

<b>Prüfbericht-Nr.:</b> <i>Test report no.:</i>	<b>CN24397K 001</b>	<b>Auftrags-Nr.:</b> <i>Order no.:</i>	<b>168459797</b>	Seite 1 von 28 Page 1 of 28
<b>Kunden-Referenz-Nr.:</b> <i>Client reference no.:</i>	N/A	<b>Auftragsdatum:</b> <i>Order date:</i>	2024-01-05	
<b>Auftraggeber:</b> <i>Client:</i>	<b>Ecovacs Home Service Robotics Co., Ltd.</b> No.518 Songwei Road, Wusongjiang industry Park Guoxiang Street, Wuzhong District, Suzhou, 215000, China (Peoples Republic Of)			
<b>Prüfgegenstand:</b> <i>Test item:</i>	Lawn Mowing Robot			
<b>Bezeichnung / Typ-Nr.:</b> <i>Identification / Type no.:</i>	MPB14 (Trademark: ECOVACS)			
<b>Auftrags-Inhalt:</b> <i>Order content:</i>	Test Report			
<b>Prüfgrundlage:</b> <i>Test specification:</i>	CFR47 FCC Part 15: Subpart C Section 15.247 RSS-247 Issue 3 August 2023 RSS-Gen Issue 5 February 2021			
<b>Wareneingangsdatum:</b> <i>Date of sample receipt:</i>	2024-01-23	Please refer to Photo Document		
<b>Prüfmuster-Nr.:</b> <i>Test sample no.:</i>	A003634855-001 A003634599-001~004			
<b>Prüfzeitraum:</b> <i>Testing period:</i>	2024-01-24 - 2024-02-28			
<b>Ort der Prüfung:</b> <i>Place of testing:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.			
<b>Prüflaboratorium:</b> <i>Testing laboratory:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.			
<b>Prüfergebnis*:</b> <i>Test result*:</i>	Pass			
<b>geprüft von:</b> <i>tested by:</i>	<u>X Bell Hu</u>	<b>genehmigt von:</b> <i>authorized by:</i>	<u>X Jonathan Li</u>	
<b>Datum:</b> <i>Date:</i>	2024-03-06 <small>Signed by: Bell Hu</small>	<b>Ausstellungsdatum:</b> <i>Issue date:</i>	2024-03-06 <small>Signed by: Jonathan Li</small>	
<b>Stellung / Position:</b>	Sachverständige(r)/Expert	<b>Stellung / Position:</b>	Sachverständige(r)/Expert	
<b>Sonstiges /</b> <i>Other:</i>	FCC ID: 2A64B-MPB14 IC: 28593-MPB14, HVIN: MPB14-V1.0  This report is for Bluetooth function.			
<b>Zustand des Prüfgegenstandes bei Anlieferung:</b> <i>Condition of the test item at delivery:</i>	Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>			
<small>* Legende:</small>	<small>P(ass) = entspricht o.g. Prüfgrundlage(n)</small>	<small>F(ail) = entspricht nicht o.g. Prüfgrundlage(n)</small>	<small>N/A = nicht anwendbar</small>	<small>N/T = nicht getestet</small>
<small>* Legend:</small>	<small>P(ass) = passed a.m. test specification(s)</small>	<small>F(ail) = failed a.m. test specification(s)</small>	<small>N/A = not applicable</small>	<small>N/T = not tested</small>
<b>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.</b> <i>This test report only relates to the above mentioned test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

v05

Prüfbericht-Nr.: CN24397K 001  
Test report no.:

