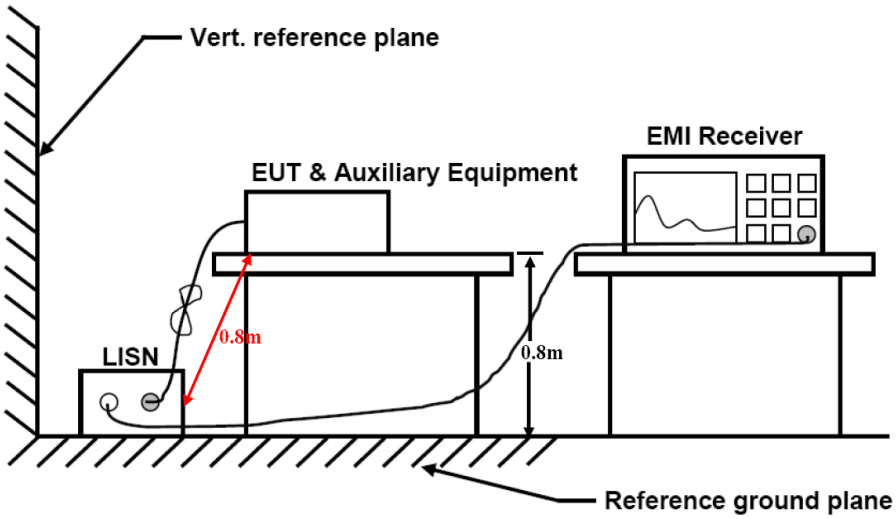
5.2.1 Standard Applicable

According to §15.207 (a): For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range are listed as follows:

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

* Decreasing linearly with the logarithm of the frequency

5.2.2 Block Diagram of Test Setup



5.2.3. Disturbance Calculation

The AC mains conducted disturbance is calculated by adding the 10dB Pulse Limiter and Cable Factor and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

CD (dBuV) = RA (dBuV) + PL (dB) + CL (dB)

Where	CD = Conducted Disturbance	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	PL = 10 dB Pulse Limiter Factor

5.2.4 Test Results

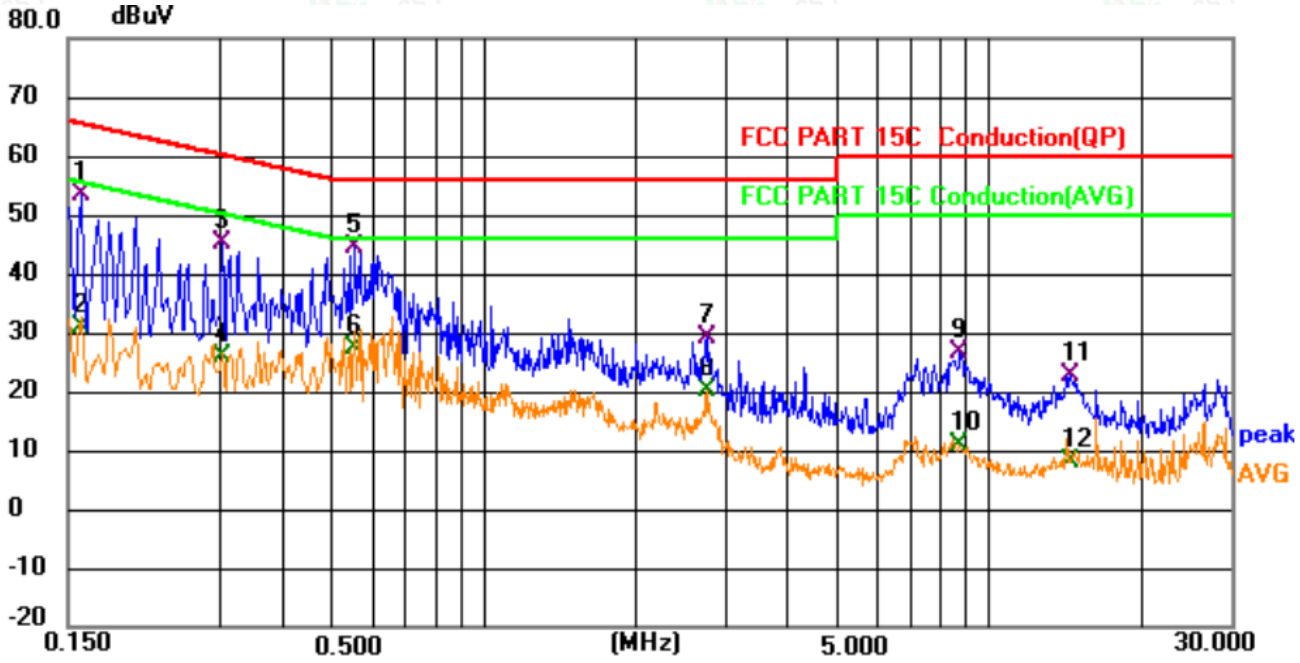
Temperature	22.5℃	Humidity	53.7%
Test Engineer	Jerry Chu	Configurations	BT LE, 1 Mbps

PASS.

