

Prüfbericht-Nr.: <i>Test report no.:</i>	CN23YM2B 001	Auftrags-Nr.: <i>Order no.:</i>	244467981	Seite 1 von 24 <i>Page 1 of 24</i>
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	1288983	Auftragsdatum: <i>Order date:</i>	2022-12-08	
Auftraggeber: <i>Client:</i>	IKEA of Sweden AB Box 702, SE-343 81 Älmhult, Sweden			
Prüfgegenstand: <i>Test item:</i>	Self-Ballasted LED Lamp			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	LED2106R3			
Auftrags-Inhalt: <i>Order content:</i>	TÜV Rheinland EMC service			
Prüfgrundlage: <i>Test specification:</i>	FCC 47 CFR Part 15, Subpart B:2021 Class B ICES-005:2018			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2023-01-03	Refer to the EUT photos file		
Prüfmuster-Nr.: <i>Test sample no.:</i>	A003397901-001			
Prüfzeitraum: <i>Testing period:</i>	Refer to test report			
Ort der Prüfung: <i>Place of testing:</i>	Refer to clause 1.1			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (Shanghai) Co., Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von: <i>tested by:</i>	genehmigt von: <i>authorized by:</i>			
Datum: <i>Date:</i> 2023-08-01	<i>Jessie Xu</i>		Ausstellungsdatum: <i>Issue date:</i> 2023-08-01	
Stellung / Position:	Sachverständige(r)/Expert		Stellung / Position: Sachverständige(r)/Expert	
Sonstiges / <i>Other:</i>	FCC ID: FHO-LED2106R3 Test Firm Registration Number: 958801			
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>	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
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Anmerkungen
Remarks

- | | |
|---|--|
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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> |
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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 to the resulting risk based of this decision rule please refer to ILAC G8:2019.</i></p> |

TEST SUMMARY

5.1.1 CONDUCTED EMISSION

Result:

Passed

5.2.1 RADIATED EMISSION (30-1000 MHz)

Result:

Passed

5.2.2 RADIATED EMISSION (1-18 GHz)

Result:

Passed

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1 Test Sites

1.1 Test Facilities

Laboratory: TÜV Rheinland (Shanghai) Co., Ltd.

Address: No.177, 178, Lane 777 West Guangzhong Road, Jing'an District, Shanghai, China

The used test equipment is in accordance with CISPR 16-1 series standards for measurement of radio interference.

Refer to Clause 7 for test and measurement instruments.

2 General Product Information

2.1 Product Function and Intended Use

The EUT (equipment under test) is the ordinary self-ballasted LED lamp for lighting and similar use. For the further information, refer to the user's manual.

2.2 Ratings and System Details

Rated input : AC 120 V, 60 Hz
Rated power : 3.3 W

2.3 Independent Operation Modes

The basic operation modes are: "ON" and "OFF".

2.4 Description of interconnecting cables

N/A

2.5 Noise Generating and Noise Suppressing Parts

Refer to the circuit diagram for further information.

2.6 Highest frequency generated or used in the device or on which the device operates or tunes

The highest frequency used in the EUT is 2480 MHz.

2.7 Submitted Documents

Circuit diagram, user's manual and rating label.

3 Test Set-up and Operation Modes

3.1 Principle of Configuration Selection

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

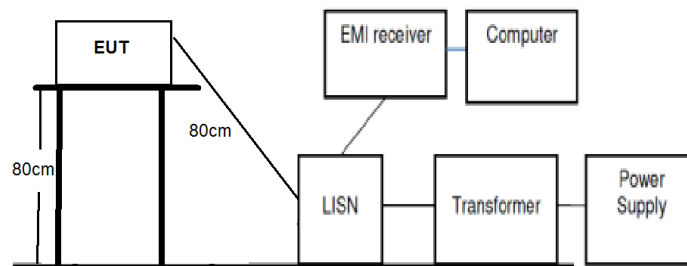
Refer to the related paragraph of this report.

