

Prüfbericht-Nr.: Test report no.:	DE21RISG 002	Auftrags-Nr.: Order no.:	1079814_111	Seite 1 von 33 Page 1 of 33
Kunden-Referenz-Nr.: Client reference No.:	N/A	Auftragsdatum: Order date:	16.10.2020	
Auftraggeber: Client:	IONIQ Skincare GmbH & Co. KG Otto-Lilienthal-Straße 18, 88677 Markdorf, Germany			
Prüfgegenstand: Test item:	IONIQ-Skincare Body Spray			
Bezeichnung / Typ-Nr.: Identification / Type no.:	N/A			
Auftrags-Inhalt: Order content:	Prüfung der Funkparameter nach FCC Test of radio parameters acc. to FCC			
Prüfgrundlage: Test specification:	Vollprüfung / Complete test FCC CFR 47 Part 15 Subpart C- §15.225			
Wareneingangsdatum: Date of sample receipt:	04.01.2021			
Prüfmuster-Nr.: Test sample no.:	A002980367-004			
Prüfzeitraum: Testing period:	08.02.2021 – 12.02.2021			
Ort der Prüfung: Place of testing:	Nürnberg Nuremberg			
Prüflaboratorium: Testing laboratory:	Wireless Labor Wireless Test Lab			
Prüfergebnis*: Test result*:	Pass			
geprüft von: tested by:			genehmigt von: authorized by:	
Datum: Date:	20.04.2021	M. Sc. Alaa Bustati	Datum: Issue date:	20.04.2021
Stellung / Position	Sachverständige(r)/Expert		Stellung / Position	Dipl.-Ing. Melanie Bense Team Leader Wireless
Sonstiges / Other: Dieser Prüfbericht DE21RISG 002 ersetzt den Prüfbericht DE21RISG 001 (siehe Änderungsverzeichnis) / The test report DE21RISG 002 replaces the test report DE21RISG 001 (see change history).				
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:		Prüfmuster vollständig und unbeschädigt Test item complete and undamaged		
* Legende:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend 3 = satisfactory	4 = ausreichend N/A = nicht anwendbar 4 = sufficient N/A = not applicable
* Legende:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	5 = mangelhaft N/T = nicht getestet 5 = poor 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 a. m. 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

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Remarks

- | | |
|---|--|
| 4 | <p>Die Messunsicherheit der in diesem Prüfbericht aufgeführten Messverfahren wird nicht unmittelbar in die Bewertung zur Einhaltung der jeweiligen Grenzwerte mit einbezogen. Es gelten die Anforderungen der Spezifikationen TS 103 051 und TS 100 028-1/-2 in aktueller Form, deren Grundlage der „shared risk“ Ansatz ist. Dieser beschreibt für die jeweilige Norm die maximalen zulässigen Unsicherheitsbeträge unter denen der Messwert als „wahr“ angesehen werden kann. Eine zusätzliche Betrachtung der Messunsicherheit bezüglich des gemessenen Wertes findet bei Unterschreitung der maximalen Unsicherheitsbeträge gemäß den Spezifikationen nicht statt.</p> <p><i>The measurement uncertainty of the measurement methods listed in this test report is not directly included in the assessment of compliance with the respective limit values. The requirements of the specifications TS 103 051 and TS 100 028-1/-2 apply in their current form, based on the "shared risk" approach. For the respective standard, this describes the maximum acceptable uncertainty below which the measured value can be regarded as "true". An additional consideration of the measurement uncertainty with regard to the measured value does not take place if the maximum acceptable uncertainties according to the specifications are not reached.</i></p> |
| 5 | <p>Die Aussage zur Konformität des in diesem Prüfbericht geprüften Produktes wird auf Kundenwunsch nach den Kriterien und Anforderungen der angewendeten Normen durchgeführt. Abweichende Bewertungsbedingungen durch den Kunden werden in den jeweiligen Kapiteln gesondert dokumentiert. Grundsätzlich wird eine Konformitätsbewertung auf Basis der angewendeten Normen durchgeführt, sofern mit dem Kunden keine abweichende Regelung getroffen wurde.</p> <p><i>The statement of conformity of the product tested in this test report is carried out according to the criteria and requirements of the applied standards on customer request. Deviating assessment conditions by the customer are documented separately in the respective chapters. In principle, the assessment of conformity is made on the basis of the standards applied, unless otherwise agreed with the customer.</i></p> |

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**Produktbeschreibung
Product description**

1	Test item	IONIQ-Skincare Body Spray
2	Test sample obtaining	☒ Sending by customer ☐ Sampling by TÜV Rheinland Group ☐ others:
3	FCC-ID	2AYXK-IQS01
4	Description of EUT	Skincare device with RFID and BLE
5	Operating Frequency	13.56 MHz
6	Number of Channels	1
7	Rated Voltage / Frequency	Chargeable Battery Output: 3.7 V / DC Charging input: 5 V / DC (USB-C) AC/DC Adapter input: 100-240 V / 50-60 Hz
8	Antenna Type	☒ Integral antenna ☐ Permanent antenna connector
9	Used Samples	A002980367-004
10	Accessory Devices	AC/DC Adapter Model: ICP06C-050-1000B Manufacturer: Shen Zhen Shi Yingyuan Electronics Co.,Ltd
11	Temperature Range	-5 °C to 50 °C
12	Environment	Indoor and Outdoor
13	Pictures of the EUT	

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Product description

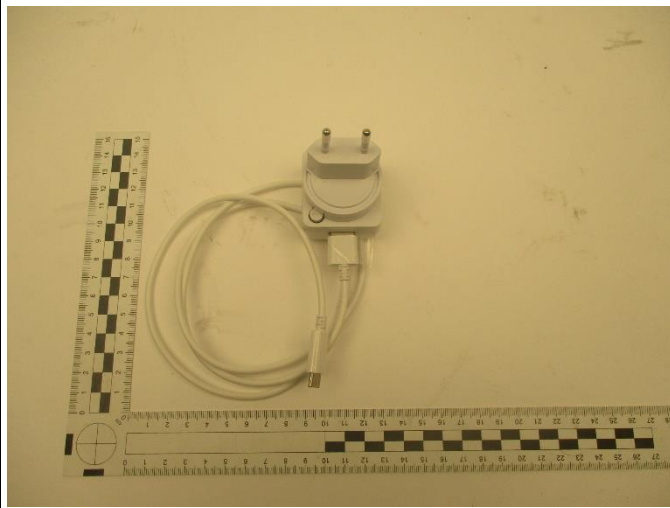
Front view



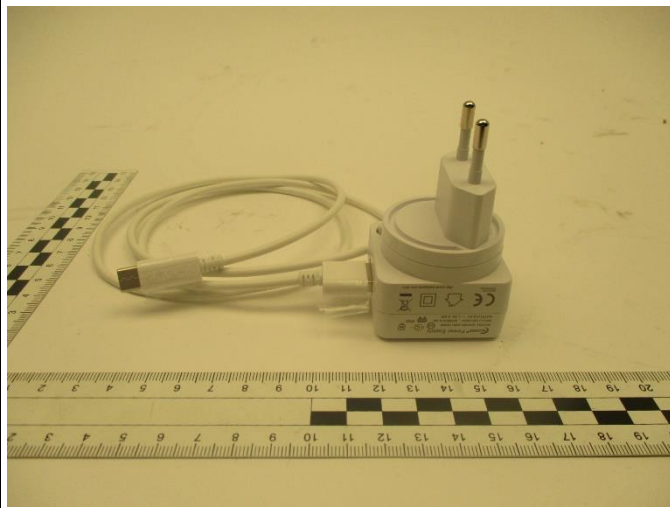
Back View



Accessory Devices (AC/DC Adapter with cable)



Accessory Devices (AC/DC Adapter with cable)



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Absatz Clause	Anforderungen – Prüfungen / Requirements - Tests	Bemerkungen / Remarks	Ergebnis Result
FCC 15.203	Antenna Requirement	-	P ☒ F ☐ N/A ☐ N/T ☐
FCC 15.215 (c)	20dB Bandwidth	-	P ☒ F ☐ N/A ☐ N/T ☐
FCC 15.225 (a)(b)(c)	Fundamental Field Strength within the band 13.110-14.010 MHz	-	P ☒ F ☐ N/A ☐ N/T ☐
FCC 15.225 (d)	Radiated Spurious Emission outside of the 13.110-14.010 MHz band	-	P ☒ F ☐ N/A ☐ N/T ☐
FCC 15.225 (e)	Frequency Stability	-	P ☒ F ☐ N/A ☐ N/T ☐
FCC 15.207	AC Power Conducted Emissions	-	P ☒ F ☐ N/A ☐ N/T ☐

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1 EUT Classification

1.1 Wireless technologies and frequencies supported by the EUT

The named technologies are only those falling in the specification of the applied standard.

