

Prüfbericht-Nr.: Test report no.:	CN237L5F 002	Auftrags-Nr.: Order no.:	168423348	Seite 1 von 22 Page 1 of 22
Kunden-Referenz-Nr.: Client reference no.:	N/A	Auftragsdatum: Order date:	2023-04-18	
Auftraggeber: Client:	Uniorange Internet Design Co., Ltd. No.113, Shanhai Road, Laishan District, Yantai City, Shandong			
Prüfgegenstand: Test item:	Intelligent Robot Vacuum and Mop Cleaner			
Bezeichnung / Typ-Nr.: Identification / Type no.:	ROB-02A1AT, ROB-02A1 (Trademark: Uniorange)			
Auftrags-Inhalt: Order content:	Test Report			
Prüfgrundlage: Test specification:	CFR47 FCC Part 15: Subpart E Section 15.407 RSS-247 Issue 2 February 2017 RSS-Gen Issue 5 March 2019			
Wareneingangsdatum: Date of sample receipt:	2023-05-17	Please refer to Photo Document		
Prüfmuster-Nr.: Test sample no.:	A003473764-001			
Prüfzeitraum: Testing period:	2023-05-29 - 2023-06-13			
Ort der Prüfung: Place of testing:	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüflaboratorium: Testing laboratory:	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüfergebnis*: Test result*:	Pass			
geprüft von: tested by:	X <u>Breeze Jiang</u>		genehmigt von: authorized by:	X <u>Winnie Hou</u>
Datum: Date:	2023-08-11	Ausstellungsdatum: Issue date:		2023-08-11
Stellung / Position:		Stellung / Position:		
Sachverständige(r)/Expert		Sachverständige(r)/Expert		
Sonstiges / Other:	FCC ID: 2BBP9-QI2A IC: 30776-QI2A, HVIN: ROB-02A1			
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:		Prüfmuster vollständig und unbeschädigt Test item complete and undamaged		
* Legende: P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet * Legend: P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested				
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. 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.				

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Anmerkungen
Remarks

1	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. <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>
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3	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. <i>Test clauses with remark of * are subcontracted to qualified subcontractors and described under the respective test clause in the report.</i> <i>Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.</i>
4	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. <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 to the resulting risk based of this decision rule please refer to ILAC G8:2019.</i>

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 FREQUENCY STABILITY

RESULT: Pass

5.1.5 26dB BANDWIDTH AND 99% BANDWIDTH

RESULT: Pass

5.1.6 6dB BANDWIDTH

RESULT: Pass

5.1.7 RADIATED SPURIOUS EMISSION

RESULT: Pass

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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 5GHz Wi-Fi

Appendix B: Photographs of the Test Set-up

2 Test Sites

2.1 Test Facilities

TÜV Rheinland (Shenzhen) Co., Ltd.

No.362, Huanguan Middle Road, Songyuansha Community, Guanhu Subdistrict, Longhua District, Shenzhen 518110, Guangdong, 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

Radio Spectrum Testing (TS8997)				
Equipment	Manufacturer	Model	Serial No.	Cal. until
Signal Analyzer	R&S	FSV 40	101441	2023-08-01
OSP	R&S	OSP 150	101017	2023-11-21
Control PC	DELL	OptiPlex 7050	FTJZ9P2	N/A
Test Software	R&S	WMS32 (V11.00.00)	N/A	N/A
Power Meter	R&S	NRP2	107105	2023-11-21
Wideband Power Sensor	R&S	NRP-Z81	105677	2023-08-01
Shielding Room 8#	Albatross	SR8	APC17151-SR8	2024-06-22
Unwanted Emission Testing (TS9975)				
Equipment	Manufacturer	Model	Serial No.	Cal. until
EMI Test Receiver	R&S	ESR 7	102021	2023-08-02
Signal Analyzer	R&S	FSV 40	101439	2023-08-01
System Controller Interface	R&S	SCI-100	S10010038	N/A
Filterbank	R&S	Wlan	100759	2023-08-01
OSP	R&S	OSP 120	102040	N/A
Pre-amplifier	R&S	SCU08F1	08320031	2023-08-02
Amplifier	R&S	SCU-18F	180070	2023-08-02
Amplifier	R&S	SCU40A	100475	2023-08-02
Trilog Broadband Antenna (30 MHz - 7 GHz)	Schwarzbeck	VULB 9162	193	2024-08-06
Double-Ridged Antenna (1 -18 GHz)	ETS-LINDGREN	3117	00218717	2024-08-06
Wideband Ridged Horn Antenna (18-40 GHz)	Steatite	QMS-00880	19067	2024-08-27
Active Loop Antenna	Schwarzbeck	FMZB 1513	302	2023-08-06
Test software	R&S	EMC32 (V10.60.10)	N/A	N/A
Control PC	Dell	OptiPlex 7050	36NV9P2	N/A
3m Semi-Anechoic Chamber	Albatross	SAC-3m	APC17151-SAC	2024-06-22