Seite 2 von 28  
Page 2 of 28

**Anmerkungen**  
Remarks

1	<p>Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibrierungsprogramms unseres Prüfhauses kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben. Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden.</p> <p><i>The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system. Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.</i></p>
2	<p>Wie vertraglich vereinbart, wurde dieses Dokument nur digital unterzeichnet. Der TÜV Rheinland hat nicht überprüft, welche rechtlichen oder sonstigen diesbezüglichen Anforderungen für dieses Dokument gelten. Diese Überprüfung liegt in der Verantwortung des Benutzers dieses Dokuments. Auf Verlangen des Kunden kann der TÜV Rheinland die Gültigkeit der digitalen Signatur durch ein gesondertes Dokument bestätigen. Diese Anfrage ist an unseren Vertrieb zu richten. Eine Umweltgebühr für einen solchen zusätzlichen Service wird erhoben.</p> <p><i>As contractually agreed, this document has been signed digitally only. TUV Rheinland has not verified and unable to verify which legal or other pertaining requirements are applicable for this document. Such verification is within the responsibility of the user of this document. Upon request by its client, TUV Rheinland can confirm the validity of the digital signature by a separate document. Such request shall be addressed to our Sales department. An environmental fee for such additional service will be charged.</i></p>
3	<p>Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben. Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt.</p> <p><i>Test clauses with remark of * are subcontracted to qualified subcontractors and described under the respective test clause in the report. Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.</i></p>
4	<p>Die Entscheidungsregel für Konformitätserklärungen basierend auf numerischen Messergebnissen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2021, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird. Zu weiteren Informationen bezüglich des Risikos durch diese Entscheidungsregel siehe ILAC G8:2019.</p> <p><i>The decision rule for statements of conformity, based on numerical measurement results, in this test report is based on the "Zero Guard Band Rule" and "Simple Acceptance" in accordance with ILAC G8:2019 and IEC Guide 115:2021, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report. For additional information on the resulting risk based of this decision rule please refer to ILAC G8:2019.</i></p>

## Test Summary

**5.1.1 ANTENNA REQUIREMENT***RESULT: Pass***5.1.2 MAXIMUM PEAK CONDUCTED OUTPUT POWER***RESULT: Pass***5.1.3 CONDUCTED POWER SPECTRAL DENSITY***RESULT: Pass***5.1.4 6dB BANDWIDTH***RESULT: Pass***5.1.5 99% BANDWIDTH***RESULT: Pass***5.1.6 20dB BANDWIDTH***RESULT: Pass***5.1.7 CARRIER FREQUENCY SEPARATION***RESULT: Pass***5.1.8 NUMBER OF HOPPING FREQUENCY***RESULT: Pass***5.1.9 TIME OF OCCUPANCY***RESULT: Pass***5.1.10 CONDUCTED SPURIOUS EMISSIONS MEASURED IN 100 KHz BANDWIDTH***RESULT: Pass***5.1.11 RADIATED SPURIOUS EMISSION***RESULT: Pass***5.1.12 CONDUCTED EMISSION ON AC MAINS***RESULT: Pass*

## Contents

<b>1</b>	<b>GENERAL REMARKS .....</b>	<b>5</b>
<b>1.1</b>	<b>COMPLEMENTARY MATERIALS.....</b>	<b>5</b>
<b>2</b>	<b>TEST SITES.....</b>	<b>6</b>
<b>2.1</b>	<b>TEST FACILITIES .....</b>	<b>6</b>
<b>2.2</b>	<b>LIST OF TEST AND MEASUREMENT INSTRUMENTS .....</b>	<b>6</b>
<b>2.3</b>	<b>TRACEABILITY .....</b>	<b>7</b>
<b>2.4</b>	<b>CALIBRATION.....</b>	<b>7</b>
<b>2.5</b>	<b>MEASUREMENT UNCERTAINTY.....</b>	<b>7</b>
<b>2.6</b>	<b>LOCATION OF ORIGINAL DATA.....</b>	<b>8</b>
<b>2.7</b>	<b>STATUS OF FACILITY USED FOR TESTING .....</b>	<b>8</b>
<b>3</b>	<b>GENERAL PRODUCT INFORMATION .....</b>	<b>9</b>
<b>3.1</b>	<b>PRODUCT FUNCTION AND INTENDED USE .....</b>	<b>9</b>
<b>3.2</b>	<b>RATINGS AND SYSTEM DETAILS.....</b>	<b>9</b>
<b>3.3</b>	<b>INDEPENDENT OPERATION MODES.....</b>	<b>11</b>
<b>3.4</b>	<b>NOISE GENERATING AND NOISE SUPPRESSING PARTS .....</b>	<b>11</b>
<b>3.5</b>	<b>SUBMITTED DOCUMENTS.....</b>	<b>11</b>
<b>4</b>	<b>TEST SET-UP AND OPERATION MODES.....</b>	<b>12</b>
<b>4.1</b>	<b>PRINCIPLE OF CONFIGURATION SELECTION .....</b>	<b>12</b>
<b>4.2</b>	<b>TEST OPERATION AND TEST SOFTWARE .....</b>	<b>12</b>
<b>4.3</b>	<b>SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT .....</b>	<b>12</b>
<b>4.4</b>	<b>COUNTERMEASURES TO ACHIEVE EMC COMPLIANCE .....</b>	<b>12</b>
<b>4.5</b>	<b>TEST SETUP DIAGRAM .....</b>	<b>13</b>
<b>5</b>	<b>TEST RESULTS .....</b>	<b>15</b>
<b>5.1</b>	<b>TRANSMITTER REQUIREMENT &amp; TEST SUITES.....</b>	<b>15</b>
<i>5.1.1</i>	<i>Antenna Requirement.....</i>	<i>15</i>
<i>5.1.2</i>	<i>Maximum Peak Conducted Output Power .....</i>	<i>16</i>
<i>5.1.3</i>	<i>Conducted Power Spectral Density.....</i>	<i>18</i>
<i>5.1.4</i>	<i>6dB Bandwidth .....</i>	<i>19</i>
<i>5.1.5</i>	<i>99% Bandwidth.....</i>	<i>20</i>
<i>5.1.6</i>	<i>20dB Bandwidth .....</i>	<i>21</i>
<i>5.1.7</i>	<i>Carrier Frequency Separation .....</i>	<i>22</i>
<i>5.1.8</i>	<i>Number of Hopping Frequency .....</i>	<i>23</i>
<i>5.1.9</i>	<i>Time of Occupancy.....</i>	<i>24</i>
<i>5.1.10</i>	<i>Conducted Spurious Emissions Measured in 100 kHz Bandwidth .....</i>	<i>25</i>
<i>5.1.11</i>	<i>Radiated Spurious Emission .....</i>	<i>26</i>
<i>5.1.12</i>	<i>Conducted Emission on AC Mains.....</i>	<i>27</i>
<b>6</b>	<b>PHOTOGRAPHS OF THE TEST SET-UP .....</b>	<b>28</b>
<b>7</b>	<b>LIST OF TABLES.....</b>	<b>28</b>