Technology	Frequency Range (TX)	Supported by the EUT	Evaluated in this report
RFID	13.11 – 14.01 MHz (fc=13.56 MHz)	☒	☒

1.2 Standard specific classification of the EUT

1.2.1 Applied standards

FCC CFR 47 Part 15 Subpart C - §15.225

1.2.2 Test Methods and Guidance Documents

ANSI C63.10:2013

KDB 558074 D01 DTS Measurement Guidance v05

KDB 662911 D01 Multiple Transmitter Output v02r01

KDB 174176 D01 Line Conducted FAQ v01r01

KDB 353028 D01 Antennas Part 15 Transmitters v01

1.2.3 Type of equipment

Equipment that can be used in multiple orientations

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2 General

2.1 Registration

The measurement facilities for conducted and radiated disturbance measurements of the TÜV Rheinland LGA Products have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules. Measurement data will be accepted in conjunction with applications for Certification under Parts 15 and 18 of the Commission's Rules.

FCC Registration Number: 939976

Bundesnetzagentur Registration Number: BNetzA-CAB-17/21-16

2.2 Equipment modifications

No modifications were found to be necessary in order to perform the tests or to achieve compliance.

2.3 Test modes

Mode	Description	Mode configuration
1	Normal TX mode	The RFID function starts immediately after the EUT is turned on
2	RFID function is disabled	The EUT is in charge mode

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3 Test conditions

3.1 General

The DUT was tested standalone on the transmit test mode in normal test conditions and the conditions defined in the frequency stability test.

3.2 Normal test conditions

Environmental condition	Parameter	Range
Temperature	°C	22
Relative humidity	%	18
Supply voltage	Volts AC	120 V / 60 Hz

3.3 Antenna assemblies

No antenna connector is prepared so tests were done in radiated mode or using test fixture.

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3.4 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 quality system acc. to ISO/IEC 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.

Test	Value	Unit	Range
Frequency Error	2,7 *10 ⁻⁸	Hz	-
Frequency Stability under low voltage conditions			
Time	1,1*10 ⁻⁹	s	-
Conducted Carrier Power	1.0	dB	9k-1GHz
	1.7	dB	1GHz-6GHz
Conducted Spurious Emissions (RX/TX)	2.8	dB	6GHz-40GHz
Occupied Bandwidth (OBW)	0.1	%	-
TX Power Spectral Density	4.2	mW	9kHz - 6GHz
	1.6	dB	9kHz - 6GHz
Dwell Time	4,6 *10 ⁻⁷	Hz	-
Frequency Separation			-
Measurement of conducted emissions at the power supply connection to LISN	2.3	dB	9kHz – 150kHz
	2.2	dB	150kHz – 30MHz
Measurement of the field strength at distance 3m	1.6	dB	9k-150kHz
	4.5	dB	30-1000MHz
	5	dB	1-6GHz
	5.3	dB	6-40GHz
Temperature	0.8	K	-
Humidity	4	%	-
Voltage (AC/DC)	1.0	%	-

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4 Test results in detail

4.1 Antenna Requirement

4.1.1 Requirements / Limits

FCC Part 15, Subpart C, §15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited... further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

4.1.2 Test Results

The EUT has a permanently attached antenna (the antenna is soldered to a printed circuit board) and therefore this is sufficient to demonstrate compliance with the antenna requirement in section 15.203 according to KDB 353028 D01 Antennas Part 15 Transmitters v01.

Final test result

Pass

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4.2 20 dB bandwidth

4.2.1 Requirements / Limits

FCC Part 15, Subpart C, §15.215

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

4.2.2 Test Method

Using a direct conducted antenna port setup was not possible to measure the 20 dB Bandwidth, so a radiated test site with H-field loop Antenna was used for the measurement. The 20 dB bandwidth is measured according to ANSI C63.10:2013 clause 6.9.2.

4.2.3 Test Setup

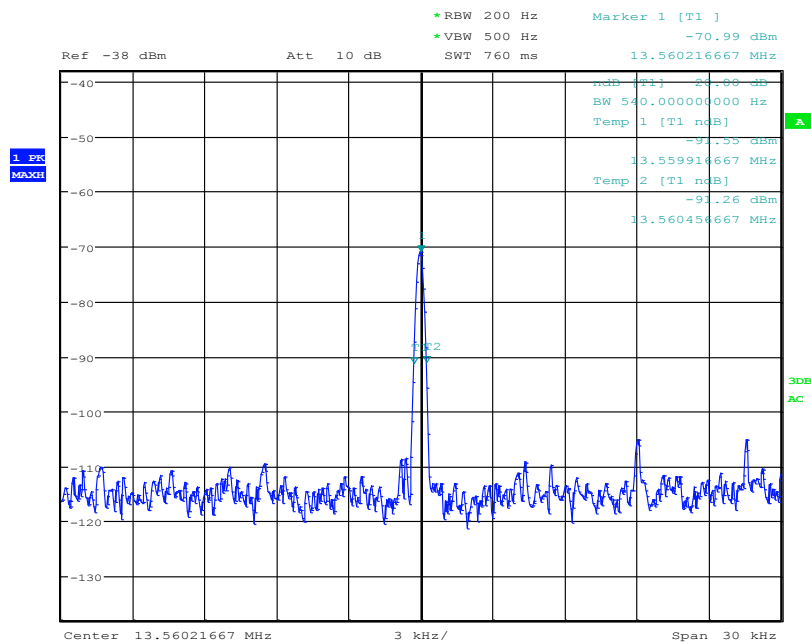
EUT		IONIQ-Skincare Body Spray - A002980367-004		
Test Condition		Normal conditions		
Chamber details		☐ 3m Fully Anechoic Chamber (FAC) ☒ 10m Semi Anechoic Chamber (SAC) ☐ Shielded room		
Measurement positioning		Distance:	EUT height:	Antenna height:
		☒ 3m ☐ 10m ☐ N/A	☐ 1.5m ☒ 0.8m	☐ 1.5m ☒ 1m
Companion device		-		
Operation mode		Mode 1: Normal TX mode		
Spectrum Analyzer	Centre Frequency	13.56 MHz		
	Resolution Bandwidth	200 Hz		
	Video Bandwidth	500 Hz		
	Span	30 kHz		
Further parameters		-		
Test engineer		M. Sc. Alaa Bustati		

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4.2.4 Test Results



Date: 20.APR.2021 12:28:41

Centre Frequency	20 dB Bandwidth (Hz)
13.56 MHz	540

Frequency	Measured frequency (MHz)	Edge Limit (MHz)	Test Result
Lower	13.5599	13.553	Pass
Upper	13.5605	13.567	Pass

Final test result	Pass
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4.3 Radiated Emission

4.3.1 Requirements / Limits

4.3.1.1 Fundamental Field Strength within the band 13.110-14.010 MHz

FCC Part 15, Subpart C, §15.225 (a)

The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

FCC Part 15, Subpart C, §15.225 (b)

Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

FCC Part 15, Subpart C, §15.225 (c)

Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

The measured values are corrected with an inverse linear distance extrapolation factor (40 dB/decade) according FCC 15.31 (f)(2).