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

2.6 Location of Original Data

The original copies of all test data taken during actual testing were attached at Appendix A & B 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 Middle Road, Songyuansha Community, Guanhu Subdistrict, Longhua District, Shenzhen 518110, Guangdong, 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 EUT is an Intelligent Robot Vacuum and Mop Cleaner which contains a Host and a Cleaning dock. The Host supports Wi-Fi 2.4G, Wi-Fi 5G and 433MHz functions. The Cleaning dock supports 433MHz function.

Models ROB-02A1 and ROB-02A1AT are identical, except for model name and used with different cleaning dock.

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:	Intelligent Robot Vacuum and Mop Cleaner
Type Designation:	ROB-02A1AT, ROB-02A1
Trademark:	Uniorange
FCC ID:	2BBP9-QI2A
IC:	30776-QI2A
HVIN:	ROB-02A1AT
PMN:	Intelligent Robot Vacuum and Mop Cleaner
Operating Voltage :	DC 14.4V input via internal battery
Testing Voltage:	Fully charged battery
Technical Specification of Wi-Fi 802.11 b/g/n	
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 :	3.08 dBi
Technical Specification of Wi-Fi 802.11 a/n/ac	
Operating Frequency:	5180-5320MHz, 5745-5825MHz
Type of Modulation:	OFDM(BPSK/QPSK/16QAM/64QAM/256QAM)
Data Rate:	6/9/12/18/24/36/48/54 Mbps for 802.11a MCS0 ~ MCS15 for 802.11 n20/n40 VHT-MCS 0 ~ VHT-MCS 8 for 802.11 ac20 VHT-MCS 0 ~ VHT-MCS 9 for 802.11 ac40/ac80
Channel Number:	5180-5320MHz, 14CHs, 802.11 a/n20/n40/ac20/ac40/ac80 5745-5825MHz, 8CHs, 802.11 a/n20/n40/ac20/ac40/ac80
Channel Separation:	5 MHz
Antenna Type:	Integral Antenna
Antenna Gain:	3.98 dBi for 5180-5320MHz, 4.24 dBi for 5745-5825MHz

Table 4: RF Channel and Frequency of 5GHz Wi-Fi 802.11 a/n/ac

U-NII-1					
20MHz Bandwidth		40MHz Bandwidth		80MHz Bandwidth	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
36	5180	38	5190	42	5210

40	5200	46	5230		
44	5220				
48	5240				

U-NII-3					
20MHz Bandwidth		40MHz Bandwidth		80MHz Bandwidth	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
149	5745	151	5755	155	5775
153	5765	159	5795		
157	5785				
161	5805				
165	5825				

3.3 Independent Operation Modes

The basic operation modes are:

- A. On, Wi-Fi 802.11 a/n/ac wireless transmitting mode
 - 1. Low channel
 - 2. Middle channel
 - 3. High channel
- B. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

3.5 Submitted Documents

- Application Form
- User Manual
- ID Label and Location Info
- 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 ROB-02A1AT in this report.

4.3 Special Accessories and Auxiliary Equipment

Table 5: List of Accessories and Auxiliary Equipment

Description	Manufacturer	Model	S/N
Laptop	Lenovo	T480	PF-16A6N8

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)