# 1 General Remarks

## 1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix A: Test Results of Bluetooth BR & EDR

Appendix B: Test Results of Bluetooth LE & Conducted Emission

Appendix C: Photographs of the Test Set-up

## 2 Test Sites

### 2.1 Test Facilities

**TÜV Rheinland (Shenzhen) Co., Ltd.**

No. 362 Huanguan Road Middle, Longhua District, 518110, Shenzhen, P. R. China.

FCC Accreditation Designation No.: 694916

ISED wireless device testing laboratory: 25069

### 2.2 List of Test and Measurement Instruments

**Table 1: List of Test and Measurement Equipment**

<b>Radio Spectrum Testing (SRD-Tonscend)</b>					
<b>Equipment</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial No.</b>	<b>Cal. Date</b>	<b>Cal. until</b>
EXA Signal Analyzer, Multi-touch	Keysight	N9010B	MY60241175	2023-09-22	2024-09-21
MXG X-Series RF Vector Signal Generator	Keysight	N5182B	MY61250137	2023-09-22	2024-09-21
EXG X-Series Microwave Analog Signal Generator	Keysight	N5173B	MY61250141	2023-09-22	2024-09-21
DC power supply	Keysight	E3642A	MY61276100	2023-09-22	2024-09-21
Power Control Unit	Tonscend	JS0806-4ADC	N/A	2023-09-22	2024-09-21
Automation Control Unit	Tonscend	JS0806-2	21C8060396	2023-09-22	2024-09-21
Test Software	Tonscend	JS1120-3	N/A	N/A	N/A
Control PC	Lenovo	TianYi510S-071MB	YLX23JMF	N/A	N/A
Shielding Room 8#	Albatross	SR8	APC17151-SR8	2021-06-22	2024-06-22
<b>Unwanted Emission Testing (TS9975)</b>					
<b>Equipment</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial No.</b>	<b>Cal. Date</b>	<b>Cal. until</b>
EMI Test Receiver	R&S	ESR 7	102021	2023-07-26	2024-07-25
Signal Analyzer	R&S	FSV 40	101439	2023-07-26	2024-07-25
System Controller Interface	R&S	SCI-100	S10010038	N/A	N/A
Filterbank	R&S	Wlan	100759	2023-07-26	2024-07-25
OSP	R&S	OSP 120	102040	N/A	N/A
Pre-amplifier	R&S	SCU08F1	08320031	2023-07-26	2024-07-25
Amplifier	R&S	SCU-18F	180070	2023-07-26	2024-07-25
Amplifier	R&S	SCU40A	100475	2023-07-26	2024-07-25
Trilog Broadband Antenna (30 MHz - 7 GHz)	Schwarzbeck	VULB 9162	193	2022-08-07	2024-08-06