Frequency [MHz]	Limit [μV/m]	Measurement distance [m]	Limits [dBμV/m]
13.11-13.41 13.71-14.01	106@30m	3	80.5@3m
13.41-13.553 13.567-13.71	334@30m	3	90.5@3m
13.553 – 13.567	15848@30m	3	124.0@3m

4.3.1.2 Radiated Spurious Emission outside of the 13.110-14.010 MHz band

FCC Part 15, Subpart C, §15.225 (d)

The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

FCC Part 15, Subpart C, §15.209, Radiated Emission Limits

Frequency [MHz]	Limit [μV/m]	Measurement distance [m]	Limits [dBμV/m]
0.009 – 0.49	2400/F(kHz)@300m	3	(48.5 – 13.8)@300m
0.49 – 1.705	24000/F(kHz)@30m	3	(33.8 – 23.0)@30m
1.705 – 30	30@30m	3	29.5@30m

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Used conversion factor:

$$\text{Limit [dB}\mu\text{V/m]} = 20 \log (\text{Limit } [\mu\text{V/m]} / 1\mu\text{V/m})$$

Frequency [MHz]	Limit [$\mu\text{V/m}$]	Measurement distance [m]	Limits [dB $\mu\text{V/m}$]
30 – 88	100@3m	3	40.0@3m
88 – 216	150@3m	3	43.5@3m
216 – 960	200@3m	3	46.0@3m
960 - 40000	500@3m	3	54.0@3m

§15.35(b) ..., there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit....

4.3.2 Test Method

4.3.2.1 Preliminary Test

A test program that controls instrumentation and data logging was used to automate the preliminary RF emission test procedure. Preliminary emission profile testing was performed inside the anechoic chamber. The receiving antenna was placed at a distance of 3m for all measurements. Measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT. The different measurement setup for each frequency range are shown below.

9 kHz - 30 MHz

Following Measurement Setup is used:

Test Site	Semi-anechoic chamber
Receiving Antenna	Loop antenna (HFH 2)
Receiving Antenna Height	1 m
Receiving Antenna Polarisation	Parallel – Perpendicular
EUT Table	1.0m x 1.5m non-conductive table 80cm above the floor
EUT Turn Table Step Size	22.5°
Receiver Configurations	Average and peak detectors
	RBW: 200Hz (9 - 150 kHz) and 9 kHz (150 kHz – 30 MHz)
	Step Size: 50Hz (9-150kHz) and 2.25kHz (150k-30MHz)
	Sweep Time: 100ms (FFT)

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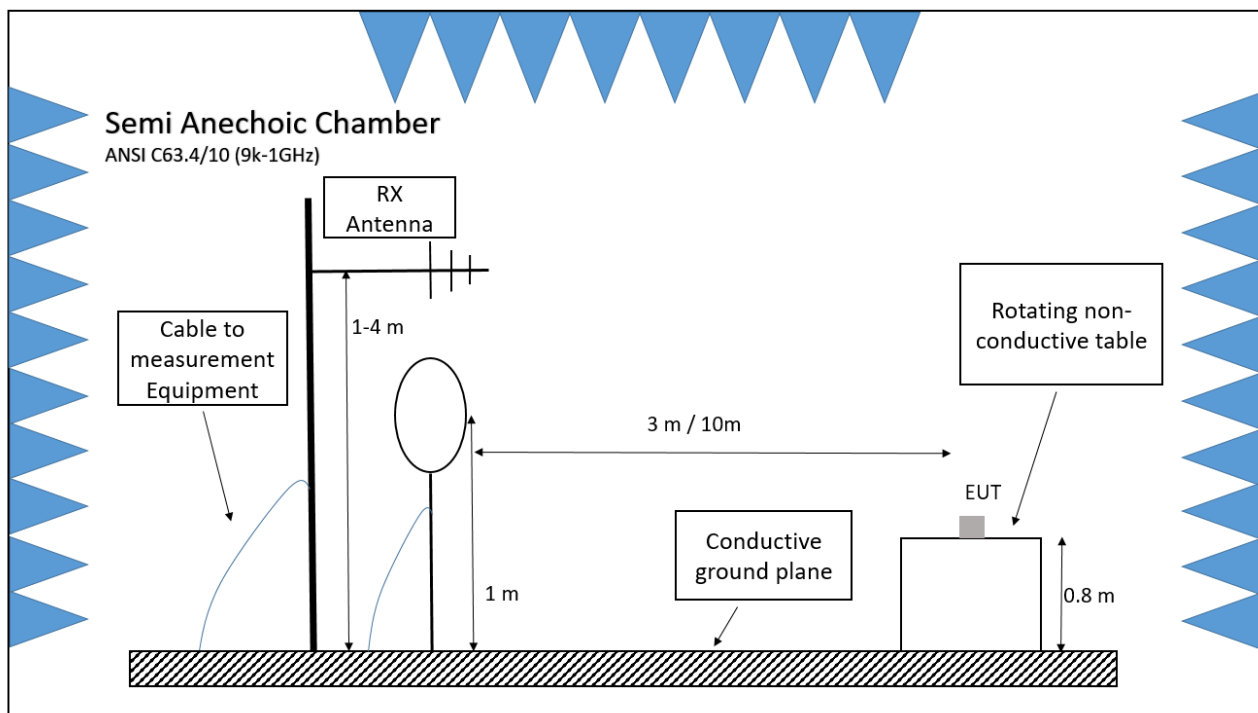
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30 MHz - 1 GHz

Following Measurement Setup is used:

Test Site	Semi-anechoic chamber
Receiving Antenna	Hybrid Antenna VULB 9168
Receiving Antenna height	Varied (1m to 4 m, step size 1m)
Receiving Antenna Polarisation	Horizontal– Vertical
EUT Table	1.0m x 1.5m non-conductive table 80cm above the floor
EUT Turn Table Step Size	45°
Receiver Configurations	Average and peak detectors
	RBW :120 kHz
	Step Size: 30kHz (30-1000MHz)
	Sweep Time : 100 ms (FFT)

For Measurements below 1 GHz, the EUT was positioned as shown in the setup photograph:



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4.3.2.2 Final Test

The placement of EUT and cables were the same as for preliminary testing. The six highest emissions relative to the limit were measured unless such emissions were more than 20 dB below the limit. If less than six emissions are within 20 dB of the limit, then the noise level of the receiver is measured at frequencies where emissions are expected. Multiples of all oscillator and microprocessor frequencies were also checked. For the measurements in the frequency range 30 MHz to 1 GHz for each measured frequency the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation. For the measurements in the frequency ranges (90-110kHz, 490kHz-1GHz) quasi-peak detector is used, while average and peak detectors are used in other ranges.

Final testing was performed on an SVSWR compliant test site.