The sequence of testing:

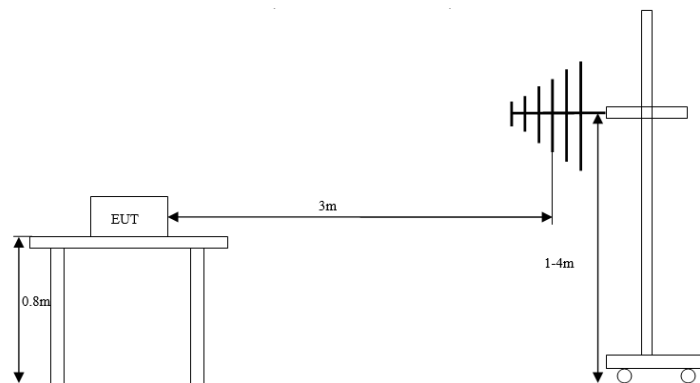
1. Radiated emission tests were performed on 2023-01-11~2023-02-13.
2. Conducted emission tests were performed on 2023-01-11.

3.2 Equipment and cable arrangement

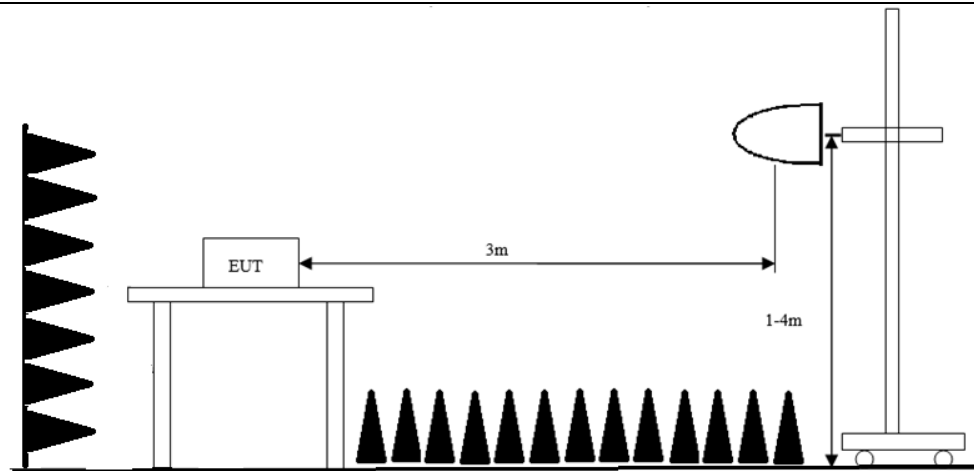
Block diagram for both conducted emission and radiated emission tests is as follows:



(Conducted emission)



(Radiated emission 30-1000 MHz)



(Radiated emission 1-18 GHz)

Also refer to photographs on clause 6 for test setups for both conducted emission test and radiated emission test.

3.3 Test Software

No special test software was used during the tests.

3.4 Special Accessories and Auxiliary Equipment

During the tests, the Zigbee remote control was used.

3.5 Countermeasures to achieve EMC Compliance

No other special measure is employed to achieve the requirement.

4 Conformity Decision Rule

For all EMI tests included in this report, as measurement uncertainties are less than the values U_{CISPR} given in CISPR 16-4-2, compliance with the limits is determined by comparing measurement results directly with corresponding limits without taking into consideration of measurement uncertainties.

5 Test Results EMISSION

5.1 Emission in the Frequency Range up to 30 MHz

5.1.1 Conducted emission

Result:	Passed
Date of testing	: 2023-01-11
Test procedure	: FCC 47 CFR Part 15, Subpart B:2021, ICES-005:2018, ANSI C63.4-2014 and CISPR 16-2-1
Frequency range	: 0.15 – 30 MHz
Limits	: Quasi-peak limit: 0.15 – 0.5 MHz, 66 to 56 dB μ V (decrease with the logarithm of frequency); 0.5 – 5 MHz, 56 dB μ V; 5 – 30 MHz, 60 dB μ V Average limit: 0.15 – 0.5 MHz, 56 to 46 dB μ V (decrease with the logarithm of frequency); 0.5 – 5 MHz, 46 dB μ V; 5 – 30 MHz, 50 dB μ V
Bandwidth of EMI receiver for final measurement	: 9 kHz
Measurement time for final measurement	: 1 s
Kind of test site	: Shielded room
Input voltage	: AC 120 V, 60 Hz
Operational mode	: Power on and dimming
Ambient condition	: Temperature: 20.6 °C; Relative humidity: 37.9 %
Expanded measurement uncertainty ($k=2$)	: 3.39 dB

The measurement setup was made according to ANSI C63.4-2014 in a shielded room.

