

Test Report No.: <i>Prüfbericht-Nr.:</i>	DE22N2UX 002	Order No.: <i>Auftrags-Nr.:</i>	1110669_090	Page 1 of 36 Seite 1 von 36	
Client Reference No.: <i>Kunden-Referenz-Nr.:</i>	—	Order date: <i>Auftragsdatum:</i>	2022-03-15		
Client: <i>Auftraggeber:</i>	Julius Blum GmbH, Industriestr. 1, 6973 Höchst, Österreich				
Test item: <i>Prüfgegenstand:</i>	Servo Motor (household appliance)				
Identification / Type No.: <i>Bezeichnung / Typ-Nr.:</i>	Servo Drive AVENTOS HFSL top Modell: 23.A001				
Order content: <i>Auftrags-Inhalt:</i>	Prüfung der elektromagnetischen Verträglichkeit EMV / Test of electromagnetic compatibility EMC				
Test specification: <i>Prüfgrundlage:</i>	Komplettprüfung / Complete test 47 CFR FCC Part 15 Subpart B ICES-003:issue 7				
Date of receipt: <i>Wareneingangsdatum:</i>	2022-05-04				
Test sample No.: <i>Prüfmuster-Nr.:</i>	A003254653-019				
Testing period: <i>Prüfzeitraum:</i>	2022-05-27 - 2022-06-09				
Place of testing: <i>Ort der Prüfung:</i>	Nürnberg / Nuremberg				
Testing laboratory: <i>Prüflaboratorium:</i>	EMV Labor / EMC test lab				
Test result*: <i>Prüfergebnis*:</i>	PASS				
tested by: <i>geprüft von:</i>	 29.09.2022 Signiert von: Sami Ullah		authorized by: <i>genehmigt von:</i>	 12.10.2022 Signiert von: Patrick Reusch	
Date: <i>Datum:</i> 2022-09-29	Issue Date: <i>Ausstelldatum:</i> 2022-09-29		Position / Stellung Expert/Sachverständige(r)		
Other / Sonstiges: The test report DE22N2UX 002 replaces the test report DE22N2UX 001 (FCC and IC IDs' have been updated)					
Condition of the test item at delivery: <i>Zustand des Prüfgegenstandes bei Anlieferung:</i>			Test item complete and undamaged <i>Prüfmuster vollständig und unbeschädigt</i>		
* 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 * Legende: P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet					
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. <i>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.</i>					

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Remarks Anmerkungen

1	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>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.</i> <i>Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden.</i>
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3	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>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>
4	The measurement uncertainty of the measurement procedures listed in this test report does not include the compliance of the respective limit values / operating conditions. For emission tests the requirements, CISPR 16-4-2 / EN 55016-4-2 (chapter 4.2) apply in their current form. For immunity tests, the specific dated requirements of the applied measurement and test procedures shall apply. <i>Die Messunsicherheit der in diesem Prüfbericht aufgeführten Messverfahren wird nicht in die Einhaltung der jeweiligen Grenzwerte / Betriebsbedingungen mit einbezogen. Für Emissionsprüfungen gelten die Anforderungen CISPR 16-4-2 / EN55016-4-2 (Kapitel 4.2) in aktueller Form. Für Störfestigkeitsprüfungen gelten die speziellen datierten Anforderungen der angewendeten Mess- und Prüfverfahren.</i>

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Remarks
Anmerkungen

- | | |
|----------|--|
| 5 | <p>Unless otherwise agreed with the customer, a conformity assessment is always carried out based on the applied standards.
At the customer's request, the statement on the conformity of the product tested in this test report is carried out according to the criteria/requirements of the applied standards.
Evaluation conditions deviating from these are documented separately in the respective chapters.</p> <p><i>Sofern mit dem Kunden keine abweichende Regelung getroffen wurde, wird eine Konformitätsbewertung grundsätzlich auf Basis der angewendeten Normen durchgeführt.
Auf Kundenwunsch wird die Aussage zur Konformität des in diesem Prüfbericht geprüften Produktes nach den Kriterien/Anforderungen der angewendeten Normen durchgeführt.
Davon abweichende Bewertungsbedingungen werden in den jeweiligen Kapiteln gesondert dokumentiert.</i></p> |
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Product description

6	Identical types	—
7	Description	Refer to technical documentation and user manual
8	Serial number	—
9	Manufacturer	identisch mit Auftraggeber / same as applicant
10	Rated voltage	120 V AC (during conducted emission test) 24 V DC
11	Rated frequency	60 Hz (during conducted emission test)
12	Rated current	—
13	Rated power consumption	—
14	Equipment type	Sonstiges/Other
15	Equipment categorie	—
16	Number of phases	1
17	Protection class	I - Schutzleiter/Protective earth
18	Hardware version	—
19	Software version	—
20	Other	Bluetooth short burst at 2.4GHz FCC ID: W95-23A001 IC: 8352A-23A001
21	Test sample obtaining:	☒ Sending by customer ☐ Sampling by TÜV Rheinland Group ☐ others:

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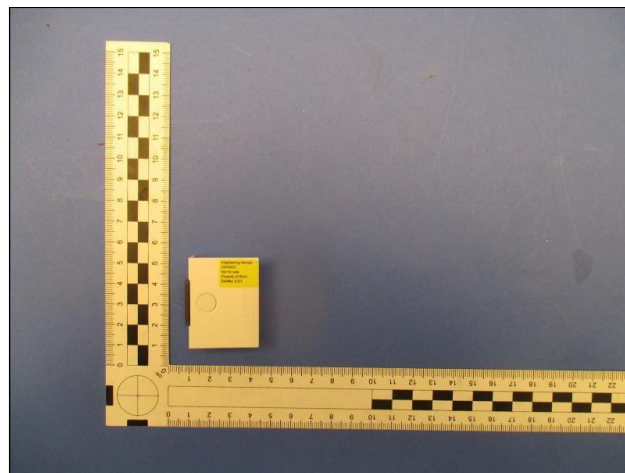
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Product description

Picture 1



Picture 2



Picture 3



Picture 4



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Clause	Requirements – Tests	Measuring results - Remarks	Result
22	Conducted voltage emissions FCC Part 15 Subpart B ICES-003:issue 7	<i>Details in protocol number:</i> 1271 <i>Operating mode:</i> Continuous operation <i>EUT:</i> Servo Drive AVENTOS HFSL top Modell: 23.A001 (A003254653-019) <i>Terminals:</i> Netzleitung / Supply line <i>Remarks:</i>	P ☒ F ☐ N/A ☐ N/T ☐

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Clause	Requirements – Tests	Measuring results - Remarks	Result
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Limits

47 CFR FCC Part 15 Subpart B section §15.107

Except for Class A digital devices, for equipment 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). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

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

*Decreases linearly with the logarithm of the frequency.

For a Class A digital device 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 LISN. Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency [MHz]	Quasi-peak [dB(μ V)]	Average [dB(μ V)]
0.15 – 0.5	79	66
0.5 – 30	73	60

ICES-003 section 3.2.1

Frequency [MHz]	Class A Quasi-peak [dB(μ V)]	Class A Average [dB(μ V)]	Class B Quasi-peak [dB(μ V)]	Class B Average [dB(μ V)]
0.15 – 0.5	79	66	66 to 56*	56 to 46*
0.5 – 5	73	60	56	46
5 – 30	73	60	60	50

*Decreases linearly with the logarithm of the frequency.