The final average electric field value (E_{final}) is calculated in the final measurement table using the following equation:

$$E_{final} = \text{RawRec} + \text{Corr.}$$

While

$$\text{Corr.} = \text{Trd. Corr.} + \text{Sig Path} + \text{Preamp}$$

4.3.3 Test Setup

EUT	IONIQ-Skincare Body Spray - A002980367-004
Test Condition	Normal conditions
Companion device	-
Operation mode	Mode 1: Normal TX mode
Further parameters	-
Test engineer	M. Sc. Alaa Bustati

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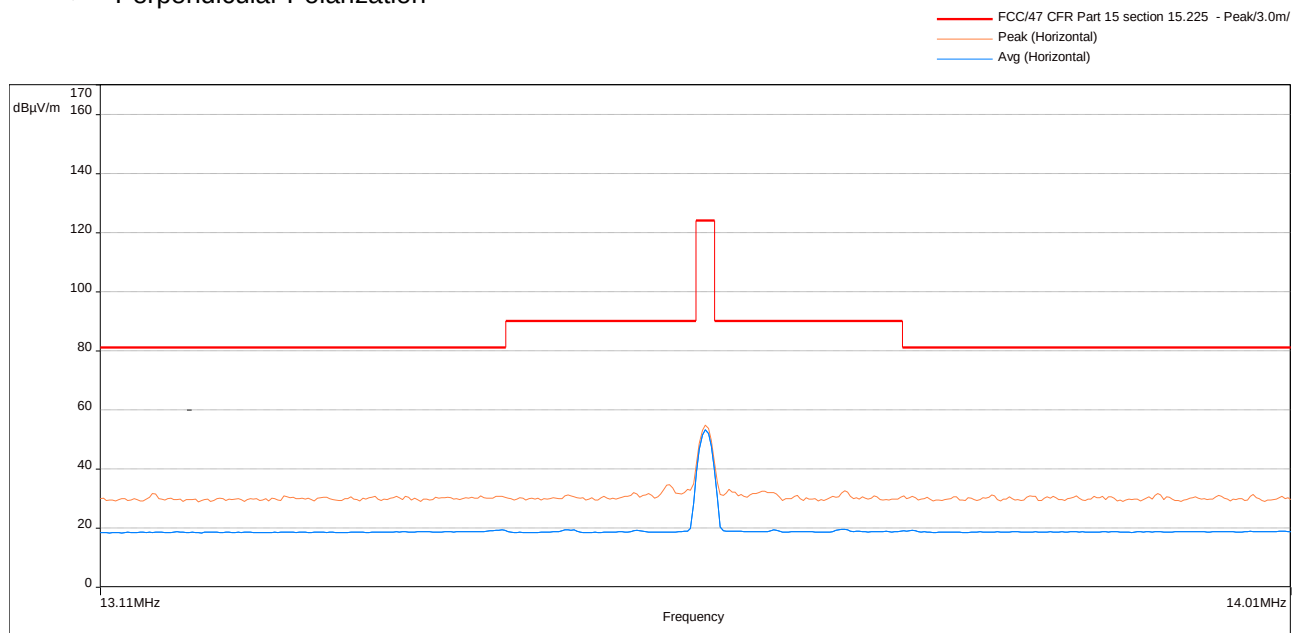
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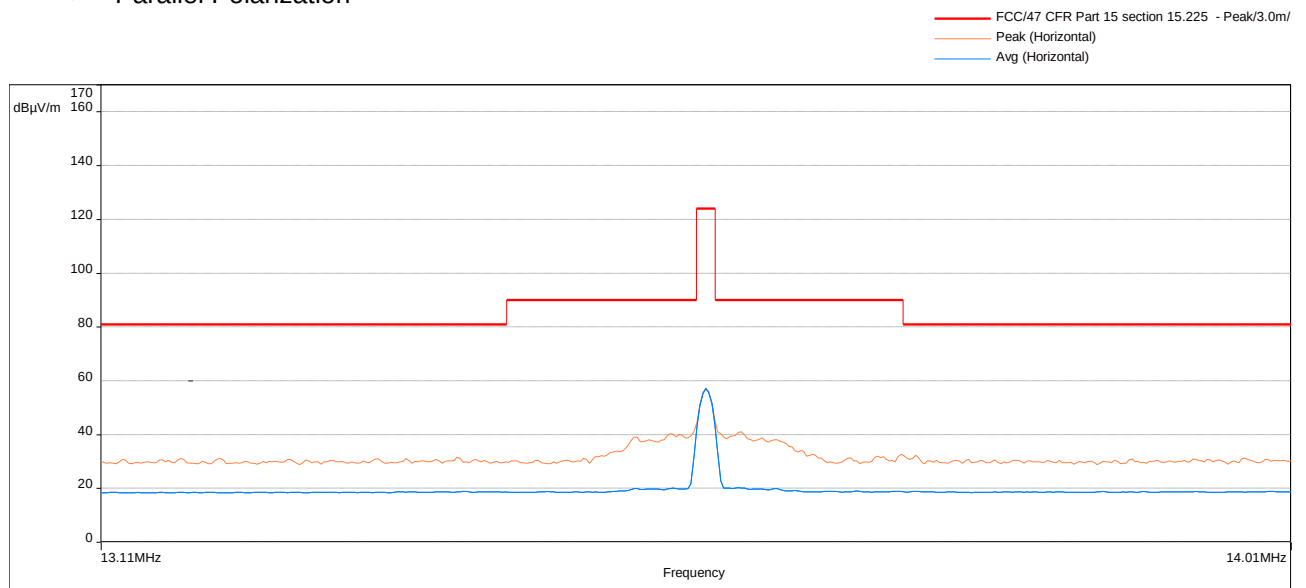
4.3.4 Test results

4.3.4.1 Fundamental Field Strength within the band 13.110-14.010 MHz

- Perpendicular Polarization



- Parallel Polarization



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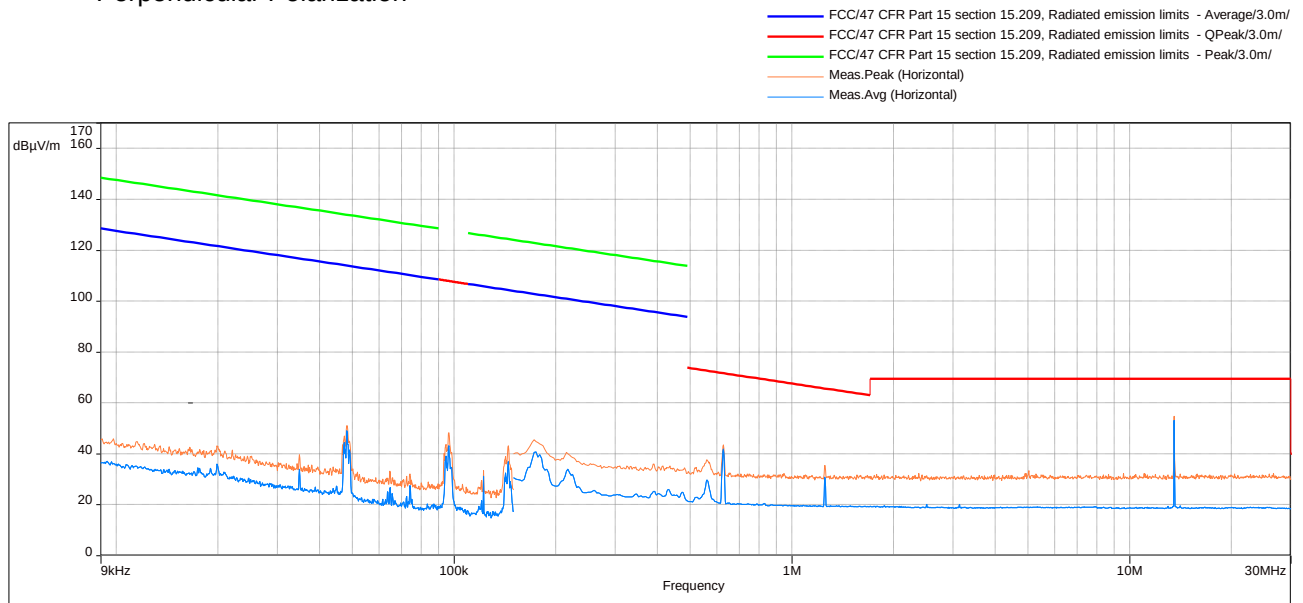
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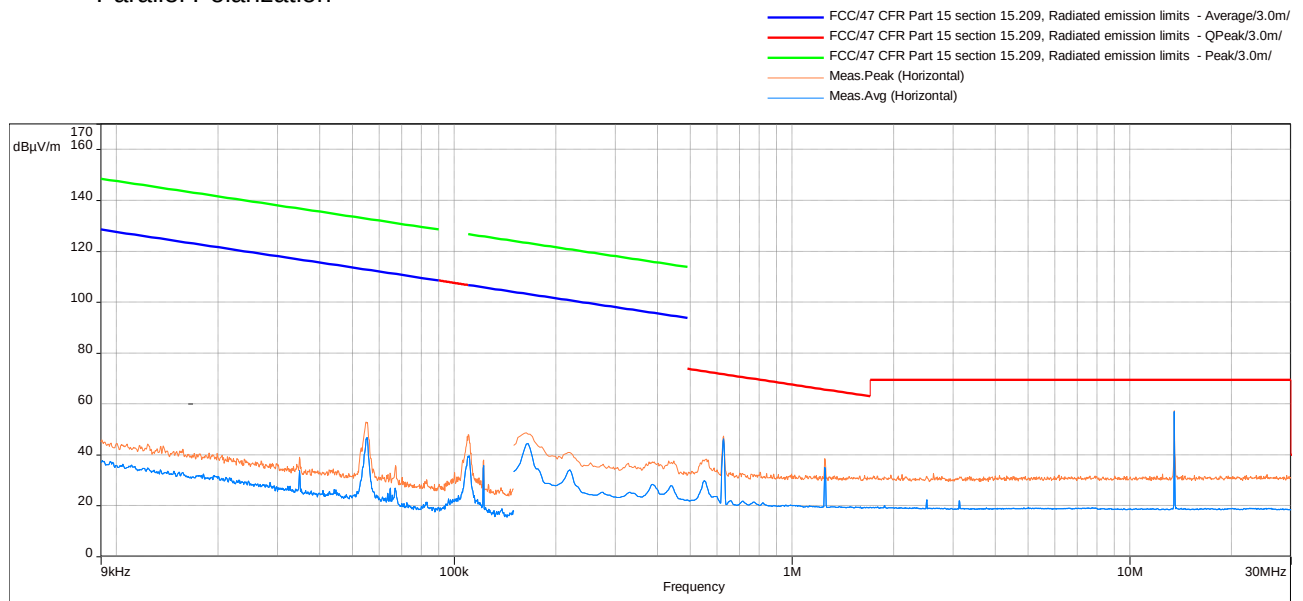
4.3.4.2 Radiated Spurious Emission outside of the 13.110-14.010 MHz band