The measurement equipment like test receivers, quasi-peak detector and artificial mains network (AMN) are in compliance with CISPR 16-1 series standards.

The tested object was set-up on a wooden support. The EUT was set 0.8 m away from the AMN. The cord longer than necessary to be connected to the AMN was folded forth and back parallel so as to form a bundle with a length between 0.3 m and 0.4 m.

The disturbance voltage test was performed on the neutral line and phase line of the power supply of the EUT respectively.

The following figures and tables were those measured by an automatic measuring system. Both quasi-peak and average measurements were performed. In the following spectral diagram, “*” means Quasi-Peak Value and “*” means Average Value results.

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Test Report No.:

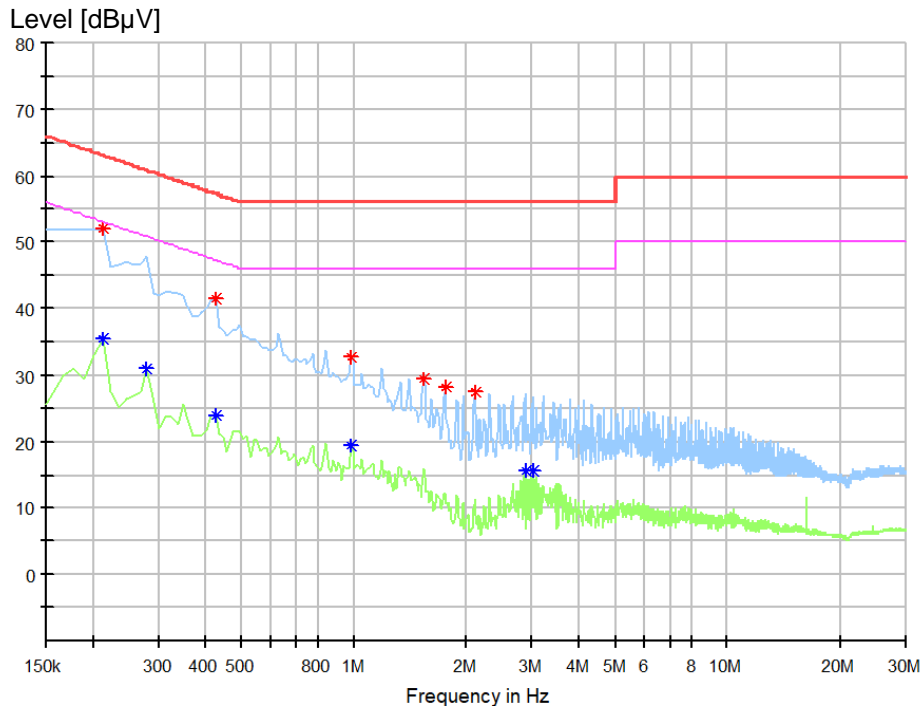
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Notes on following tables of conducted emission results and conversions:

Level (dB μ V): final measurement results by using quasi-peak detector and average detector

Transd (dB): transducer factor including cable loss, insertion loss of artificial mains network and gain of pre-amplifier (if used)

Margin: Limit (dB μ V) - Level (dB μ V)