The test data please refer to following page.

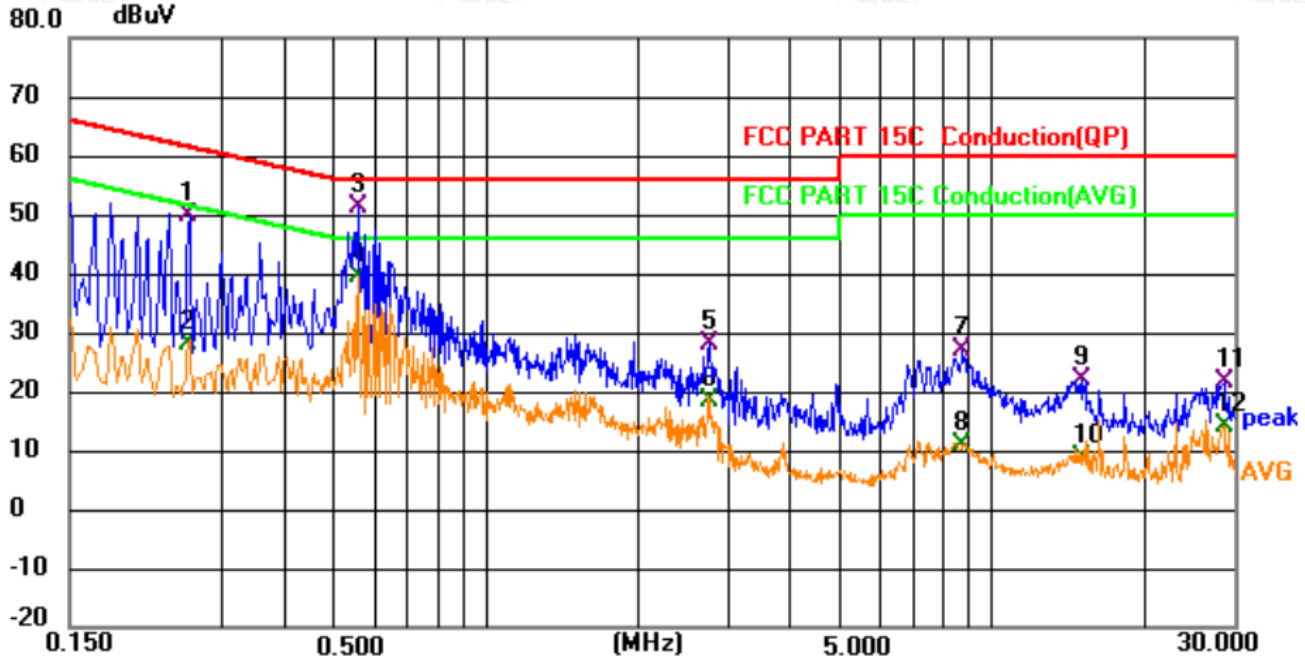
AC Conducted Emission of @ AC 120V60Hz (worst case)

Line



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.159	33.59	19.84	53.43	65.52	-12.09	QP	
2		0.159	11.10	19.84	30.94	55.52	-24.58	AVG	
3		0.303	25.46	19.82	45.28	60.16	-14.88	QP	
4		0.303	5.94	19.82	25.76	50.16	-24.40	AVG	
5	*	0.555	24.96	19.67	44.63	56.00	-11.37	QP	
6		0.555	7.49	19.67	27.16	46.00	-18.84	AVG	
7		2.764	9.79	19.17	28.96	56.00	-27.04	QP	
8		2.764	0.98	19.17	20.15	46.00	-25.85	AVG	
9		8.745	6.81	19.62	26.43	60.00	-33.57	QP	
10		8.745	-8.63	19.62	10.99	50.00	-39.01	AVG	
11		14.460	2.68	19.90	22.58	60.00	-37.42	QP	
12		14.460	-11.75	19.90	8.15	50.00	-41.85	AVG	

Neutral



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.258	30.07	19.78	49.85	61.50	-11.65	QP	
2		0.258	8.35	19.78	28.13	51.50	-23.37	AVG	
3	*	0.559	31.88	19.42	51.30	56.00	-4.70	QP	
4		0.559	20.08	19.42	39.50	46.00	-6.50	AVG	
5		2.760	8.98	19.03	28.01	56.00	-27.99	QP	
6		2.760	-0.71	19.03	18.32	46.00	-27.68	AVG	
7		8.754	7.01	19.79	26.80	60.00	-33.20	QP	
8		8.754	-8.76	19.79	11.03	50.00	-38.97	AVG	
9		15.009	2.09	19.74	21.83	60.00	-38.17	QP	
10		15.009	-10.86	19.74	8.88	50.00	-41.12	AVG	
11		28.689	2.67	18.84	21.51	60.00	-38.49	QP	
12		28.689	-4.84	18.84	14.00	50.00	-36.00	AVG	