– 9kHz to 30 MHz

• Perpendicular Polarization



• Parallel Polarization



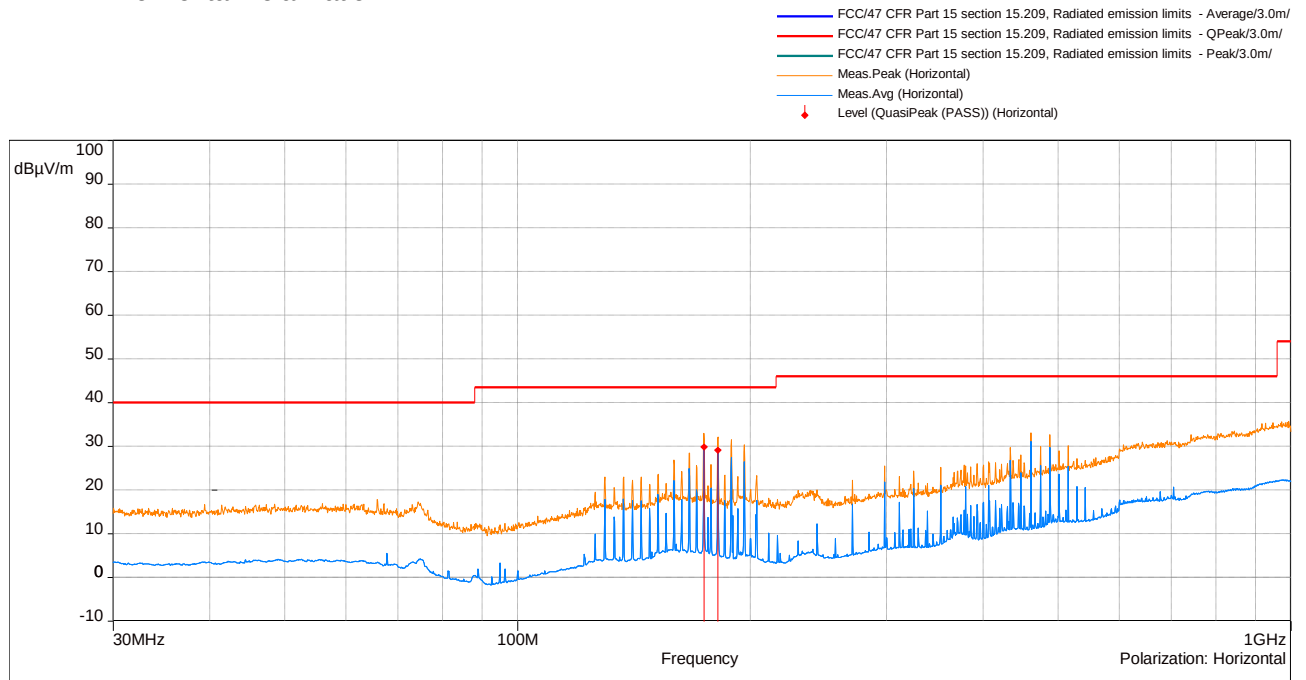
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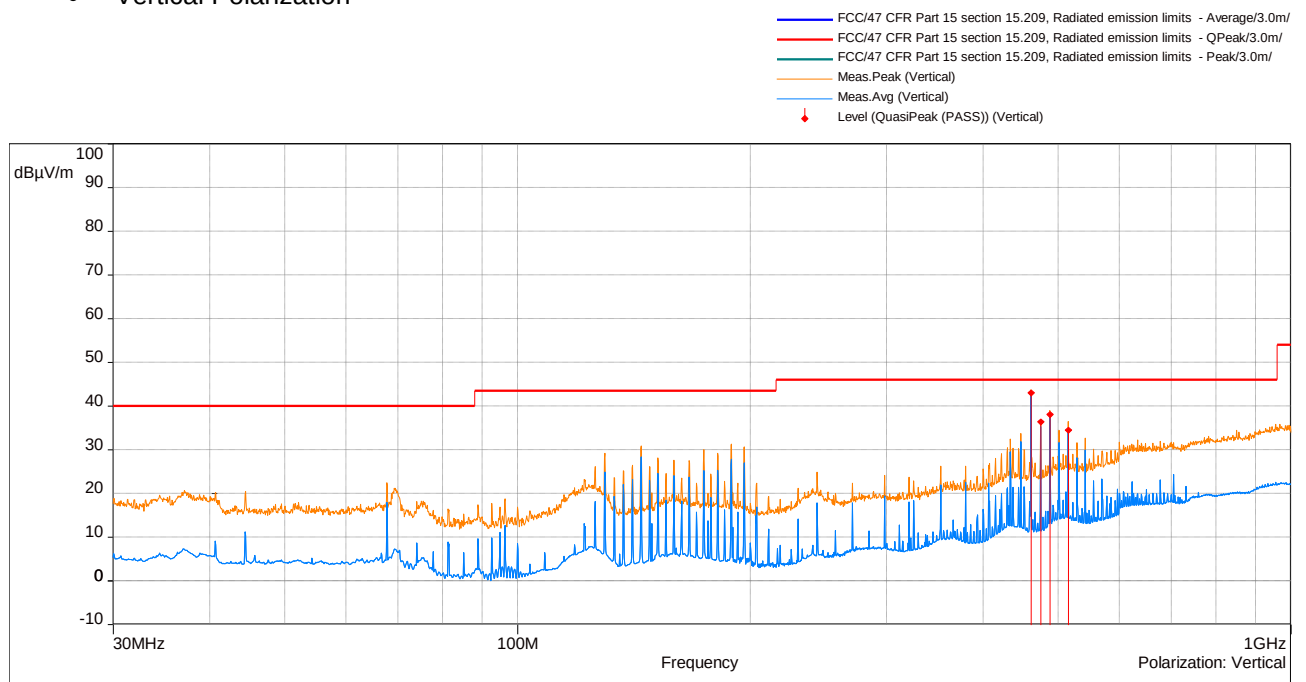
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– 30 MHz – 1 GHz