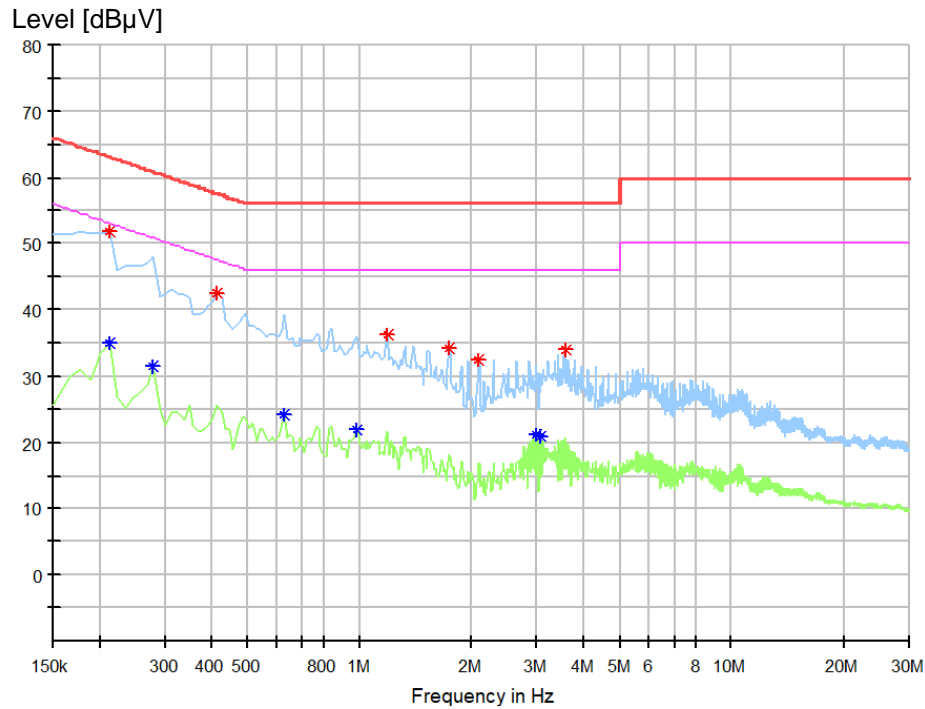
Figure 1: Spectral Diagrams, Conducted Emission, 150 kHz – 30 MHz, L


Final Quasi-peak measurement result:

Frequency (MHz)	QuasiPeak (dBuV)	Limit (dBuV)	Margin (dB)	Line
0.211875	52.00	63.13	11.13	L1
0.425625	41.59	57.34	15.75	L1
0.976875	32.82	56.00	23.18	L1
1.539375	29.53	56.00	26.47	L1
1.753125	28.32	56.00	27.68	L1
2.101875	27.36	56.00	28.64	L1

Final Average measurement result:

Frequency (MHz)	Average (dBuV)	Limit (dBuV)	Margin (dB)	Line
0.211875	35.38	53.13	17.75	L1
0.279375	30.96	50.83	19.87	L1
0.425625	23.84	47.34	23.50	L1
0.976875	19.49	46.00	26.51	L1
2.878125	15.54	46.00	30.46	L1
3.013125	15.75	46.00	30.25	L1

Figure 2: Spectral Diagrams, Conducted Emission, 150 kHz – 30 MHz, N

Final Quasi-peak measurement result:

Frequency (MHz)	QuasiPeak (dBuV)	Limit (dBuV)	Margin (dB)	Line
0.211875	51.73	63.13	11.41	N
0.414375	42.50	57.56	15.06	N
1.190625	36.20	56.00	19.80	N
1.741875	34.22	56.00	21.78	N
2.090625	32.47	56.00	23.53	N
3.564375	33.99	56.00	22.01	N

Final Average measurement result:

Frequency (MHz)	Average (dBuV)	Limit (dBuV)	Margin (dB)	Line
0.211875	34.98	53.13	18.16	N
0.279375	31.41	50.83	19.43	N
0.628125	24.16	46.00	21.84	N
0.976875	21.92	46.00	24.08	N
2.979375	21.24	46.00	24.76	N
3.046875	20.85	46.00	25.15	N

5.2 Emission in the Frequency Range above 30 MHz

5.2.1 Radiated emission (30-1000 MHz)

Result:
Passed

Date of testing	: 2023-01-11
Test procedure	: FCC 47 CFR Part 15, Subpart B:2021, ICES-005:2018, ANSI C63.4-2014 and CISPR 16-2-3
Product classification	: Class B
Frequency range	: 30 – 1000 MHz
Limits	: Quasi-peak limits (3 m distance): 30 – 88 MHz, 40 dB μ V/m; 88 – 216 MHz, 43.5 dB μ V/m; 216 – 1000 MHz, 46 dB μ V/m (see Note)
Bandwidth of EMI receiver for final measurement	: 120 kHz
Measurement time for final measurement	: 1 s
Kind of test site	: Semi-anechoic chamber
Input voltage	: AC 120 V, 60 Hz
Operational mode	: Power on and dimming
Ambient condition	: Temperature: 22.1 °C; Relative humidity: 36.5 %
Expanded measurement uncertainty ($k=2$)	: 5.49 dB

The radiated disturbance test was carried out in a semi-anechoic chamber. The test distance from the receiving antenna to the EUT is 3 m. The normalized site attenuation of the semi-anechoic chamber is regularly calibrated to ensure the radiated disturbance test results are valid. During the test, the EUT was placed on an 80 cm wooden support above the reference ground plane. The wooden support was rotated 360° around and the height of the antenna was varied from 1 m to 4 m to find the maximum disturbance. The test was performed with the antenna both in its horizontal and vertical polarizations.