Double-Ridged Antenna (1 -18 GHz)	ETS-LINDGREN	3117	00218717	2022-08-07	2024-08-06
Wideband Ridged Horn Antenna (18-40 GHz)	Steatite	QMS-00880	19067	2022-08-28	2024-08-27
Active Loop Antenna	Schwarzbeck	FMZB 1513	302	2022-08-07	2024-08-06
Test software	R&S	EMC32 (V10.60.10)	N/A	N/A	N/A
Control PC	Dell	OptiPlex 7050	36NV9P2	N/A	N/A
3m Semi-Anechoic Chamber	Albatross	SAC-3m	APC17151-SAC	2021-06-22	2024-06-22

Conducted Emission				
Equipment	Manufacturer	Model No.	Serial No.	Cal. Until
EMI Test Receiver	R&S	ESR3	102428	2024-07-30
Artificial Mains Network	R&S	ENV216	102333	2024-07-31
EMC32 test software	R&S	EMC32(Ver.10.50.00)	N/A	N/A

## 2.3 Traceability

All measurement equipment calibrations are traceable to NIM (National Institute of Metrology) or where calibration is performed in other countries, to equivalent nationally recognized standards organizations.

## 2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

## 2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements as below table.

**Table 2: Measurement Uncertainty**

Parameter	Uncertainty (k=2)
RF output power, conducted	± 0.99 dB
Occupied Channel Bandwidth	± 2.08 %
RF power density, conducted	± 0.99 dB
Unwanted Emissions, conducted	± 0.89 dB
All emissions, radiated	±4.17 dB
Conducted Emission, (9kHz to 150kHz)/(150kHz to 30MHz)	± 3.70 dB / ± 3.30 dB

## 2.6 Location of Original Data

The original copies of all test data taken during actual testing were attached at Appendix A & B & C of this report and delivered to the applicant. A copy has been retained in the TÜV Rheinland (Shenzhen) Co., Ltd. file for certification follow-up purposes.

## 2.7 Status of Facility Used for Testing

The TÜV Rheinland (Shenzhen) Co., Ltd. Test facility located at No. 362 Huanguan Road Middle, Longhua District, 518110, Shenzhen, P. R. China. is listed on the US Federal Communications Commission list of facilities approved to perform measurements.



## 3 General Product Information

### 3.1 Product Function and Intended Use

The product is a Lawn Mowing Robot, which supports Bluetooth dual mode and 2.4GHz Wi-Fi wireless technologies.

For details refer to the User Manual, Technical Description and Circuit Diagram.

### 3.2 Ratings and System Details

**Table 3: Technical Specification of EUT**

General Information of EUT	Value
Kind of Equipment:	Lawn Mowing Robot
Type Designation:	MPB14
Trademark:	ECOVACS
FCC ID:	2A64B-MPB14
IC:	28593-MPB14
PMN:	Lawn Mowing Robot
HVIN:	MPB14-V1.0
Operating Voltage:	DC 21V from the charging base or DC 18.5V by internal battery
Operating Temperature Range:	0°C ~ +50 °C
<b>Technical Specification of Bluetooth (dual mode)</b>	
Operating Frequency:	2402 MHz to 2480 MHz
Type of Modulation:	GFSK, $\pi/4$ -DQPSK, 8DPSK
Channel Number:	BR & EDR mode:79 channels, Low Energy mode:40 channels
Channel Separation:	BR & EDR mode:1MHz, Low Energy mode:2MHz
Data Rate:	BR & EDR mode:( 1Mbps, 2Mbps, 3Mbps) Low Energy mode: (1Mbps)
Antenna Type:	Integral antenna
Antenna Gain:	4.1 dBi (Provided by the Client)
<b>Technical Specification of 2.4GHz Wi-Fi</b>	
Operating Frequency:	2412 - 2462 MHz for 802.11b/g/n(HT20) 2422 - 2452 MHz for 802.11n(HT40)
Type of Modulation:	DSSS(DBPSK/DQPSK/CCK) OFDM(BPSK/QPSK/16QAM/64QAM)
Data Rate:	1/2/5.5/11 Mbps for 802.11b 6/9/12/18/24/36/48/54 Mbps for 802.11g MCS0 ~ MCS7 for 802.11n
Channel Number:	11 channels for 802.11b/g/n(HT20) 7 channels for 802.11n(HT40)
Channel Separation:	5 MHz
Antenna Type:	Integral antenna
Antenna Gain:	4.1 dBi (Provided by the Client)