Method of measurement of conducted emission

Floor-standing equipment was placed on a non-conducting support (up to 15 cm) over the reference ground plane. Tabletop equipment was placed on a table at a height of 0.8 m above the reference ground plane. All equipment was minimum 0.4 m away from the conducting walls of a shielded room. The Artificial Mains Network (AMN) was placed 0.8 m away from the boundary of the unit under test and bonded to the ground reference plane. All other units of the EUT and associated equipment were at least

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Clause	Requirements – Tests	Measuring results - Remarks	Result										
	0.8 m from the AMN. Supporting units were connected to other AMN if necessary. A pre-scan was made with peak and average-detector on all mains lines at the output of the AMN. The whole required frequency range was investigated for maximum conducted interferences. After data reduction, a final measurement of the highest emissions was made with quasi-peak and average detector with a measurement time of at least 1 s per single frequency.												
23	Radiated disturbance FCC Part 15 Subpart B ICES-003:issue 7	<i>Details in protocol number:</i> 1277 <i>Operating mode:</i> Dauerbetrieb / Continuous operation <i>EUT:</i> Servo Drive AVENTOS HFSL top Modell: 23.A001 (A003254653-019) <i>Terminals:</i> Gehäuse / Enclosure <i>Remarks:</i>	P ☒ F ☐ N/A ☐ N/T ☐										
24	Radiated disturbance (> 1 GHz) 47 CFR FCC Part 15 Section 15.109 ICES-003:issue 7	<i>Details in protocol number:</i> 1278 <i>Operating mode:</i> Dauerbetrieb / Continuous operation <i>EUT:</i> Servo Drive AVENTOS HFSL top Modell: 23.A001 (A003254653-019) <i>Terminals:</i> Gehäuse / Enclosure <i>Remarks:</i>	P ☒ F ☐ N/A ☐ N/T ☐										
	Limits 47 CFR FCC Part 15 Subpart B section §15.109 Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values <table><tr><td>Frequency [MHz]</td><td>Quasi-peak [dB(µV)/m]</td></tr><tr><td>30 – 88</td><td>40</td></tr><tr><td>88 – 216</td><td>43.5</td></tr><tr><td>216 – 960</td><td>46</td></tr><tr><td>Above 960</td><td>54</td></tr></table>			Frequency [MHz]	Quasi-peak [dB(µV)/m]	30 – 88	40	88 – 216	43.5	216 – 960	46	Above 960	54
Frequency [MHz]	Quasi-peak [dB(µV)/m]												
30 – 88	40												
88 – 216	43.5												
216 – 960	46												
Above 960	54												

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Clause	Requirements – Tests	Measuring results - Remarks	Result
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The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the following, using measurement instrumentation employing a CISPR quasi-peak detector.

Frequency [MHz]	Quasi-peak [dB(μV)/m]
30 – 88	39.1
88 – 216	43.5
216 – 960	46.4
Above 960	49.5

Note: For frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function.
When average radiated emission measurements are specified, there also is a limit on the peak level of the radio frequency emissions which is 20 dB above the maximum permitted average emission limit. (see § 15.35 Measurement detector functions and bandwidths)

As an alternative to the radiated emission limits shown above, digital devices may be shown to comply with the standards contained in Third Edition of the International Special Committee on Radio Interference (CISPR), Pub. 22 (acc. §15.109 (g)).

The field strength of radiated emissions from Class B devices at a distance of 10 meters shall not exceed the following values

Frequency [MHz]	Quasi-peak [dB(μV)/m]
30 – 230	30
230 - 1000	37

The field strength of radiated emissions from Class A devices at a distance of 10 meters shall not exceed the following values

Frequency [MHz]	Quasi-peak [dB(μV)/m]
30 – 230	40
230 - 1000	47

ICES-003 section 3.2.2

Radiated emissions limits (30 MHz to 1 GHz)

Frequency [MHz]	Class A (3 m) Quasi-peak [dB(μV)/m]	Class A (10 m) Quasi-peak [dB(μV)/m]	Class B (3 m) Quasi-peak [dB(μV)/m]	Class B (10 m) Quasi-peak [dB(μV)/m]
30 – 88	50.0	40.0	40.0	30.0
88 – 216	54.0	43.5	43.5	33.1
216 – 230	56.9	46.4	46.0	35.6
230 – 960	57.0	47.0	47.0	37.0
960 – 1000	60.0	49.5	54.0	43.5

Radiated emission limits at 3 m distance (at and above 1 GHz)

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Clause	Requirements – Tests			Measuring results - Remarks		Result
	Frequency [GHz]	Class A Average [dB(μV)/m]	Class A Peak [dB(μV)/m]	Class B Average [dB(μV)/m]	Class B Peak [dB(μV)/m]	
	1 – F _M	60	80	54	74	
	The highest measurement frequency, F _M , in GHz, shall be determined as					
	Highest internal frequency (F _x)		Highest measurement frequency (F _M)			
	F _x ≤ 108 MHz		1 GHz			
	108 MHz < F _x ≤ 500 MHz		2 GHz			
	500 MHz < F _x ≤ 1 GHz		5 GHz			
	F _x > 1 GHz		5 x F _x up to a maximum of 40 GHz			
	F _x is the highest fundamental frequency generated and/or used in the ITE or digital apparatus under test These limit levels apply for a measurement distance of 3 m. If using a different measurement distance, the measured levels shall be extrapolated to the 3 m limit distance using a factor of 20 dB per decade of distance. The measurement distance shall place the measurement antenna in the far field of the ITE or digital apparatus under test					

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Clause	Requirements – Tests	Measuring results - Remarks	Result
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Method of measurement of radiated emission

Measurements were made in a 10-meter semi-anechoic chamber that complies to ANSI C63.4:2014. Floor-standing equipment was placed on a non-conducting support (0.1 ± 0.01) m over the reference ground plane. Tabletop equipment was placed on a table at a height of (0.8 ± 0.05) m above the reference ground plane. Preliminary measurements were performed with a receiver employing a peak detector at an antenna to EUT distance of 10 m or 3 m (as defined in the standard). The EUT was rotated in 45° steps for frequencies below 1 GHz and 22.5° steps for frequencies over 1GHz about its azimuth to determine the position of the highest emissions. The measurement antenna was adjusted between 1 m and 4 m above ground to find the maximum signal strength. These measurements were done and in both horizontal and vertical polarizations. After this, final measurements with a receiver employing a quasi-peak detector for frequencies below 1 GHz and with a peak and an average detector for frequencies above 1 GHz were performed by rotating the EUT by 360° and adjusting the receive antenna height from 1 m to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity. For frequencies over 1 GHz floor absorbers were used between antenna and EUT to fulfil the SVSWR requirements.

The whole required frequency range was investigated for maximum radiated interferences. After data reduction, a final measurement of the highest emissions was made with quasi-peak, peak and average detector with a measurement time of at least 1 s per single frequency.

The emission limits are calculated from the field strength limit of this section using this formula:

$$Emission\ level\left(\frac{dB\mu V}{m}\right) = 20\log Emission\ level\left(\frac{\mu V}{m}\right)$$

When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade as per §15.31(f)(1). For this documentation a distance extrapolation factor was added to the limit that was calculated using this formula:

$$Emission\ limit_{new}\left(\frac{dB\mu V}{m}\right) = Emission\ limit_{old} + 20\log\left(\frac{d_1}{d_2}\right)$$

Where

d_1 : old distance (e. g. 3 m)

d_2 : new distance (e. g. 10 m)

The field strength is calculated by adding the antenna factor and cable loss. The basic equation with a sample calculation is as follows:

$$E = U + AF + CA$$

Where

E : Field strength

U : Receiver reading

AF : Antenna factor

CA : Cable loss

For example:

Frequency (MHz)	Receiver reading U (dBμV)	Correction antenna factor AF + cable loss CA (dB)	Field strength E (dBμV/m)
320	15.9	15.8	31.7

ADDITIONAL DOCUMENTATION

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25 Accreditations & Endorsements

26 US Federal Communications Commission

TUV Rheinland LGA Products GmbH located at, Tillystraße 2, 90431 Nuremberg is recognized by the Bundesnetzagentur (Federal Network Agency for Electricity, Gas, Telecommunications, Post and Railway) as conformity assessment body.