The following figures and tables were those measured by an automatic measurement system. A preview test was firstly performed with peak detector. The final test was performed with quasi-peak at those critical frequencies during the preview test. In the following spectral diagram, “x” means quasi-peak test results.

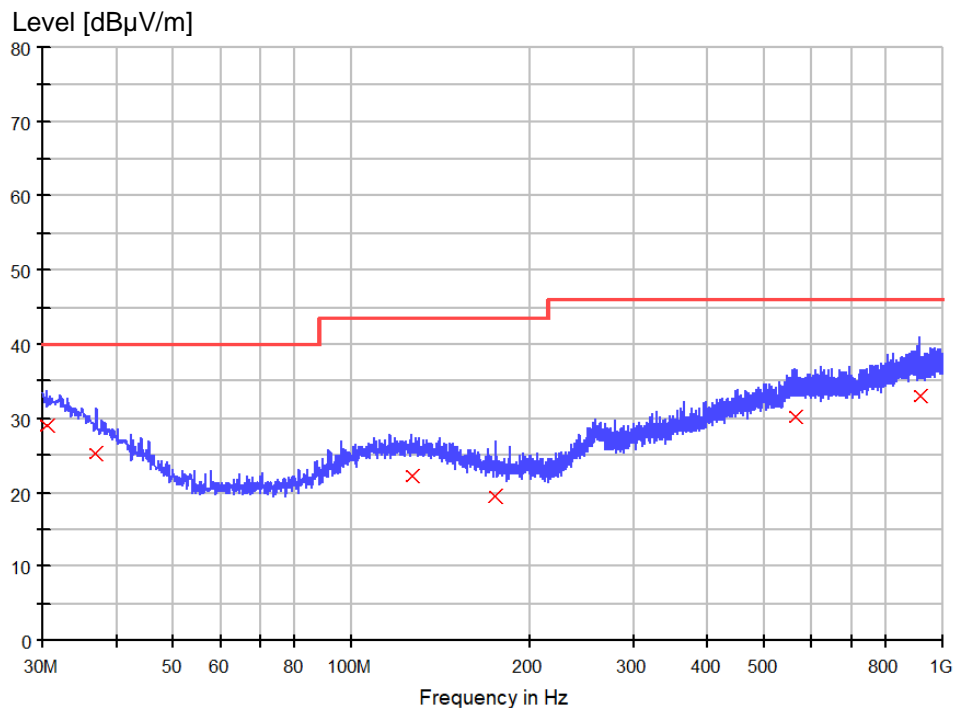
Note: The class B limits of ICES-005:2018 is stricter than those FCC 47 CFR Part 15, Subpart B:2021 for 3 m test distance. Therefore, the former limits are used in following figures and tables.

Notes on following tables of radiated emission results and conversions:

QuasiPeak (dB μ V/m): final measurement results by using quasi-peak detector

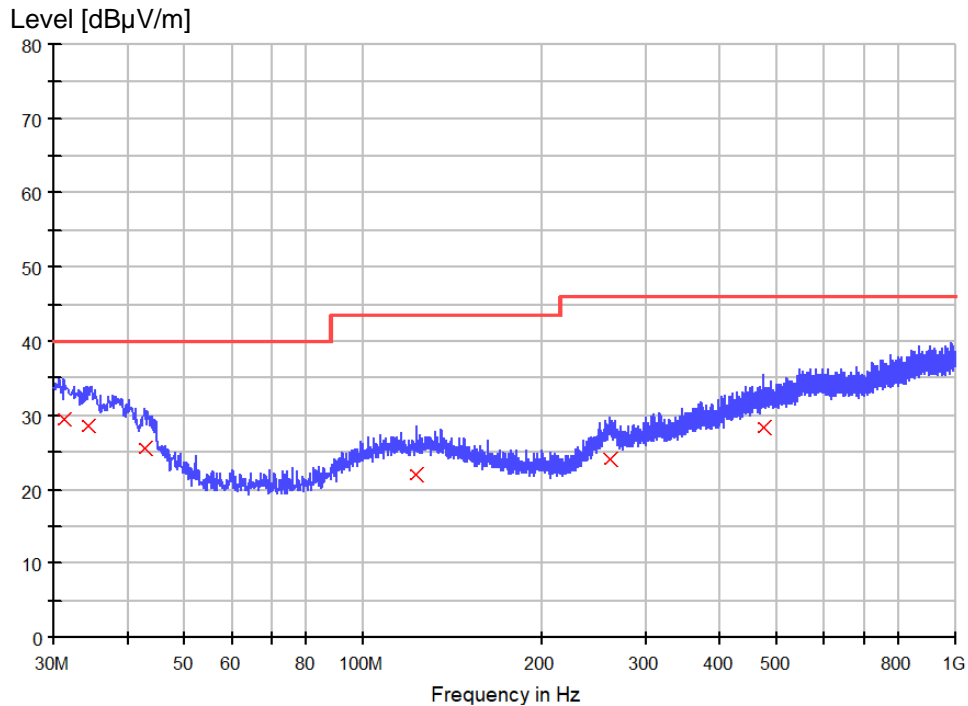
Corr. (dB): correction factor including: antenna factor, cable loss, and gain of pre-amplifier (if used)

Margin: Limit (dB μ V/m) - QuasiPeak (dB μ V/m)

Figure 3: Spectral Diagrams, Radiated Emission, 30 MHz – 1000 MHz, Horizontal polarization


Final quasi-peak measurement results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
30.363750	28.9	120.000	100.0	H	25.0	25.2	11.1	40.0
36.911250	25.2	120.000	150.0	H	36.0	21.6	14.8	40.0
126.272500	22.1	120.000	100.0	H	-103.0	18.8	21.4	43.5
175.136250	19.4	120.000	200.0	H	99.0	16.1	24.1	43.5
564.227500	30.2	120.000	200.0	H	72.0	26.2	15.8	46.0
913.791250	33.0	120.000	100.0	H	-168.0	28.1	13.0	46.0

Figure 4: Spectral Diagrams, Radiated Emission, 30 MHz – 1000 MHz, Vertical polarization


Final quasi-peak measurement results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
31.212500	29.4	120.000	150.0	V	58.0	24.8	10.6	40.0
34.365000	28.5	120.000	200.0	V	-27.0	23.1	11.6	40.0
42.731250	25.4	120.000	100.0	V	110.0	18.4	14.6	40.0
122.877500	22.0	120.000	100.0	V	74.0	18.6	21.5	43.5
261.102500	24.2	120.000	150.0	V	-93.0	20.7	21.8	46.0
474.502500	28.3	120.000	100.0	V	-155.0	24.5	17.7	46.0

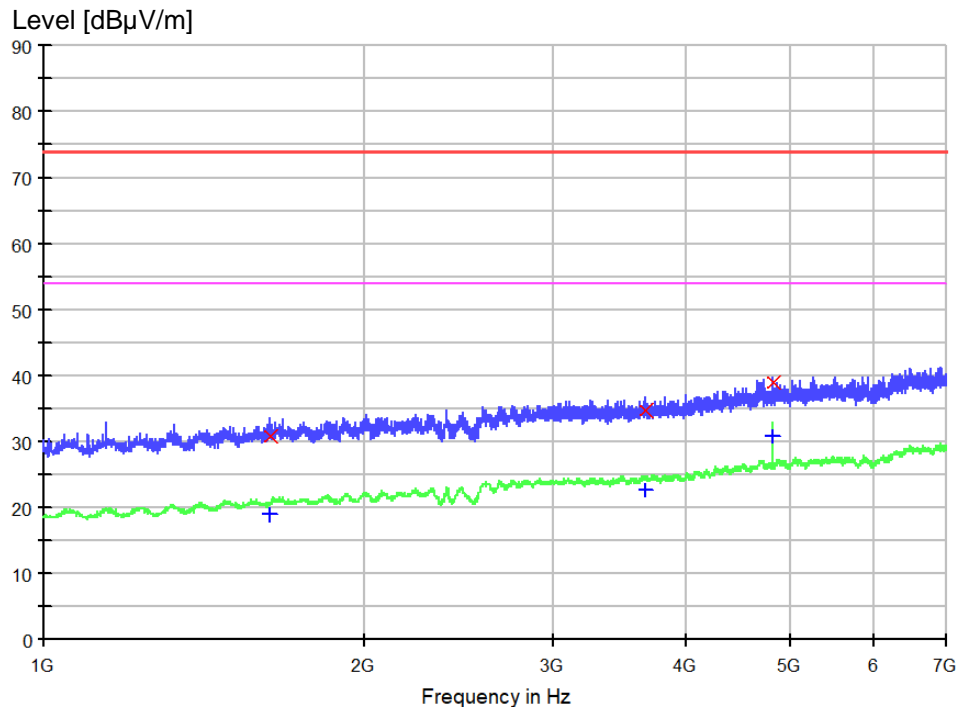
5.2.2 Radiated Emission (1-18 GHz)