- Horizontal Polarization



- Vertical Polarization



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Frequency (MHz)	SR	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (deg)	Height (m)	Pol	Meas. Time (s)	Corr. (dB)
174.18	1	29.94	43.50	-13.56	62.20	3.00	Horizontal	1.00	14.08
181.56	1	29.15	43.50	-14.35	77.40	3.00	Horizontal	1.00	13.13
461.04	2	43.10	46.00	-2.90	168.10	1.00	Vertical	1.00	20.13
474.6	2	36.39	46.00	-9.61	185.30	1.00	Vertical	1.00	20.49
488.16	2	38.12	46.00	-7.88	179.70	1.00	Vertical	1.00	20.67
515.28	2	34.56	46.00	-11.44	177.10	1.00	Vertical	1.00	21.48

Final test result

Pass

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4.4 AC Power Conducted Emission

4.4.1 Requirements / Limits

AC power-line conducted emission measurements shall be made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz, to determine the line-to-ground radio-noise voltage that is conducted from all of the EUT current-carrying power input terminals that are directly (or indirectly via separate transformers or power supplies) connected to a public power network.

FCC Part 15, Subpart C, §15.207 (a)

... for an intentional radiator that 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 the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN).

FCC Part 15, Subpart C, §15.207, Conducted Emission Limits

Frequency [MHz]	Conducted Limit [dB μ V]	
	Quasi-peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30	60	50

*Decreases with logarithm of the frequency

FCC Part 15, Subpart C, §15.207 (c)

... Devices that include, or make provisions for, the use of battery chargers which permit operating while charging, AC adapters or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

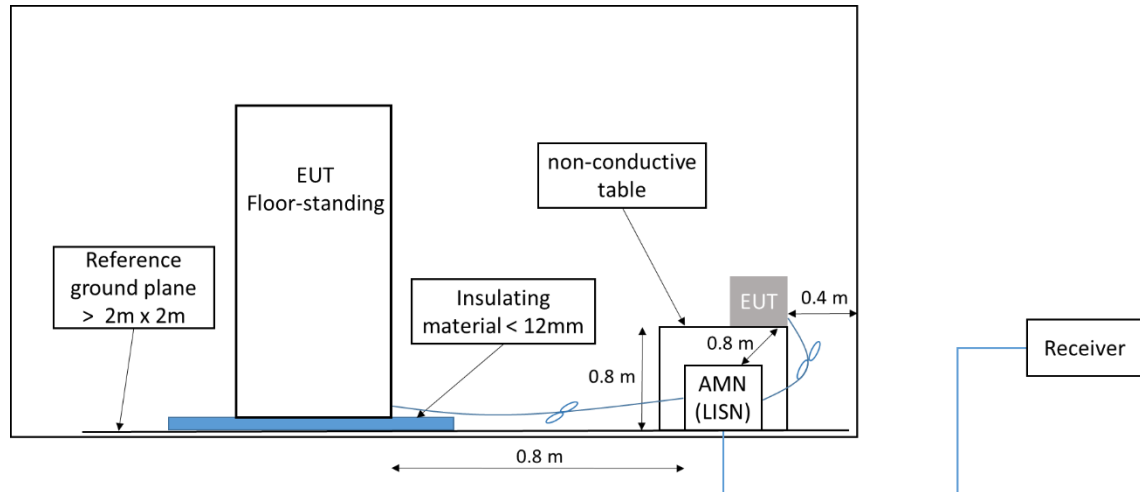
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4.4.2 Test Method

The test setup was made according to ANSI C63.10:2013 clauses 6.2.2 & 6.2.3 as shown in the photograph



The EUT with a permanent antenna operating below 30 MHz shall be tested two times according to KDB174176 D01 Line Conducted FAQ v01r01. In the first measurement the AC power-line conducted emission is tested with the antenna connected to determine compliance with limits outside the transmitter's fundamental emission. In the second measurement the antenna shall be removed and the RF output should be terminated with a suitable dummy load but instead the intentional radiator at 13.56 MHz is turned off to determine compliance in the fundamental frequency band.

4.4.3 Test Setup

EUT	IONIQ-Skincare Body Spray - A002980367-004
Test Condition	Normal conditions
Companion device	-
Operation mode	Mode 1: Normal TX mode Mode 2: RFID function is disabled
Further parameters	-
Test engineer	M. Sc. Alaa Bustati

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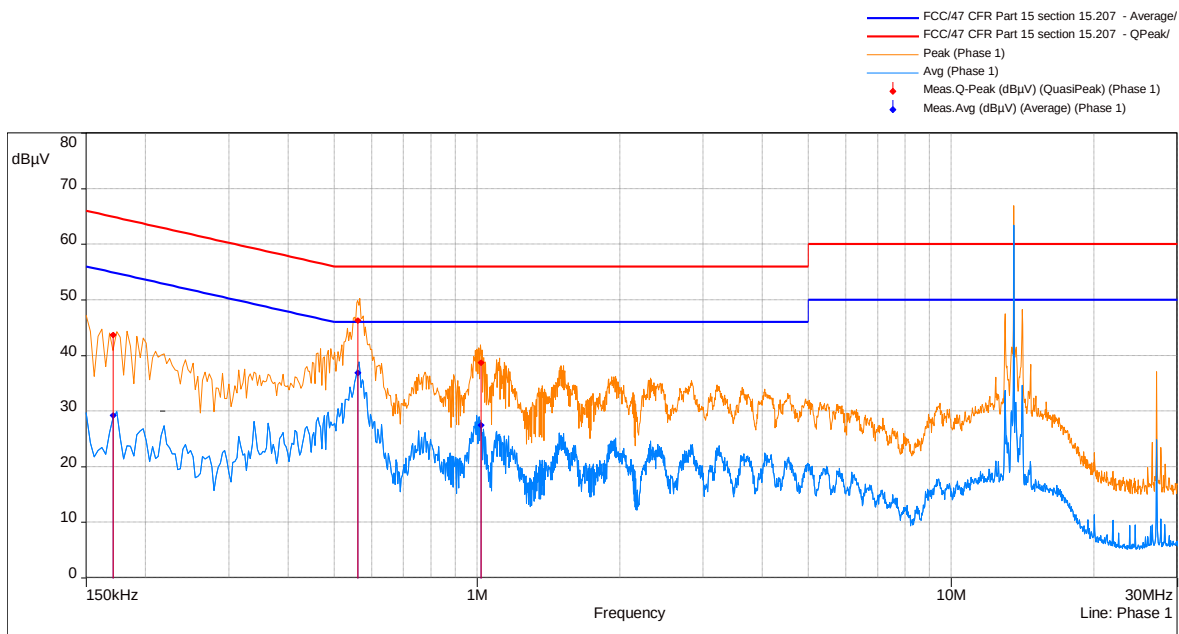
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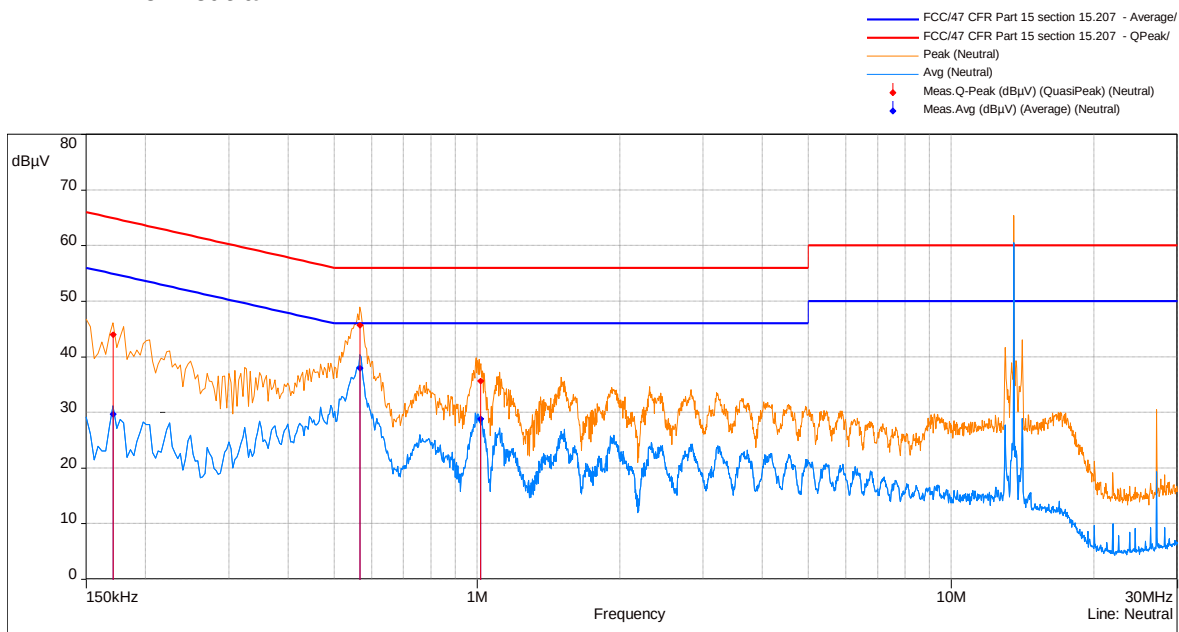
4.4.4 Test results