FCC designation number	DE0016
Bundesnetzagentur registration number	BNetzA-CAB-17/21-16

27 Applied basic standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- Title 47 CFR FCC Part 15 Subpart B
- ANSI C63.4-2014 (Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz)
- ICES-003:2020 (Issue 7) (Information Technology Equipment (Including Digital Apparatus) — Limits and Methods of Measurement)

The test setup and test was done according to ANSI C63.4-2014.

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28 Equipment used during test

Equipment under test

Product type	Manufacturer	Model	Comments
Servo Motor (household appliance)	identisch mit Auftraggeber / same as applicant	Servo Drive AVENTOS HFSL top Modell: 23.A001	EUT

Auxiliary Equipment / Peripherals

Product type	Manufacturer	Model	Comments
Power supply	identisch mit Auftraggeber / same as applicant	Z10NE030	Auxiliary

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29 Input/Output ports

Name	Type*	Cable length	Shielded	Comments
Enclosure	N/E	—	—	None
Wechselstromanschluss / AC supply	AC	—	—	24V auxiliary power supply
DC Power Port	DC	—	N	24V DC
* AC = AC Power Port DC = DC Power Port N/E = Non-Electrical I/O = Signal Input or Output Port (Not Involved in Process Control) TP = Telecommunication Ports				

30 Internal operating frequencies

Frequency	Description
2.4GHz	Bluetooth short burst

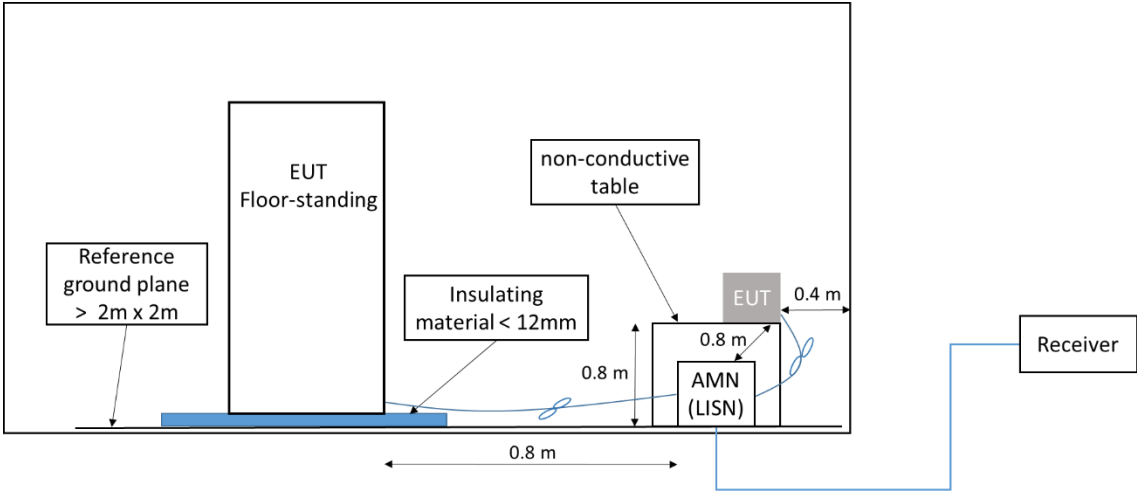
31 Operating modes

No.	Description
1	Dauerbetrieb / Continuous operation
For details see the corresponding protocol	

32 Special EMC measures

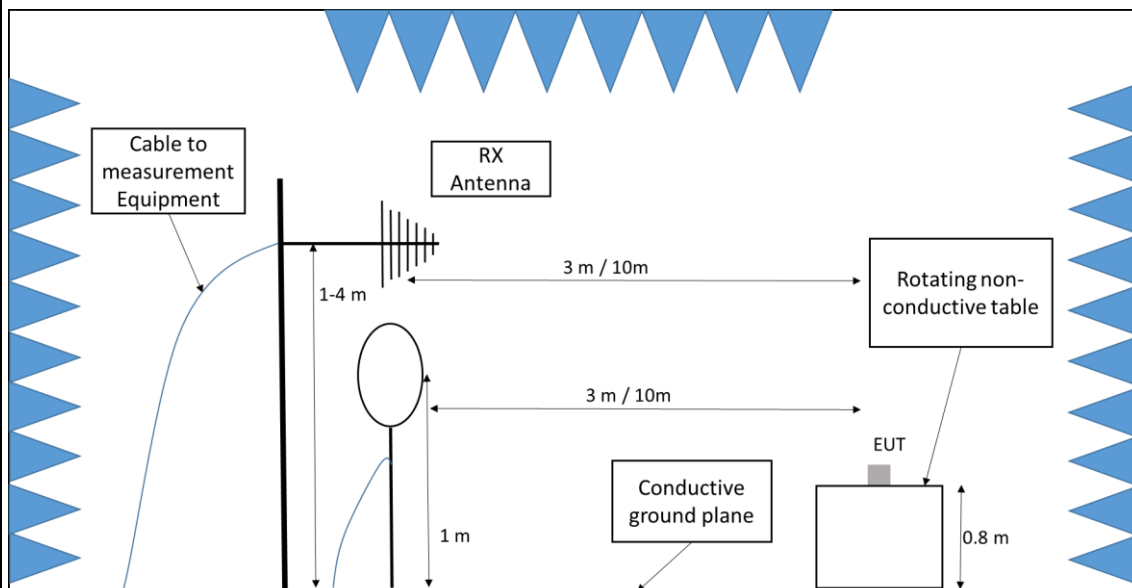
Radiated disturbance
- None
Conducted voltage emissions
- None

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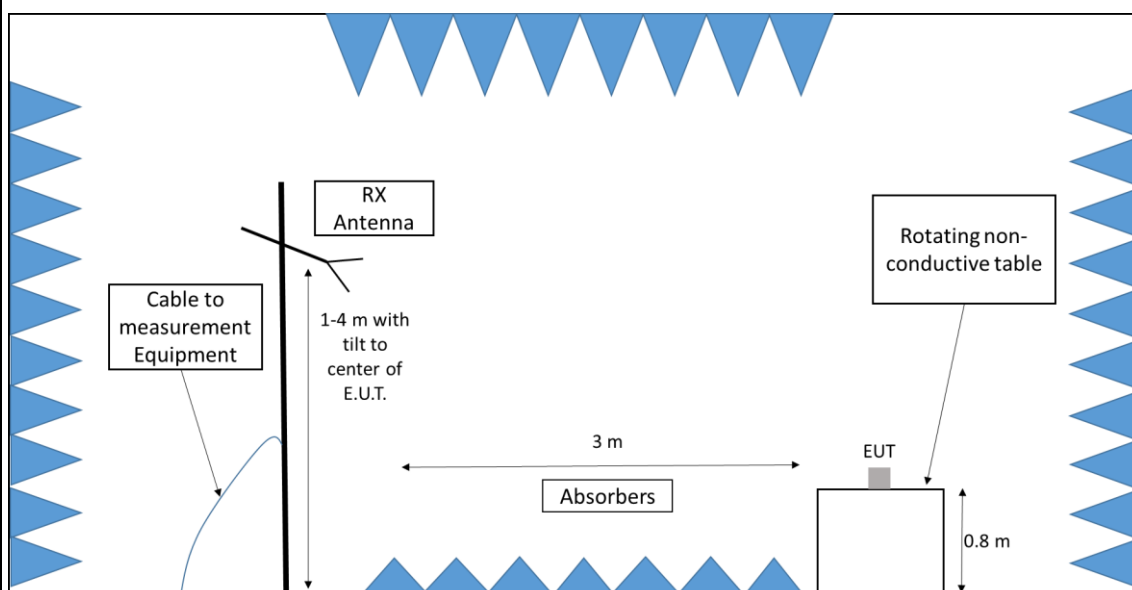
33	EUT configuration
	The test setup was made in accordance with mentioned EMC standards. Measurements and tests were executed under "worst case" conditions. Typical EUT arrangements or operating modes were chosen or assumed which let suspect maximum emission or susceptibility (a so called "unfavourable configuration"). Details of test setup or adjustments are (particularly) shown inside the photo documentation. As far as not mentioned otherwise these statements are valid for all following tests.
34	Conducted emission (9kHz – 30 MHz) acc. ANSI C63.4
	

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- 35** Field strength measurement (9 kHz – 30 MHz) with loop antenna
Field strength measurement (30 MHz – 1000 MHz) with log-per antenna acc. ANSI C63.4



- 36** Field strength measurement (>1 GHz) horn antenna acc. ANSI C63.4



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37 Climatic conditions

Ambient Temperature	15 - 35 °C
Relative Humidity	30 - 60 %
Air pressure	860 - 1060 mbar

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38 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 quality system acc. to ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation.