Result:
Passed

Date of testing	: 2023-02-13
Port	: Enclosure
Test procedure	: FCC 47 CFR Part 15, Subpart B:2021, ANSI C63.4-2014 and CISPR 16-2-3
Product classification	: Class B
Limit	: MaxPeak limits (3 m distance): 1-18 GHz, 74 dB μ V/m Average limits (3 m distance): 1-18 GHz, 54 dB μ V/m
Frequency range	: 1 GHz – 18 GHz (Note: The highest frequency in the EUT is 2480 MHz. According to FCC Part 15 subpart B §15.33 (b) (1) the upper frequency for radiated emission measurement is 18 GHz.
Kind of test site	: Semi-anechoic chamber with RF absorber material on the ground plane
Test distance	: 3 m
Test voltage	: AC 120 V, 60 Hz
Operational mode	: Power on and dimming
Ambient condition	: Temperature: 22.1 °C; Relative humidity: 36.5 %
Expanded measurement uncertainty ($k=2$)	: 5.17 dB (1 GHz~6 GHz) 5.12 dB (6 GHz~18 GHz)

The radiated disturbance test was carried out in semi-anechoic chamber with RF absorber material on the ground plane. The test distance from the receiving antenna to the EUT is 3 m. The normalized site attenuation of the semi-anechoic chamber with RF absorber material on the ground plane is regularly calibrated to ensure the radiated disturbance test results are valid. During the test, the EUT was placed on a support, which is 80 cm high. And the support was rotated 360° around and the height of the antenna was varied from 1 m to 4 m to find the maximum disturbance. The test was performed with the antenna both in its horizontal and vertical polarizations.

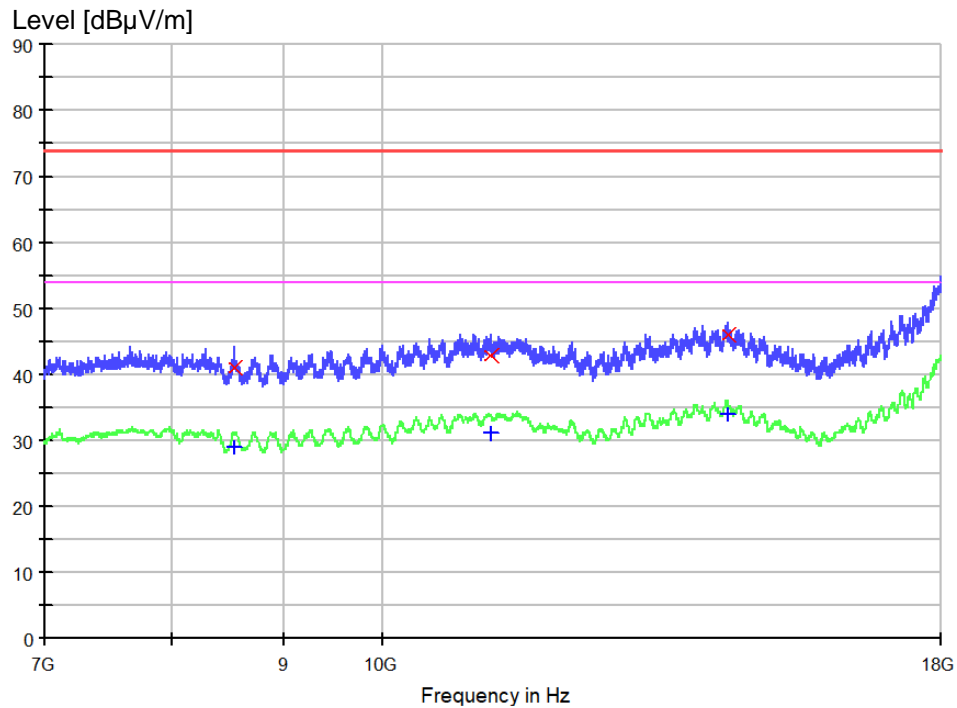
The following figures and tables were those measured by an automatic measurement system. The final test was performed with peak detector and average detector at those critical frequencies during the preview test. In the following figure, “× (red)” means measurement results with peak detector and “+ (blue)” means measurement results with average detector.