4.4.4.1 AC conducted emission outside the transmitter's fundamental emission

– Line: Phase 1



– Line: Neutral



Note: Emissions at 13.56 MHz are emissions inside the fundamental frequency band

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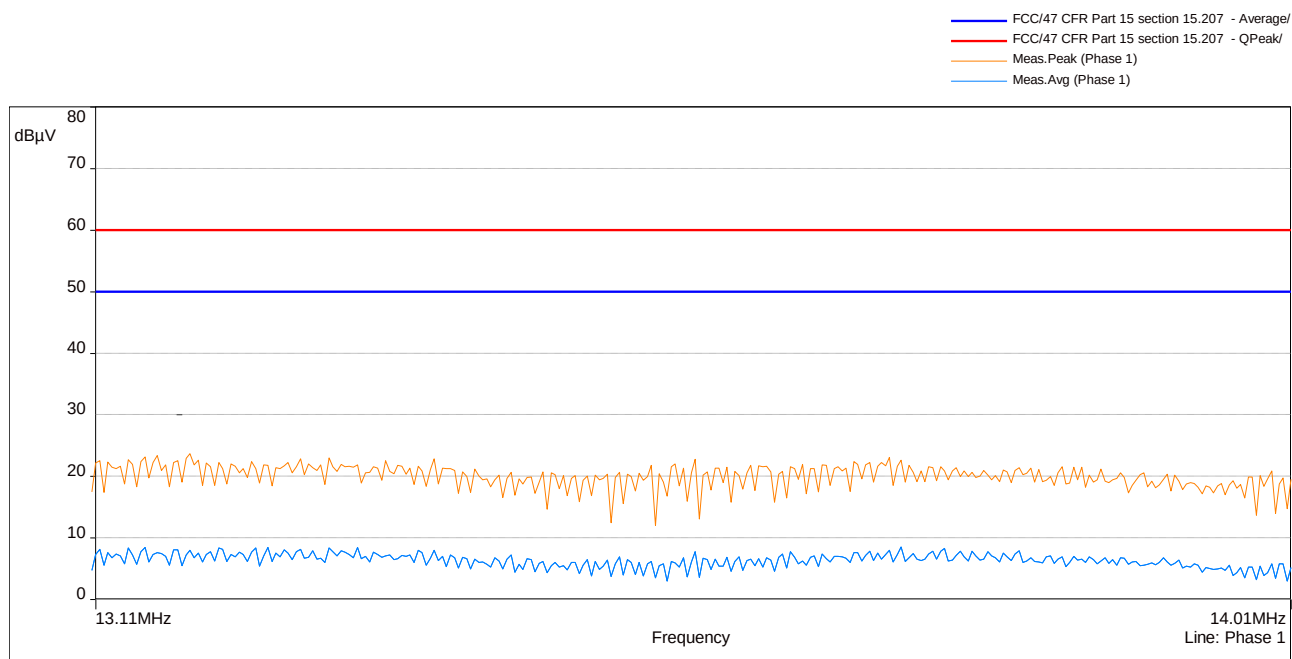
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Frequency (MHz)	SR	Meas. AVG (dBμV)	Meas. Q-Peak (dBμV)	Limit (dBμV)	Margin (dB)	Line	Result	Correction (dB)
0.17025	2	29.73	-	54.91	-25.18	Neutral	Pass	9.99
0.17025	1	29.26	-	54.91	-25.65	Phase	Pass	9.97
0.56175	1	36.91	-	46.00	-9.09	Phase	Pass	10.01
0.567	2	37.98	-	46.00	-8.02	Neutral	Pass	10.01
1.0155	2	28.90	-	46.00	-17.10	Neutral	Pass	10.03
1.01925	1	27.45	-	46.00	-18.55	Phase	Pass	10.03
0.17025	2	-	43.99	64.91	-20.92	Neutral	Pass	9.99
0.17025	1	-	43.69	64.91	-21.22	Phase	Pass	9.97
0.56175	1	-	46.33	56.00	-9.67	Phase	Pass	10.01
0.567	2	-	45.73	56.00	-10.27	Neutral	Pass	10.01
1.0155	2	-	35.67	56.00	-20.33	Neutral	Pass	10.03
1.01925	1	-	38.78	56.00	-17.22	Phase	Pass	10.03

4.4.4.2 AC conducted emission in the fundamental frequency band

– Line: Phase 1

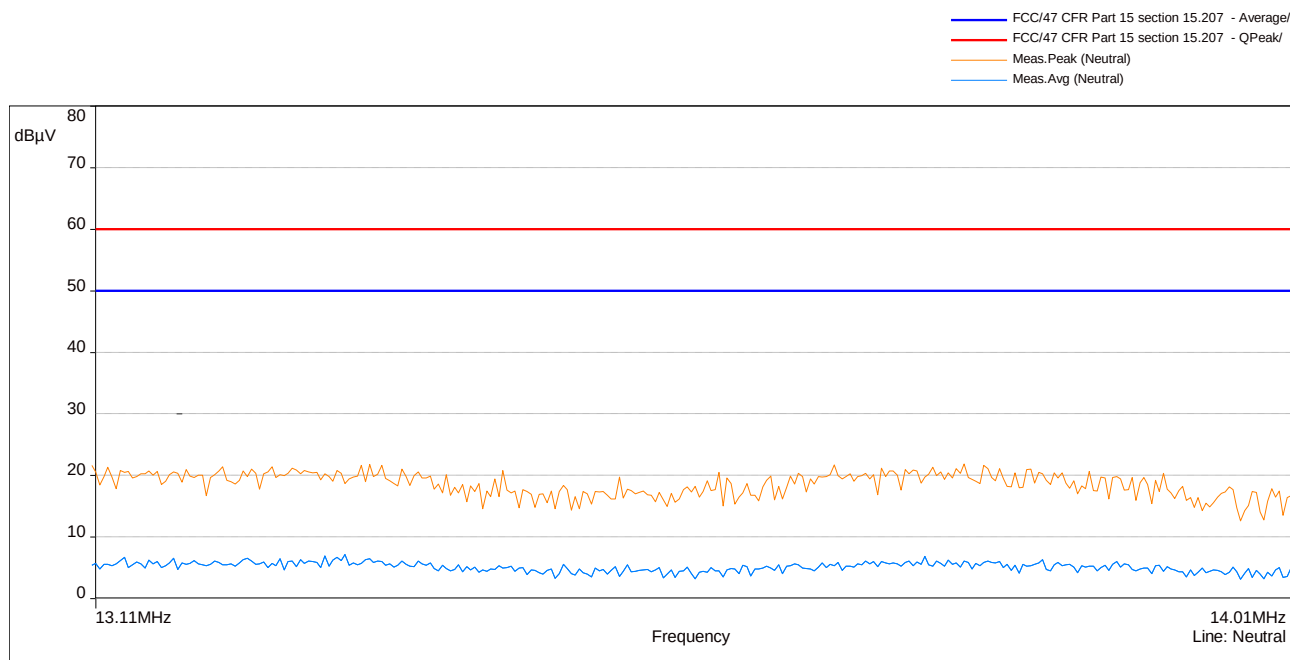


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– **Line: Neutral**



Final test result

Pass

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4.5 Frequency Stability

4.5.1 Requirements / Limits

Carrier frequency stability is the amount of drift the center of the transmit signal is from the nominal center frequency