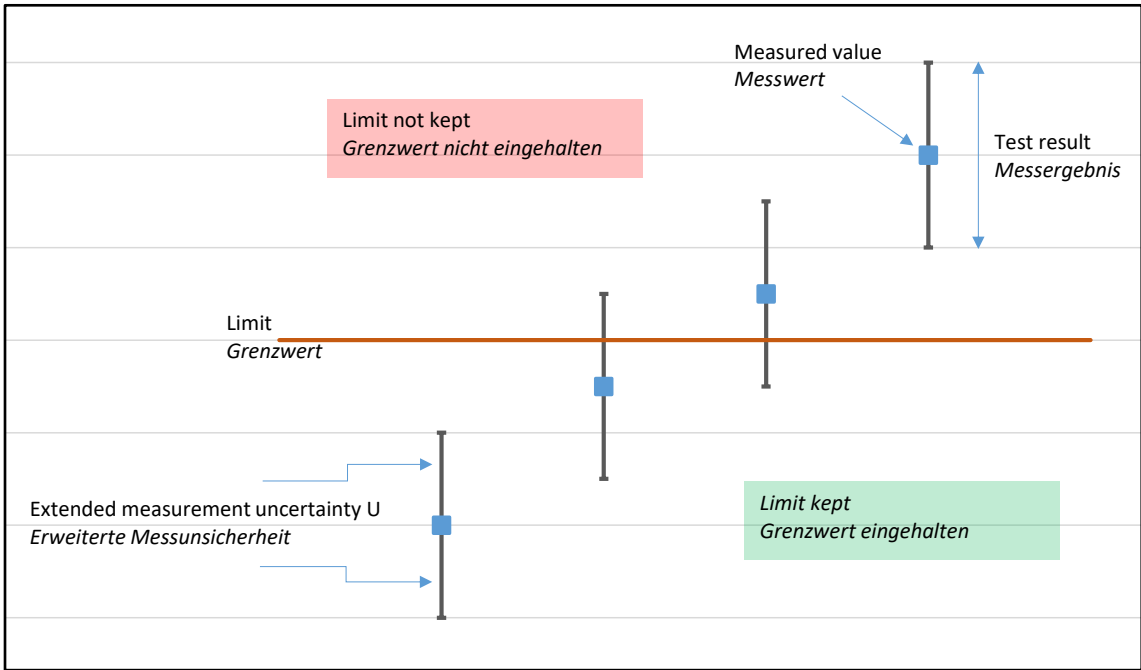
The manufacturer has the sole responsibility of continued compliance of the device.

Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.

Measurement procedure	U _{Lab}
Measurement of conducted emissions at the power supply connection to LISN in the frequency range 9k-150kHz (CISPR Band A)	2.3 dB
Measurement of conducted emissions at the power supply connection to LISN in the frequency range 150k-30MHz (CISPR Band B) with 150 ohm Delta LISN	3.3 dB
Measurement of conducted emissions at the power supply connection to LISN in the frequency range 150k-30MHz (CISPR Band B)	2.2 dB
Measurement of conducted emissions at the power supply connection to voltage probes in the frequency range 9k-30MHz (CISPR Band A and B)	2.0 dB
Measurement of conducted emissions at telecommunication connection to ISN in the frequency range 150k-30MHz (CISPR Band B) ISN CAT 5	3.3 dB
Measurement of conducted emissions at the telecommunication connection to ISN in the frequency range 150k-30MHz (CISPR Band B) ISN CAT 6 Shielded	2.6 dB
Measurement of conducted emissions at the telecommunications connection to current clamps in the frequency range 150k-30MHz (CISPR Band B)	2.2 dB
Measurement of interference power in the frequency range 30-300MHz (CISPR Band C)	2.9 dB
Measurement of interference power in the frequency range 30-300MHz (CISPR Band C) CDNE	2.6 dB

ADDITIONAL DOCUMENTATION

39 Example for interpretation of measuring results



Measured value	Limit	Extended measurement uncertainty (k=2)	Test result
48.9 dBµV @ 16.5 MHz	50 dBµV	2.2 dB	46.7 dBµV – 51.1 dBµV

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Protocol number		<u>1271</u>
Conducted voltage emissions		PASS
Applied Standard	FCC Part 15 Subpart B ICES-003	
Test method	CISPR 16-2-1	
Test sample No.	A003254653-019	
Model	Servo Drive AVENTOS HFSL top Modell: 23.A001	
Tested terminals	Netzleitung / Supply line	
Supply voltage	120 V AC	
Operating mode	Dauerbetrieb / Continuous operation	
Test setup	nach Norm (siehe Foto) / according to standard (see picture)	
EMC measures	None	
Remarks	—	
Temperature (°C)	15 - 35	
Humidity (% rH)	30 - 60	
Air pressure (mbar)	860 - 1060	
Test Software	BAT EMC 2021.0.15.2	
Tested by	Sami Ullah	
Test date	2022-05-27	

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Used test equipment

Type	Manufacturer	Model	ID	Last calibration	Next calibration
LISN	Rohde & Schwarz	ESH2-Z5	2731908	2021-06-23	2024-06-23
Limiter	Rohde & Schwarz	ESH3-Z2	2732546	2021-02-11	2023-02-11
Receiver	Rohde & Schwarz	ESU 8	2728148	2021-11-03	2022-11-03
Commutation relay	MTS Systemtechnik	KRM4-5811-T-S1	2730174	---	---
Shielded room	TDK	SR 2	—	---	---

Test parameter of Conducted voltage emissions

#1271

Sample number:A003254653-019

Model name:Servo Drive AVENTOS HFSL top Modell: 23.A001

Subrange 1 (Phase 1)	150 kHz ... 30 MHz
IF Bandwidth	9 kHz
Step Size	30001 Pts
Preamplifier	OFF
Preamplifier Auto Ranging	ON
LN-Preamplifier	OFF
RF Attenuation	Auto
Sweep Time	10 ms
Reference Level	80 dBµV
VBW	Auto
EMI Filter	6dB
Subrange 2 (Neutral)	150 kHz ... 30 MHz
IF Bandwidth	9 kHz
Step Size	30001 Pts
Preamplifier	OFF
Preamplifier Auto Ranging	ON
LN-Preamplifier	OFF
RF Attenuation	Auto
Sweep Time	10 ms
Reference Level	80 dBµV
VBW	Auto
EMI Filter	6dB