**Table 4: RF Channel and Frequency of Bluetooth BR & EDR**

RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)
0	<b>2402.00</b>	20	2422.00	40	2442.00	60	2462.00
1	2403.00	21	2423.00	41	2443.00	61	2463.00
2	2404.00	22	2424.00	42	2444.00	62	2464.00
3	2405.00	23	2425.00	43	2445.00	63	2465.00
4	2406.00	24	2426.00	44	2446.00	64	2466.00
5	2407.00	25	2427.00	45	2447.00	65	2467.00
6	2408.00	26	2428.00	46	2448.00	66	2468.00
7	2409.00	27	2429.00	47	2449.00	67	2469.00
8	2410.00	28	2430.00	48	2450.00	68	2470.00
9	2411.00	29	2431.00	49	2451.00	69	2471.00
10	2412.00	30	2432.00	50	2452.00	70	2472.00
11	2413.00	31	2433.00	51	2453.00	71	2473.00
12	2414.00	32	2434.00	52	2454.00	72	2474.00
13	2415.00	33	2435.00	53	2455.00	73	2475.00
14	2416.00	34	2436.00	54	2456.00	74	2476.00
15	2417.00	35	2437.00	55	2457.00	75	2477.00
16	2418.00	36	2438.00	56	2458.00	76	2478.00
17	2419.00	37	2439.00	57	2459.00	77	2479.00
18	2420.00	38	2440.00	58	2460.00	78	<b>2480.00</b>
19	2421.00	39	<b>2441.00</b>	59	2461.00		

Test frequencies are lowest channel: 2402 MHz, middle channel: 2441 MHz and highest channel: 2480 MHz for Bluetooth BR & EDR

**Table 5: RF Channel and Frequency of Bluetooth LE**

RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)
0	<b>2402</b>	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	<b>19</b>	<b>2440</b>	29	2460	<b>39</b>	<b>2480</b>

Test frequencies are lowest channel: 2402 MHz, middle channel: 2440 MHz and highest channel: 2480 MHz for Bluetooth LE

### 3.3 Independent Operation Modes

The basic operation modes are:

- A. On, Bluetooth transmitting mode (BR & EDR mode)
  - 1) Low Channel
  - 2) Middle Channel
  - 3) High Channel
- B. On, Bluetooth transmitting mode (BLE)
  - 1) Low Channel
  - 2) Middle Channel
  - 3) High Channel
- C. On, Transmitting on Hopping channel
- D. On, Charging by Base with Wireless communicating
- E. Off

### 3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

### 3.5 Submitted Documents

- Application Form
- ID Label and Location Info
- User Manual
- Operation Description

## 4 Test Set-up and Operation Modes

### 4.1 Principle of Configuration Selection

**Radio Spectrum:** The equipment under test (EUT) was configured at its highest power output in order to measure its highest possible radiation and conducted level. The test modes were adapted accordingly in reference to the instructions for use.

**Emission:** The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

### 4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 5. All tests were performed according to the procedures in ANSI C63.10: 2013.

According to clause 3.1, all tests were performed on model MPB14 in this report.

### 4.3 Special Accessories and Auxiliary Equipment

Table 6: List of Accessories and Auxiliary Equipment

Description	Manufacturer	Model	S/N
Laptop	Lenovo	T480	PF-16A6N8
Portable Laptop	Lenovo	ThinkPad T480	10Q67059

### 4.4 Countermeasures to Achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Technical Construction File (TCF).

No additional measures were employed to achieve compliance.