****Note: 1).Pre-scan all modes and recorded the worst case results in this report BT LE mode (1Mbps-Low Channel).*

2). Measurement = Reading + Correct, Margin = Measurement – Limit.;

Correct Factor=Lisn Factor+Cable Factor+Insertion loss of Pulse Limiter.

5.3. Maximum Peak Conducted Output Power Measurement

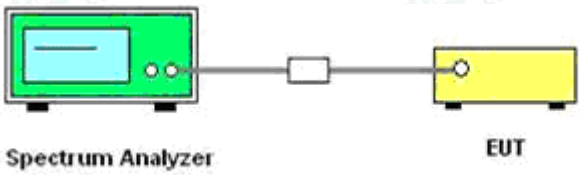
5.3.1. Standard Applicable

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

5.3.2. Test Procedures

The transmitter output (antenna port) was connected to the spectrum analyzer.
According to KDB558074 D01 15.247 Meas Guidance v05r02 Section 9.1 Maximum peak conducted output power 9.1.1.
This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.
a) Set the RBW ≥ DTS bandwidth.
b) Set VBW ≥ 3 × RBW.
c) Set span ≥ 3 x RBW
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

5.3.3. Test Setup Layout



5.3.4. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.3.5. Test Result of Maximum Peak Conducted Output Power

PASS

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)	Original Power(dBm)
BLE	0	2402	0.64	0.75
	19	2440	-0.32	-0.27
	39	2480	-0.11	-0.15
BT2LE	0	2402	-0.45	-0.23
	19	2440	0.36	0.45
	39	2480	-0.69	-0.61

Remark:
1)Test results including cable loss.

6. LIST OF MEASURING EQUIPMENTS

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	Power Meter	R&S	NRVS	100444	2024-06-06	2025-06-05
2	Power Sensor	R&S	NRV-Z81	100458	2024-06-06	2025-06-05
3	Power Sensor	R&S	NRV-Z32	10057	2024-06-06	2025-06-05
4	Test Software	Tonscend	JS1120-2	/	N/A	N/A
5	RF Control Unit	Tonscend	JS0806-2	N/A	2024-06-06	2025-06-05
6	MXA Signal Analyzer	Agilent	N9020A	MY50510140	2023-10-18	2024-10-17
7	DC Power Supply	Agilent	E3642A	N/A	2023-10-18	2024-10-17
8	EMI Test Software	AUDIX	E3	/	N/A	N/A
9	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2024-06-06	2025-06-05
10	Positioning Controller	Max-Full	MF7802BS	MF780208586	N/A	N/A
11	Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00005	2024-07-13	2027-07-12
12	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2021-09-12	2024-09-11
13	Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1925	2021-09-05	2024-09-04
14	Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	791	2021-08-29	2024-08-28
15	Broadband Preamplifier	SCHWARZBECK	BBV9719	9719-025	2021-08-29	2024-08-28
16	EMI Test Receiver	R&S	ESR 7	101181	2024-06-06	2025-06-05
17	RS SPECTRUM ANALYZER	R&S	FSP40	100503	2024-06-06	2025-06-05
18	Low-frequency amplifier	SchwarzZBECK	BBV9745	00253	2023-10-18	2024-10-17
19	High-frequency amplifier	JS Denki Pte	PA0118-43	JSPA21009	2023-10-18	2024-10-17
20	6dB Attenuator	/	100W/6dB	1172040	2024-06-06	2025-06-05
21	3dB Attenuator	/	2N-3dB	/	2023-10-18	2024-10-17
22	EMI Test Receiver	R&S	ESPI	101940	2024-06-06	2025-06-05
23	Artificial Mains	R&S	ENV216	101288	2024-06-06	2025-06-05
24	10dB Attenuator	SCHWARZBECK	MTS-IMP-136	261115-001-0032	2024-06-06	2025-06-05
25	EMI Test Software	Farad	EZ	/	N/A	N/A
26	Antenna Mast	Max-Full	MFA-515BSN	1308572	N/A	N/A
27	Pulse Limiter	R&S	ESH3-Z2	102750-NB	2024-06-06	2025-06-05

7. TEST SETUP PHOTOGRAPHS OF EUT

Please refer to separated files for Test Setup Photos of the EUT.

8. EXTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for External Photos of the EUT.

9. INTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for Internal Photos of the EUT.

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