ADDITIONAL DOCUMENTATION

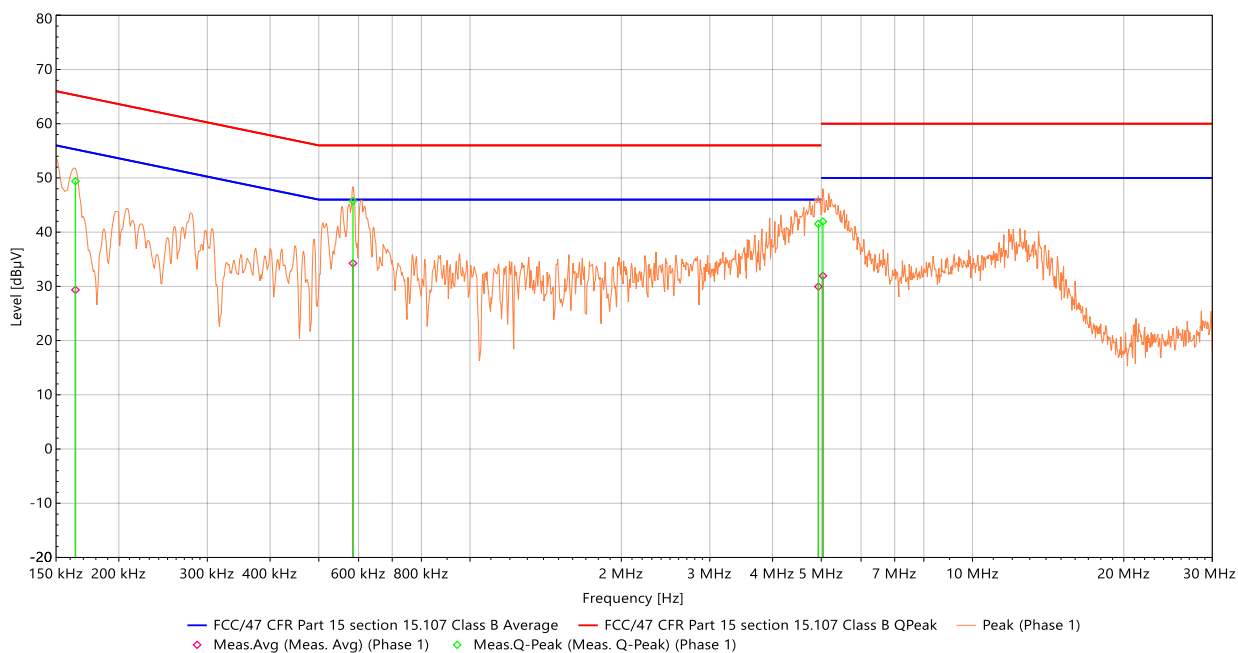
Graphical presentation of Conducted voltage emissions

#1271

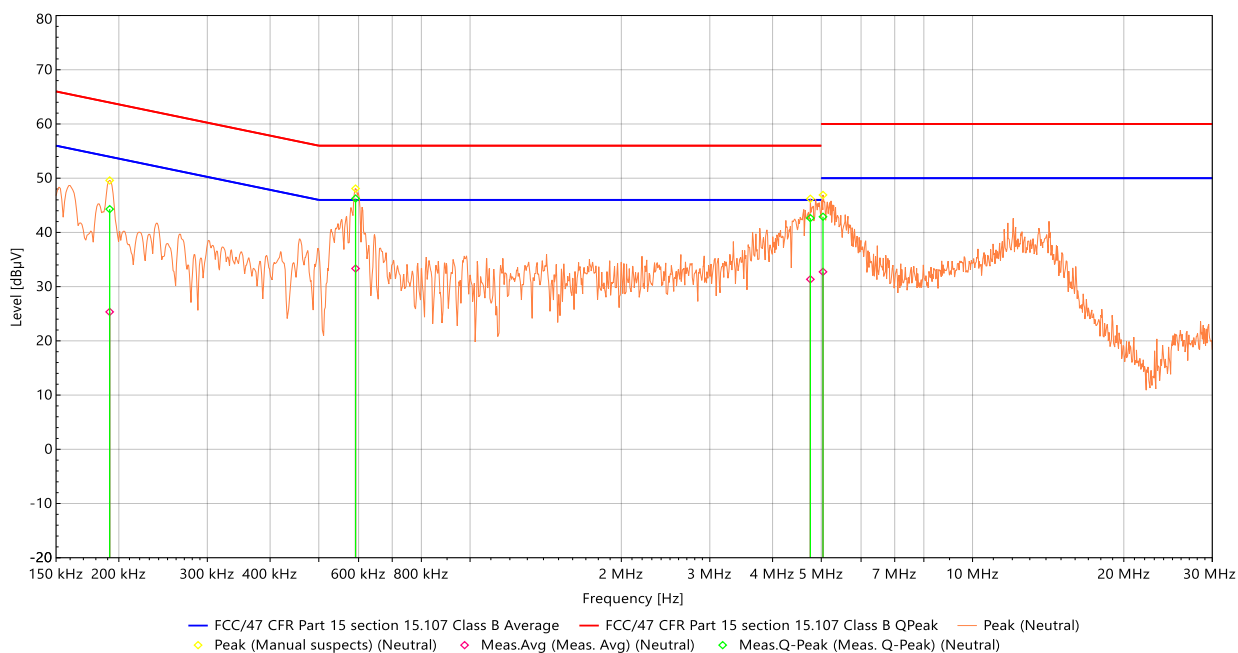
Sample number: A003254653-019

Model name: Servo Drive AVENTOS HFSL top Modell: 23.A001

Conducted voltage emissions (Phase 1)



Conducted voltage emissions (Neutral)



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ADDITIONAL DOCUMENTATION

Measurement data of Conducted voltage emissions

#1271

Sample number:A003254653-019

Model name:Servo Drive AVENTOS HFSL top Modell: 23.A001

Frequency	SR #	Meas.Avg (dBμV)	Limit (dBμV)	Meas. - Lim. (dB)	Correction (dB)	Comments
163.93 kHz	Phase 1	29.354	55.262	-25.909	10.042	PASS
584.815 kHz	Phase 1	34.25	46	-11.75	10.05	PASS
4.934955 MHz	Phase 1	29.954	46	-16.046	10.16	PASS
5.038435 MHz	Phase 1	31.943	50	-18.057	10.16	PASS
191.79 kHz	Neutral	25.344	53.959	-28.615	10.042	PASS
591.78 kHz	Neutral	33.342	46	-12.658	10.05	PASS
4.755855 MHz	Neutral	31.352	46	-14.648	10.159	PASS
5.03943 MHz	Neutral	32.733	50	-17.267	10.162	PASS

Frequency	SR #	Meas.Q-Peak (dBμV)	Limit (dBμV)	Meas. - Lim. (dB)	Correction (dB)	Comments
163.93 kHz	Phase 1	49.387	65.262	-15.875	10.042	PASS
584.815 kHz	Phase 1	45.749	56	-10.251	10.05	PASS
4.934955 MHz	Phase 1	41.516	56	-14.484	10.16	PASS
5.038435 MHz	Phase 1	41.948	60	-18.052	10.16	PASS
191.79 kHz	Neutral	44.297	63.959	-19.662	10.042	PASS
591.78 kHz	Neutral	46.249	56	-9.751	10.05	PASS
4.755855 MHz	Neutral	42.636	56	-13.364	10.159	PASS
5.03943 MHz	Neutral	42.893	60	-17.107	10.162	PASS

Remarks:

Measurement values which are more than 20 dB below the limit value were not detected or evaluated.