## 4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test (Below 1GHz)

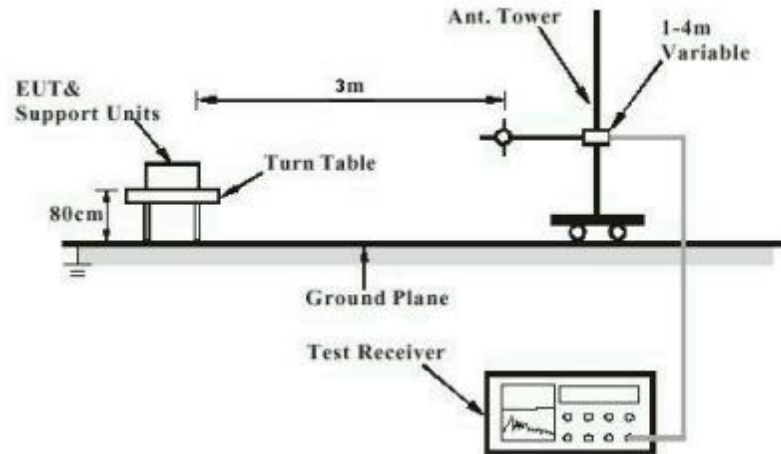


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

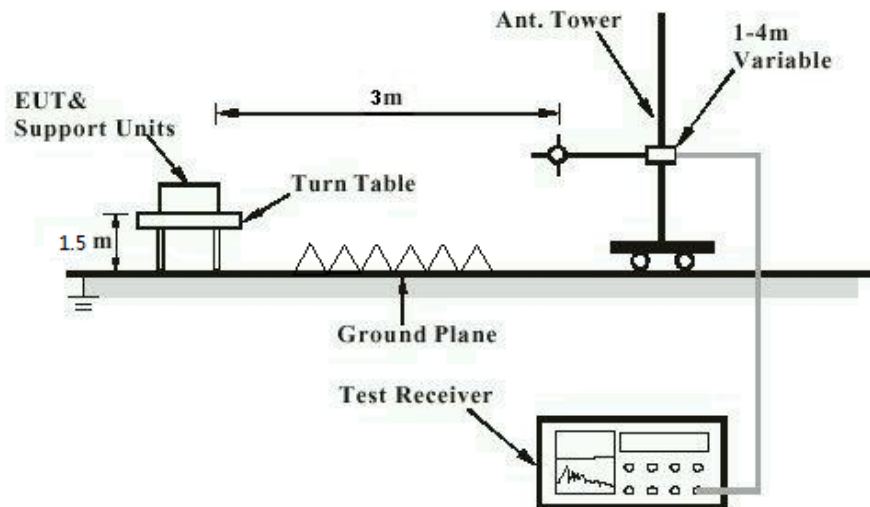


Diagram of Measurement Configuration for Mains Conduction Measurement

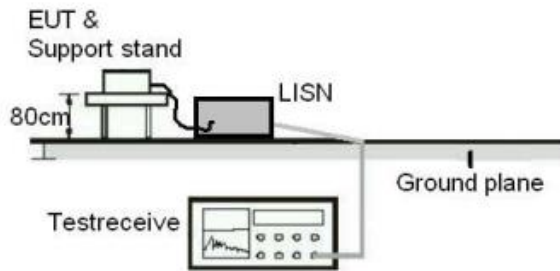
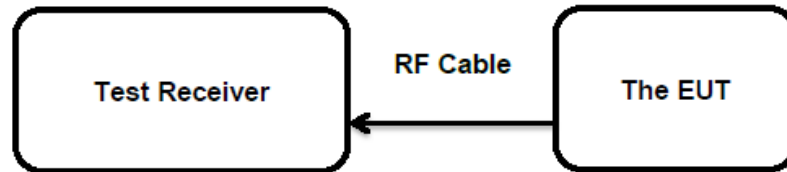


Diagram of Measurement Configuration for Conducted Transmitter Measurement



## 5 Test Results

### 5.1 Transmitter Requirement & Test Suites

#### 5.1.1 Antenna Requirement

**RESULT:****Pass****Test Specification**

Test standard : FCC Part 15.247(b)(4) and Part 15.203  
RSS-Gen Clause 6.8

The EUT has an Integral Antenna, the directional gain of antenna is 4.1 dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement.

Therefore the EUT is considered sufficient to comply with the provision.

Refer to EUT Photo for further details.

## 5.1.2 Maximum Peak Conducted Output Power

**RESULT:****Pass****Test Specification**

Test standard	: FCC Part 15.247(b)(1)&(3) RSS-247 Clause 5.4(b)&(d)
Basic standard	: ANSI C63.10: 2013
Limits	: FHSS < 0.125 Watts, DSSS < 1.0 Watts
Kind of test site	: Shielded Room

**Test Setup**

Date of testing	: 2024-02-27 to 2024-02-28
Input voltage	: Fully charged battery
Operation mode	: A, B
Test channel	: Low / Middle / High
Ambient temperature	: 22.4 °C
Relative humidity	: 38 %
Atmospheric pressure	: 101 kPa

For details refer to following test result.