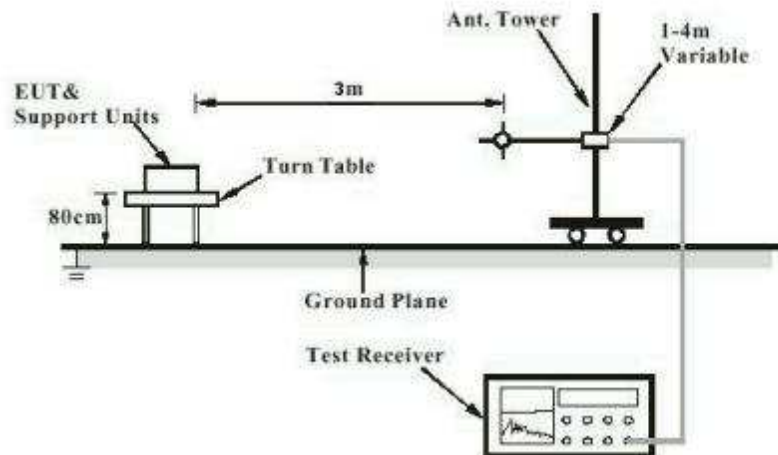


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

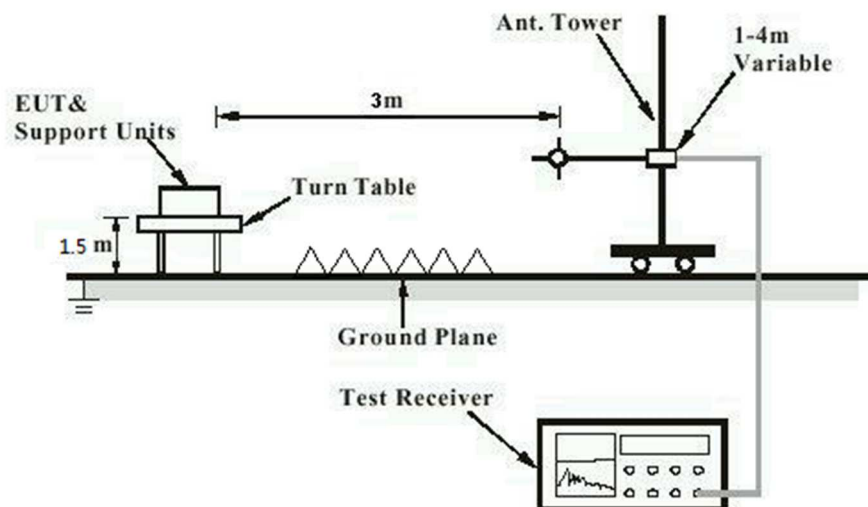


Diagram of Measurement Configuration for Mains Conduction Measurement

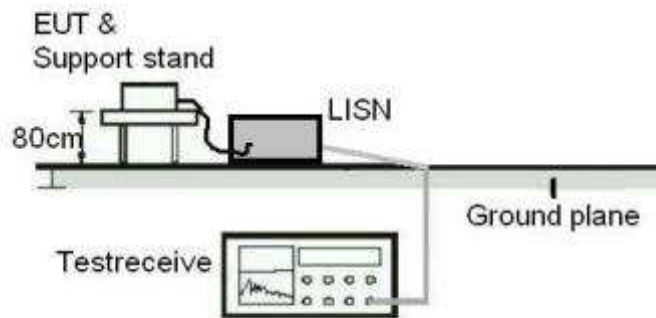
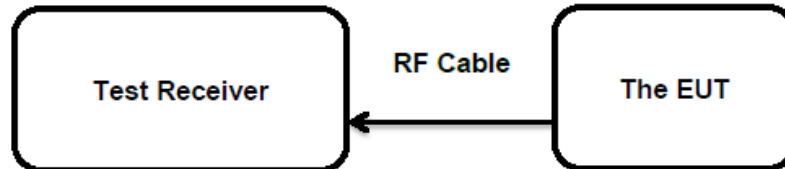


Diagram of Measurement Configuration for Conducted Transmitter Measurement



5 Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

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

Test standard : FCC Part 15.203
RSS-Gen Clause 6.8

The EUT has a Integral Antenna, the directional gain of antenna is 4.24 dBi (max.), 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 15.407(a)(1)&(2)&(4) RSS-247 clause 6.2
Basic standard	: ANSI C63.10: 2013
Limits	: FCC: <250mW (24dBm) (5150-5250MHz) <1W (30dBm) (5725-5850MHz) IC: * Max e.i.r.p.<200mW (23dBm) (5150-5250MHz) *200 mW (23dBm) or 10 dBm + 10 logB, where B is the 99% emission bandwidth in MHz, where is lesser. Max conducted output power <1W (30dBm) (5725-5850MHz)
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2023-06-13
Input voltage	: Fully charged battery
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 24.2 °C
Relative humidity	: 53 %
Atmospheric pressure	: 101 kPa

For details, refer to following test result.