Margin value = Measurement value – Limit value

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ADDITIONAL DOCUMENTATION

Protocol number		<u>1277</u>
Radiated disturbance (80M - 1GHz)		PASS
Applied Standard	FCC Part 15 Subpart B ICES-003	
Test method	ANSI C63.4-2014	
Test sample No.	A003254653-019	
Model	Servo Drive AVENTOS HFSL top Modell: 23.A001	
Tested terminals	Gehäuse / Enclosure	
Supply voltage	24 V DC	
Operating mode	Dauerbetrieb / Continuous operation	
Test setup	nach Norm (siehe Foto) / according to standard (see picture)	
EMC measures	None	
Remarks	—	
Temperature (°C)	15 - 35	
Humidity (% rH)	30 - 60	
Air pressure (mbar)	860 - 1060	
Test Software	BAT EMC 2021.0.15.2	
Tested by	Sami Ullah	
Test date	2022-06-03	

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ADDITIONAL DOCUMENTATION

Used test equipment

Type	Manufacturer	Model	ID	Last calibration	Next calibration
Turntable	INN-CO	CO 3000	2869231	---	---
Antenna mast	INN-CO	CO 3000	2869231	---	---
Receiver	Rohde & Schwarz	ESU 8	2728844	2021-12-23	2022-12-23
Anechoic chamber	Siemens	SAC 10 (NSA 30-1000MHz)	2729645	2020-06-19	2022-06-19
Antenna	Schwarzbeck	VULB 9168	2728787	2019-09-24	2022-09-24

Test parameter of Radiated disturbance (80M - 1GHz)

#1277

Sample number:A003254653-019

Model name:Servo Drive AVENTOS HFSL top Modell: 23.A001

Subrange 1 (Horizontal)	30 MHz ... 1 GHz
IF Bandwidth	120 kHz
Step Size	30 kHz
Preamplifier	ON
Preamplifier Auto Ranging	ON
LN-Preamplifier	OFF
RF Attenuation	Auto
Sweep Time	20 ms
Reference Level	80 dBµV
VBW	Auto
EMI Filter	6dB
Subrange 2 (Vertical)	30 MHz ... 1 GHz
IF Bandwidth	120 kHz
Step Size	30 kHz
Preamplifier	ON
Preamplifier Auto Ranging	ON
LN-Preamplifier	OFF
RF Attenuation	Auto
Sweep Time	20 ms
Reference Level	80 dBµV
VBW	Auto
EMI Filter	6dB

ADDITIONAL DOCUMENTATION

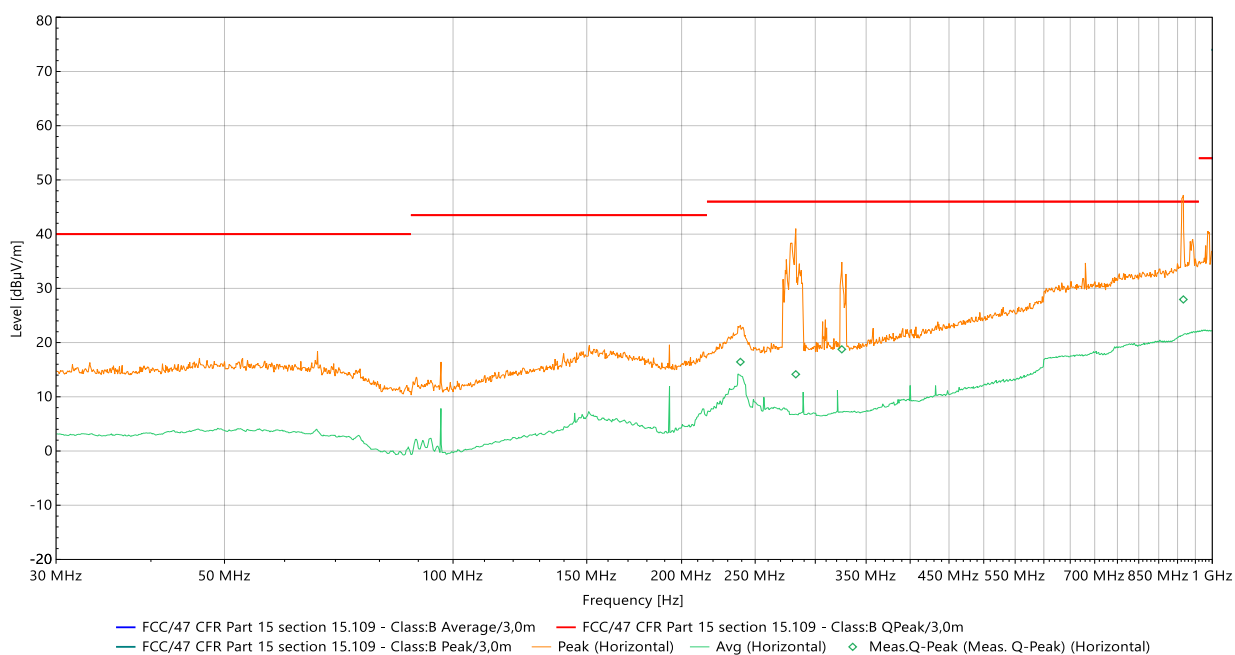
Graphical presentation of Radiated disturbance (80M - 1GHz)

#1277

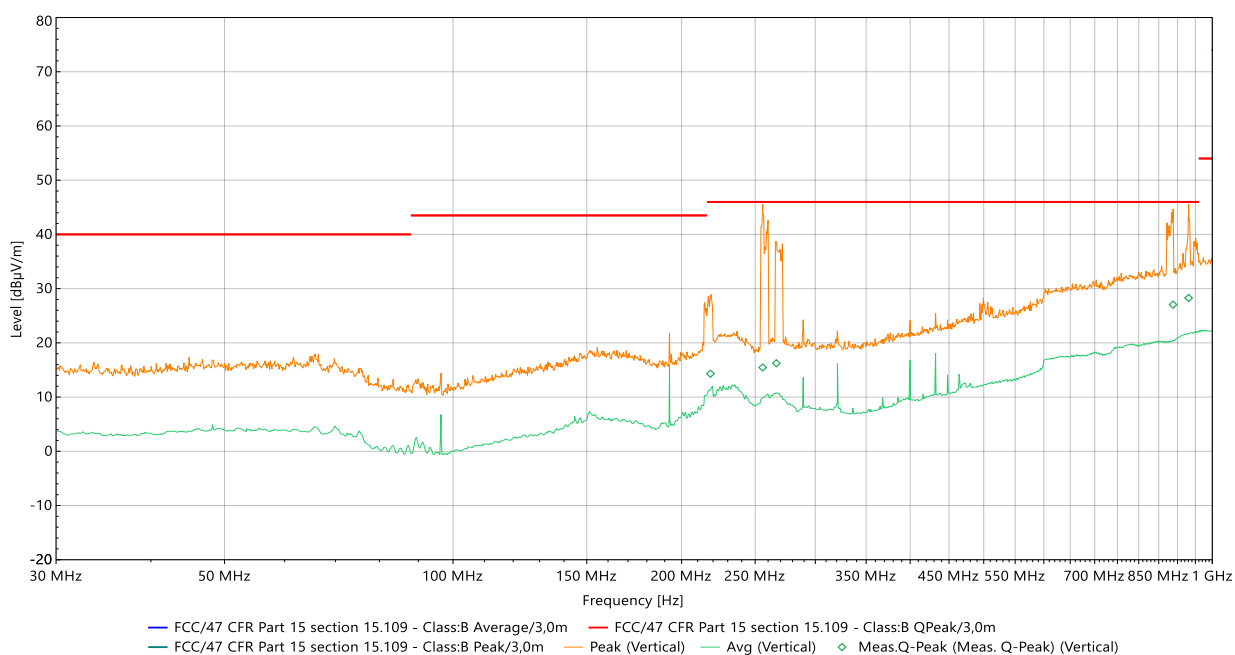
Sample number: A003254653-019

Model name: Servo Drive AVENTOS HFSL top Modell: 23.A001

Radiated disturbance (Horizontal)



Radiated disturbance (Vertical)



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ADDITIONAL DOCUMENTATION

Measurement data of Radiated disturbance (80M - 1GHz)

#1277

Sample number:A003254653-019

Model name:Servo Drive AVENTOS HFSL top Modell: 23.A001

Frequency	SR #	Meas.Q-Peak (dBµV/m)	Limit (dBµV/m)	Meas. - Lim. (dB)	Height(m)	Angle(°)	Correction
239.04 MHz	Horizontal	16.431	46	-29.569	2.377	359.6	13.095
282.75 MHz	Horizontal	14.147	46	-31.853	1.234	4.2	15.225
325.11 MHz	Horizontal	18.755	46	-27.245	1.956	289.8	16.366
915.99 MHz	Horizontal	27.947	46	-18.053	2.961	3.9	28.31
218.31 MHz	Vertikal	14.302	46	-31.698	0.999	18.4	11.539
255.78 MHz	Vertikal	15.462	46	-30.538	1.727	254.5	13.784
266.57999 9 MHz	Vertikal	16.244	46	-29.756	0.999	99.9	14.487
887.91 MHz	Vertikal	27.049	46	-18.951	1.464	13.6	27.511
930.75 MHz	Vertikal	28.279	46	-17.721	1.962	0	28.445

Remarks:

Measurement values which are more than 20 dB below the limit value were not detected or evaluated.