**Table 7: Test Result of Maximum Peak Conducted Output Power, Bluetooth BR & EDR**

Test Mode	Test Channel (MHz)	Measured Peak Power		Limit (W)
		(dBm)	(W)	
GFSK (BR)	2402.0	3.96	0.0025	< 0.125
	2441.0	4.13	0.0026	
	2480.0	4.96	0.0031	
<b>Maximum Measured Value</b>		<b>4.96</b>	<b>0.0031</b>	
Test Mode	Test Channel (MHz)	Measured Peak Power		Limit (W)
		(dBm)	(W)	
8DPSK (EDR)	2402.0	5.84	0.0038	< 0.125
	2441.0	6.79	0.0048	
	2480.0	6.70	0.0047	
<b>Maximum Measured Value</b>		<b>6.79</b>	<b>0.0048</b>	
Max. e.i.r.p=6.79dBm+4.1dBi=10.89dBm, which is less than 36dBm=4W.				

**Table 8: Test Result of Maximum Peak Conducted Output Power, Bluetooth LE**

Test Mode	Test Channel (MHz)	Measured Peak Power		Limit (W)
		(dBm)	(W)	
Bluetooth LE (1 Mbps)	2402	6.51	0.0045	< 1.0
	2440	6.82	0.0048	
	2480	7.32	0.0054	
<b>Max. Measured Value</b>		<b>7.32</b>	<b>0.0054</b>	
Max. e.i.r.p=7.32dBm+4.1dBi=11.42dBm, which is less than 36dBm=4W.				

**Note:**

- 1) The cable loss is taken into account in results.
- 2) Antenna gain(G): 4.1 dBi

### 5.1.3 Conducted Power Spectral Density

**RESULT:****Pass****Test Specification**

Test standard : FCC Part 15.247(e)  
RSS-247 Clause 5.2(b)  
Basic standard : ANSI C63.10: 2013  
Limits : < 8 dBm / 3kHz  
Kind of test site : Shielded Room

**Test Setup**

Date of testing : 2024-02-27  
Input voltage : Fully charged battery  
Operation mode : B  
Test channel : Low / Middle / High  
Ambient temperature : 22.4 °C  
Relative humidity : 38 %  
Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix B.

Prüfbericht - Nr.: **CN24397K 001**  
Test Report No.:Seite 19 von 28  
Page 19 of 28

### 5.1.4 6dB Bandwidth

**RESULT:****Pass****Test Specification**

Test standard : FCC Part 15.247(a)(2)  
RSS-247 Clause 5.2(a)

Basic standard : ANSI C63.10: 2013

Limits : > 500 KHz

Kind of test site : Shielded Room

**Test Setup**

Date of testing : 2024-02-27

Input voltage : Fully charged battery

Operation mode : B

Test channel : Low / Middle / High

Ambient temperature : 22.4 °C

Relative humidity : 38 %

Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix B.

### 5.1.5 99% Bandwidth

**RESULT:****Pass****Test Specification**

Test standard : FCC Part 15.247(a)  
RSS-Gen Clause 6.7  
Basic standard : ANSI C63.10: 2013  
Kind of test site : Shielded Room

**Test Setup**

Date of testing : 2024-02-27  
Input voltage : Fully charged battery  
Operation mode : A, B  
Test channel : Low / Middle / High  
Ambient temperature : 22.4 °C  
Relative humidity : 38 %  
Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix A & B.

Prüfbericht - Nr.: **CN24397K 001**  
Test Report No.:Seite 21 von 28  
Page 21 of 28

### 5.1.6 20dB Bandwidth

**RESULT:****Pass****Test Specification**

Test standard : FCC Part 15.247(a)(1)  
RSS-247 Clause 5.1(a)

Basic standard : ANSI C63.10: 2013

Kind of test site : Shielded Room

**Test Setup**

Date of testing : 2024-02-27

Input voltage : Fully charged battery

Operation mode : A

Test channel : Low / Middle / High

Ambient temperature : 22.4 °C

Relative humidity : 38 %

Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix A.

## 5.1.7 Carrier Frequency Separation

**RESULT:****Pass****Test Specification**

Test standard	: FCC Part 15.247(a)(1) RSS-247 Clause 5.1(b)
Basic standard	: ANSI C63.10: 2013
Limits	: $\geq 25\text{kHz}$ or 2/3 of 20dB bandwidth, whichever is greater
Kind of test site	: Shielded Room

**Test Setup**

Date of testing	: 2024-02-27
Input voltage	: Fully charged battery
Operation mode	: C
Test channel	: Low / Middle / High
Ambient temperature	: 22.4 °C
Relative humidity	: 38 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix A.