Table 6: Test Result of Maximum Peak Conducted Output Power, 5.2GHz Wi-Fi

Test Mode	Data Rate	Test Channel	Measured Peak Power		Limit (W)	
			(dBm)	(W)		
802.11a	1 Mbps	5180	16.61	0.0458	< 0.25 or 0.192*	
		5200	15.84	0.0384		
		5240	13.92	0.0247		
802.11n (HT20)	MCS0	5180	15.59	0.0362		
		5200	15.50	0.0355		
		5240	16.47	0.0444		
802.11n (HT40)	MCS0	5190	11.90	0.0155		
		5230	9.89	0.0097		
802.11ac (VHT20)	MCS0	5180	15.15	0.0327		
		5200	12.43	0.0175		
		5240	15.98	0.0396		
802.11ac (VHT40)	MCS0	5190	10.68	0.0117		
		5230	9.90	0.0098		
802.11ac (VHT80)	MCS0	5210	10.60	0.0115		
Max. e.i.r.p.=16.61dBm+3.98dBi=20.59dBm, which is less than 36dBm=4W.						
*IC e.i.r.p. limit is 200 mW (23dBm) or 10 dBm + 10 log B, the minimum B=19.181MHz, hence the e.i.r.p. limit=22.83dBm=0.192W						

Table 7: Test Result of Maximum Peak Conducted Output Power, 5.8GHz Wi-Fi

Test Mode	Data Rate	Test Channel	Measured Peak Power		Limit (W)
			(dBm)	(W)	
802.11a	1 Mbps	5745	15.68	0.0370	< 1.0
		5785	16.47	0.0444	
		5825	14.84	0.0305	
802.11n (HT20)	MCS0	5745	15.63	0.0366	
		5785	14.21	0.0264	
		5825	14.80	0.0302	
802.11n (HT40)	MCS0	5755	9.28	0.0085	
		5795	9.94	0.0099	
802.11ac (VHT20)	MCS0	5745	14.21	0.0264	
		5785	15.37	0.0344	
		5825	11.98	0.0158	
802.11ac (VHT40)	MCS0	5755	9.39	0.0087	
		5795	10.12	0.0103	
802.11ac (VHT80)	MCS0	5775	9.80	0.0095	
Max. e.i.r.p.=16.47dBm+4.24dBi=20.71dBm, which is less than 36dBm=4W.					

Note:

- 1) The cable loss is taken into account in results.
- 2) Antenna gain(G): 4.24dBi
e.i.r.p.=P_(Peak power)+ G, which is far below the 4 W

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5.1.3 Conducted Power Spectral Density

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

Test standard	: FCC part 15.407(a) RSS-247 clause 6.2
Basic standard	: ANSI C63.10: 2013 KDB 789033 D02 v01r03
Limits	: FCC: <11dBm/MHz (5150-5250MHz) <30dBm/500KHz (5725-5850MHz) IC: e.i.r.p. spectral density <10dBm/MHz (5150-5250MHz) <30dBm/500KHz (5725-5850MHz)
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2023-06-13
Input voltage	: Fully charged battery
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 24.2 °C
Relative humidity	: 53 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix A.

5.1.4 Frequency Stability

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

Test standard : FCC Part 15.407(g)
RSS-Gen Clause 6.11
Basic standard : ANSI C63.10: 2013
Limits : Within assigned bands
Kind of test site : Shielded Room

Test Setup

Date of testing : 2023-06-13
Input voltage : Fully charged battery
Operation mode : A
Test channel : Low / Middle / High
Ambient temperature : 24.2 °C
Relative humidity : 53 %
Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix A.

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Page 19 of 22**5.1.5 26dB Bandwidth and 99% Bandwidth****RESULT:****Pass****Test Specification**

Test standard	: FCC Part 15.407(e) RSS-Gen Clause 6.6
Basic standard	: ANSI C63.10: 2013
Limits	: N/A
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2023-06-13
Input voltage	: Fully charged battery
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 24.2 °C
Relative humidity	: 53 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix A.

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5.1.6 6dB Bandwidth

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

Test standard : FCC Part 15.407(e)
RSS-Gen Clause 6.6
Basic standard : ANSI C63.10: 2013
Limits : At least 500KHz (5725-5850MHz)
Kind of test site : Shielded Room

Test Setup

Date of testing : 2023-06-13
Input voltage : Fully charged battery
Operation mode : A
Test channel : Low / Middle / High
Ambient temperature : 24.2 °C
Relative humidity : 53 %
Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix A.

5.1.7 Radiated Spurious Emission

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

Test standard	: FCC Part 15.407(b) & FCC Part 15.205 & FCC Part 15.209 RSS-247 clause 6.2 & RSS-GEN clause 8.9 and 8.10
Basic standard	: ANSI C63.10: 2013 KDB 789033 D02 v01r03
Limits	: • For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz. • For transmitters operating in the 5.725-5.85 GHz band: All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge. • Restricted Bands meet the requirement of 15.209 limit and RSS-GEN
Kind of test site	: 3m Semi-anechoic Chamber

Test Setup

Date of testing	: 2023-05-29
Input voltage	: Fully charged battery
Operation mode	: A
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.

6 Photographs of the Test Set-Up

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

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