Margin value = Measurement value – Limit value

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ADDITIONAL DOCUMENTATION

Protocol number		<u>1278</u>
Radiated disturbance (> 1 GHz)		PASS
Applied Standard	47 CFR FCC Part 15 Section 15.109 ICES-003	
Test method	ANSI C63.4-2014	
Test sample No.	A003254653-019	
Model	Servo Drive AVENTOS HFSL top Modell: 23.A001	
Tested terminals	Gehäuse / Enclosure	
Supply voltage	24 V DC	
Operating mode	Dauerbetrieb / Continuous operation	
Test setup	nach Norm (siehe Foto) / according to standard (see picture)	
EMC measures	None	
Remarks	—	
Temperature (°C)	15 - 35	
Humidity (% rH)	30 - 60	
Air pressure (mbar)	860 - 1060	
Test Software	BAT EMC 2021.0.15.2	
Tested by	Sami Ullah	
Test date	2022-06-08	

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ADDITIONAL DOCUMENTATION

Used test equipment

Type	Manufacturer	Model	ID	Last calibration	Next calibration
Preamplifier	Schwarzbeck	BBV 9718B	2888179	2021-10-13	2023-10-13
Turntable	INN-CO	CO3000	2732515	---	---
Antenna	EMCO	3115	2728607	2020-02-10	2023-02-10
Receiver	Rohde & Schwarz	ESU 26	2728898	2021-08-17	2022-08-17
Antenna mast	Maturo	NCD	2733253	---	---
Anechoic chamber	TDK	SAC 10 (SVSWR 1-40GHz)	2766607	2020-04-03	2023-04-03

Test parameter of Radiated disturbance (> 1 GHz)

#1278

Sample number:A003254653-019

Model name:Servo Drive AVENTOS HFSL top Modell: 23.A001

Subrange 1 (Horizontal)	1 GHz ... 13 GHz
IF Bandwidth	1 MHz
Step Size	250 kHz
Preamplifier	ON
Preamplifier Auto Ranging	ON
LN-Preamplifier	OFF
RF Attenuation	Auto
Sweep Time	5 ms
Reference Level	80 dBμV
VBW	Auto
EMI Filter	6dB
Subrange 2 (Vertical)	1 GHz ... 13 GHz
IF Bandwidth	1 MHz
Step Size	250 kHz
Preamplifier	ON
Preamplifier Auto Ranging	ON
LN-Preamplifier	OFF
RF Attenuation	Auto
Sweep Time	5 ms
Reference Level	80 dBμV
VBW	Auto
EMI Filter	6dB

ADDITIONAL DOCUMENTATION

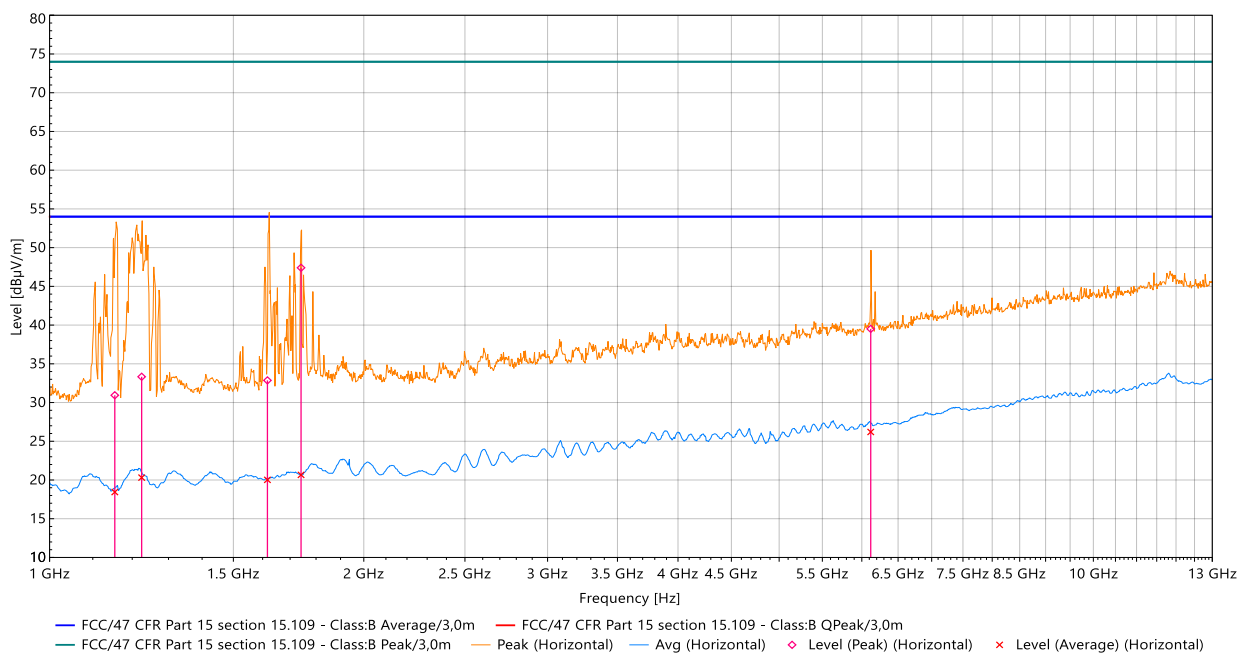
Graphical presentation of Radiated disturbance (> 1 GHz)