### 5.1.8 Number of Hopping Frequency

**RESULT:****Pass****Test Specification**

Test standard : FCC part 15.247(a)(1)(iii)  
RSS-247 Clause 5.1(d)

Basic standard : ANSI C63.10: 2013

Limits :  $\geq 15$  non-overlapping channels

Kind of test site : Shielded Room

**Test Setup**

Date of testing : 2024-02-27

Input voltage : Fully charged battery

Operation mode : C

Ambient temperature : 22.4 °C

Relative humidity : 38 %

Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix A.

### 5.1.9 Time of Occupancy

**RESULT:****Pass****Test Specification**

Test standard	:	FCC part 15.247(a)(1)(iii) RSS-247 Clause 5.1(d)
Basic standard	:	ANSI C63.10: 2013
Limits	:	< 0.4s
Kind of test site	:	Shielded Room

**Test Setup**

Date of testing	:	2024-02-27
Input voltage	:	Fully charged battery
Operation mode	:	C
Test channel	:	Low / Middle / High
Ambient temperature	:	22.4 °C
Relative humidity	:	38 %
Atmospheric pressure	:	101 kPa

For the measurement records, refer to the appendix A.



Prüfbericht - Nr.: CN24397K 001  
Test Report No.:Seite 25 von 28  
Page 25 of 28

### 5.1.10 Conducted Spurious Emissions Measured in 100 kHz Bandwidth

RESULT:

Pass

**Test Specification**

Test standard : FCC Part 15.247(d)  
RSS-247 Clause 5.5

Basic standard : ANSI C63.10: 2013

Limits : 20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power);  
In addition, radiated emissions which fall in the restricted bands, must also comply with the radiated emission limits specified in 15.209(a)

Kind of test site : Shielded Room

**Test Setup**

Date of testing : 2024-02-27

Input voltage : Fully charged battery

Operation mode : A, B

Test channel : Low / Middle / High

Ambient temperature : 22.4 °C

Relative humidity : 38 %

Atmospheric pressure : 101 kPa

Test results of 100kHz Bandwidth of Frequency Band Edge by Conducted method refer to test plots, and compliance is achieved as well.

For the measurement records, refer to the appendix A & B.

Prüfbericht - Nr.: CN24397K 001  
Test Report No.:Seite 26 von 28  
Page 26 of 28

## 5.1.11 Radiated Spurious Emission

**RESULT:****Pass****Test Specification**

Test standard : FCC Part 15.247(d) & FCC Part 15.205  
RSS-247 Clause 3.3

Basic standard : ANSI C63.10: 2013

Limits : Refer to 15.209(a) of FCC part 15.247(d)  
RSS-Gen Section 8.9 & 8.10

Kind of test site : 3m Semi-anechoic Chamber

**Test Setup**

Date of testing : 2024-02-20 to 2024-02-21

Input voltage : Fully charged battery

Operation mode : A, B

Test channel : Low / Middle / High

Ambient temperature : Refer to test result

Relative humidity : Refer to test result

Atmospheric pressure : 101 kPa

**Remark:**

Testing was carried out within frequency range 9kHz to the tenth harmonics. Only the worst case spurious emissions configuration of the each mode were reported.

For the measurement records, refer to the appendix A & B.

## 5.1.12 Conducted Emission on AC Mains

**RESULT:****Pass****Test Specification**

Test standard	: FCC Part 15.207(a) RSS-Gen Section 8.8
Basic standard	: ANSI C63.10: 2013
Frequency range	: 0.15 – 30MHz
Classification	: Class B
Limits	: FCC Part 15.207(a) RSS-Gen Table 4
Kind of test site	: Shielded Room

**Test Setup**

Date of testing	: 2024-01-24
Input voltage	: AC 120V, 60Hz
Operation mode	: D
Earthing	: Not connected
Ambient temperature	: 25.0 °C
Relative humidity	: 51.2 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix B.

## 6 Photographs of the Test Set-Up

For photographs of the test set-up, refer to the appendix C.

## 7 List of Tables

Table 1: List of Test and Measurement Equipment.....	6
Table 2: Measurement Uncertainty .....	7
Table 3: Technical Specification of EUT.....	9
Table 4: RF Channel and Frequency of Bluetooth BR & EDR .....	10
Table 5: RF Channel and Frequency of Bluetooth LE.....	10
Table 6: List of Accessories and Auxiliary Equipment.....	12
Table 7: Test Result of Maximum Peak Conducted Output Power, Bluetooth BR & EDR.....	17
Table 8: Test Result of Maximum Peak Conducted Output Power, Bluetooth LE.....	17