FCC Part 15, Subpart C, §15.225 (e)

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

4.5.2 Test Method

A test setup according to ANSI C63.10:2013 clause 6.8 is prepared. The EUT is not prepared with a dummy load so an antenna is connected to the spectrum analyser with a coaxial cable and is placed near the EUT in the middle of an environmental temperature chamber to couple the EUT output to the spectrum analyser with a suitable signal level.

Frequency stability with respect to ambient temperature

The EUT is equipped with a new charged battery before the measurements started. The environmental temperature chamber is first set to $50\text{ }^{\circ}\text{C}$. After the temperature was stabilized the EUT is turned on and the frequency is measured four times, at start up, after 2 minutes, after 5 minutes, and after 10 minutes. Then the temperature is reduced by $10\text{ }^{\circ}\text{C}$ and the measurements are repeated again in the same way at $40\text{ }^{\circ}\text{C}$. Then again the degree is reduced by $10\text{ }^{\circ}\text{C}$ step and the frequency is measured each time until the minimum degree is reached (-20°C).

Frequency stability when varying supply voltage

The test is done at ambient room temperature ($+15\text{ }^{\circ}\text{C}$ to $+25\text{ }^{\circ}\text{C}$). New fully charged battery is installed in the EUT and the EUT is turned on. The frequency is measured four times, at start up, after 2 minutes, after 5 minutes, and after 10 minutes.

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4.5.3 Test Setup

EUT	IONIQ-Skincare Body Spray - A002980367-004
Test Condition	Frequency Stability conditions
Chamber details	☐ 3m Fully Anechoic Chamber (FAC) ☐ 10m Semi Anechoic Chamber (SAC) ☒ Shielded room
Measurement positioning	Distance: EUT height: Antenna height: ☐ 3m ☐ 1.5m ☐ 1.5m ☐ 10m ☐ 0.8m ☐ 1m to 4m – height scan ☒ N/A
Companion device	-
Operation mode	Mode 1: Normal TX mode
Further parameters	-
Test engineer	M. Sc. Alaa Bustati

4.5.4 Test results

	Startup		2 Minutes		5 Minutes		10 Minutes		
Temperature	Frequency [MHz]	Drift [%]	Frequency [MHz]	Drift [%]	Frequency [MHz]	Drift [%]	Frequency [MHz]	Drift [%]	Result
50	13.560478	0.00353	13.560449	0.00331	13.56042	0.00310	13.560391	0.00288	Pass
40	13.560463	0.00341	13.560434	0.00320	13.56042	0.00310	13.56042	0.00310	Pass
30	13.560492	0.00363	13.560521	0.00384	13.560507	0.00373	13.560507	0.00374	Pass
20	13.560709	0.00523	13.560637	0.00470	13.560623	0.00459	13.560652	0.00481	Pass
10	13.560362	0.00267	13.560319	0.00235	13.560304	0.00224	13.560319	0.00235	Pass
0	13.560434	0.00320	13.56042	0.00310	13.56042	0.00310	13.56042	0.00310	Pass
-10	13.560492	0.00363	13.560478	0.00353	13.560478	0.00353	13.560478	0.00353	Pass
-20	13.560492	0.00363	13.560492	0.00363	13.560492	0.00363	13.560492	0.00363	Pass

	Startup		2 Minutes		5 Minutes		10 Minutes		
Voltage	Frequency [MHz]	Drift [%]	Frequency [MHz]	Drift [%]	Frequency [MHz]	Drift [%]	Frequency [MHz]	Drift [%]	Result
3.7	13.56042	0.00310	13.56042	0.00310	13.56042	0.00310	13.56042	0.00310	Pass

Final test result

Pass

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Liste der verwendeten Prüfmittel
List of used test equipment

6 Equipment List

6.1 Hardware

Prüfmittel <i>Test equipment</i>		Prüfmittel-Nr. / ID-Nr. <i>Equipment No. / ID-No.</i>	Letzte Kalibrierung <i>Last calibration</i>	Nächste Kalibrierung <i>Next calibration</i>
Test System TS8997: Spectrum Analyzer: FSV-30	Rohde & Schwarz	2728871	07.2019	07.2021
Antenna HFH 2	Rohde & Schwarz	2728893	06.2018	06.2021
Semi-Anechoic Chamber 30-1000 MHz	Siemens	2729645	06.2020	06.2022
Antenna VULB 9168	Schwarzbeck	2728787	09.2019	09.2022
Receiver ESU 26	Rohde & Schwarz	2728898	08.2020	08.2021
Receiver ESU 8	Rohde & Schwarz	2728148	10.2020	10.2021
Line Impedance Stabilization Network ESH2-Z5	Rohde & Schwarz	2731908	06.2018	06.2021
Limiter ESH3-Z2	Rohde & Schwarz	2730114	05.2019	05.2021
Climatic chamber PL-3 KPH	Espec	2731999	01.2019	01.2022

6.2 Software

Test Software	Developer	Version
BAT-EMC	NEXIO	3.19.1.25

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Änderungsverzeichnis Change history

7 Change History

Revision Number	List of revisions						Date of issue
DE21RISG 001	Initial Release						24.02.2021
DE21RISG 002	Page	Line	Type	What has been inserted or deleted	Author	Date	20.04.2021
	13	28	Deleted	10 kHz	Alaa Bustati	2021-04-20	
	13	28	Inserted	200 Hz	Alaa Bustati	2021-04-20	
	13	29	Deleted	30 kHz	Alaa Bustati	2021-04-20	
	13	29	Inserted	500 Hz	Alaa Bustati	2021-04-20	
	13	30	Deleted	100 kHz	Alaa Bustati	2021-04-20	
	13	30	Inserted	30 kHz	Alaa Bustati	2021-04-20	
	14	1	Deleted	/	Alaa Bustati	2021-04-20	
	14	1	Inserted	/	Alaa Bustati	2021-04-20	
	14	3	Deleted	36.538	Alaa Bustati	2021-04-20	
	14	3	Inserted	540	Alaa Bustati	2021-04-20	
	14	7	Deleted	13.541	Alaa Bustati	2021-04-20	
	14	7	Inserted	13.5599	Alaa Bustati	2021-04-20	
	14	7	Deleted	13.110	Alaa Bustati	2021-04-20	
	14	7	Inserted	13.553	Alaa Bustati	2021-04-20	
	14	8	Deleted	13.578	Alaa Bustati	2021-04-20	
	14	8	Inserted	13.5605	Alaa Bustati	2021-04-20	
	14	8	Deleted	14.010	Alaa Bustati	2021-04-20	
	14	8	Inserted	13.567	Alaa Bustati	2021-04-20	
Note: Latest revision report will replace all previous reports.							

Ende des Prüfberichts
End of Test Report