#1278

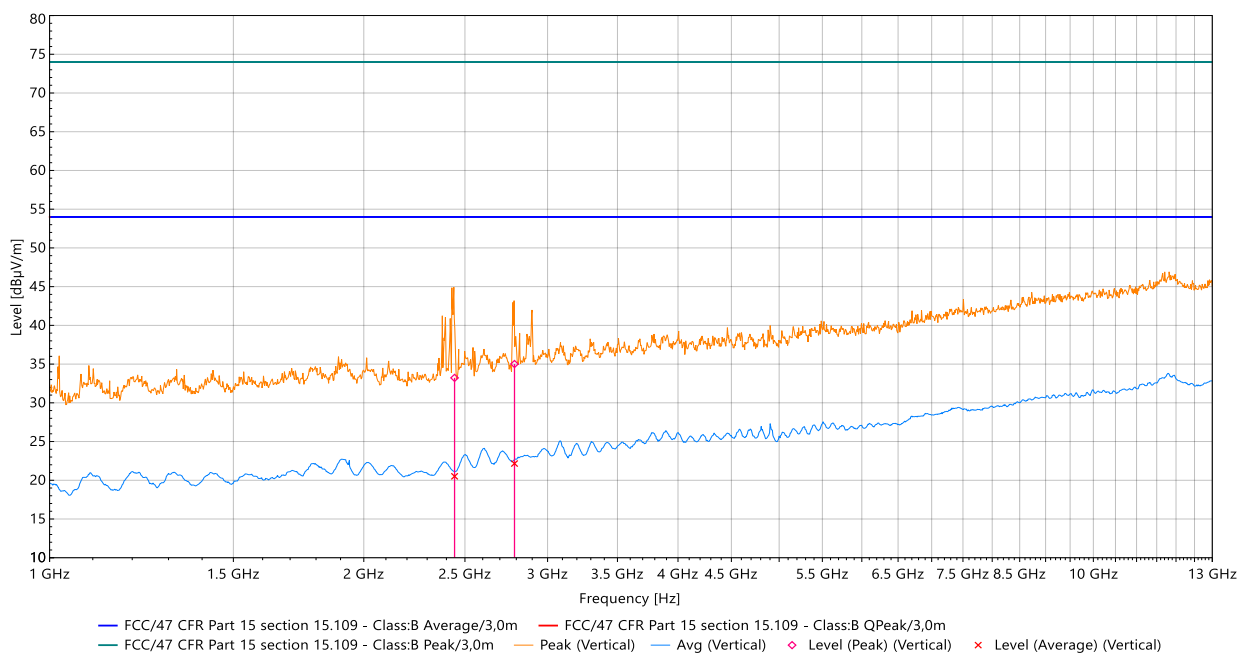
Sample number: A003254653-019

Model name: Servo Drive AVENTOS HFSL top Modell: 23.A001

Radiated disturbance (> 1 GHz) (Horizontal)



Radiated disturbance (> 1 GHz) (Vertical)



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ADDITIONAL DOCUMENTATION

Measurement data of Radiated disturbance (> 1 GHz)

#1278

Sample number:A003254653-019

Model name:Servo Drive AVENTOS HFSL top Modell: 23.A001

Source	Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Polarity	Azimuth (°)	Height (m)	M. time (s)	Comments	Correction (dB)
Peak	1154.750	30.94	74.00	-43.06	H	259.2	1.60	1	Pass	-7.65
Peak	1225.250	33.33	74.00	-40.67	H	270.0	1.17	1	Pass	-7.07
Peak	1617.000	32.86	74.00	-41.14	H	347.9	1.84	1	Pass	-6.20
Peak	1741.500	47.40	74.00	-26.60	H	217.7	2.05	1	Pass	-4.81
Peak	6119.500	39.51	74.00	-34.49	H	0.0	1.00	1	Pass	4.94
Peak	2443.500	33.22	74.00	-40.78	V	298.7	1.07	1	Pass	-3.64
Peak	2788.750	35.01	74.00	-38.99	V	144.6	2.00	1	Pass	-3.66

Source	Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Polarity	Azimuth (°)	Height (m)	M. time (s)	Comments	Correction (dB)
Average	1154.750	18.44	54.00	-35.56	H	259.2	1.60	1	Pass	-7.65
Average	1225.250	20.31	54.00	-33.69	H	270.0	1.17	1	Pass	-7.07
Average	1617.000	20.02	54.00	-33.98	H	347.9	1.84	1	Pass	-6.20
Average	1741.500	20.66	54.00	-33.34	H	217.7	2.05	1	Pass	-4.81
Average	6119.500	26.20	54.00	-27.80	H	0.0	1.00	1	Pass	4.94
Average	2443.500	20.51	54.00	-33.49	V	298.7	1.07	1	Pass	-3.64
Average	2788.750	22.16	54.00	-31.84	V	144.6	2.00	1	Pass	-3.66

Remarks:

Measurement values which are more than 20 dB below the limit value were not detected or evaluated.

Margin value = Measurement value – Limit value

PHOTO DOCUMENTATION

40 Picture 1: Radiated disturbance (80M - 1GHz)

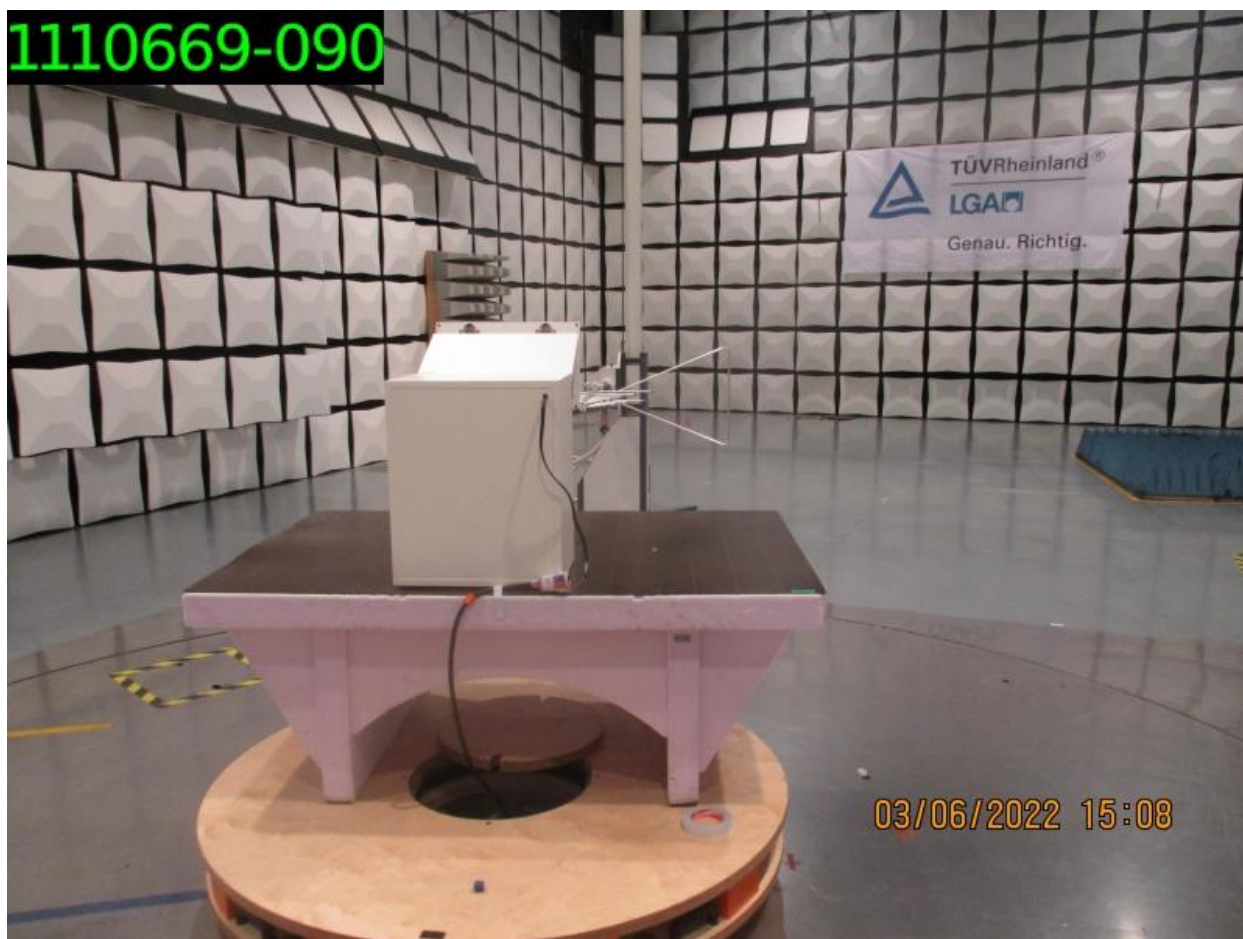


PHOTO DOCUMENTATION

41 Picture 2: Conducted voltage emissions



PHOTO DOCUMENTATION

42 Picture 3: Radiated disturbance (> 1 GHz)



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REVISION HISTORY

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Change history

Rev. No.	List of changes	Date Author
001	First edition (DE22N2UX 001)	2022-06-09 Sami Ullah
002	Second edition (DE22N2UX 002)	2022-09-29 Sami Ullah

End of test report