Figure 5: Spectral Diagrams and measurement results, 1 GHz – 7 GHz, horizontal polarization

Final maxpeak measurement result:

Frequency (MHz)	MaxPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
1627.000000	30.8	1000.000	150.0	H	43.0	-18.7	43.2	74.0
3667.750000	34.6	1000.000	150.0	H	43.0	-13.5	39.4	74.0
4813.000000	38.9	1000.000	150.0	H	43.0	-10.6	35.1	74.0

Final average measurement result:

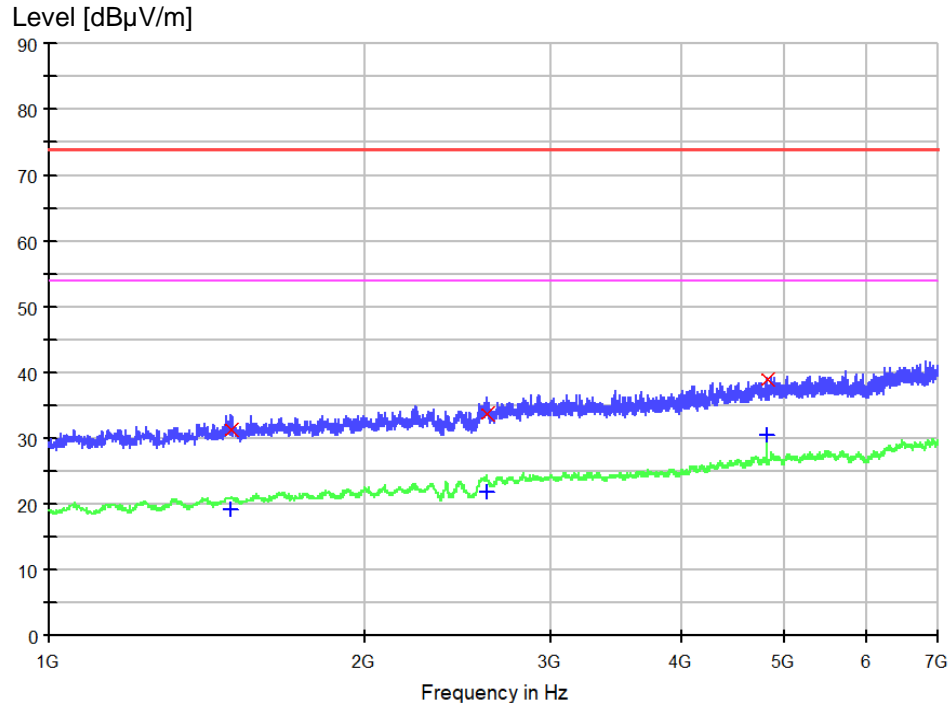
Frequency (MHz)	Average (dBµV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
1627.000000	18.9	1000.000	150.0	H	43.0	-18.7	55.1	74.0
3667.750000	22.7	1000.000	150.0	H	43.0	-13.5	51.3	74.0
4813.000000	30.7	1000.000	150.0	H	43.0	-10.6	43.3	74.0

Figure 6: Spectral Diagrams and measurement results, 7 GHz – 18 GHz, horizontal polarization

Final maxpeak measurement result:

Frequency (MHz)	MaxPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
8551.000000	41.2	1000.000	150.0	H	-118.0	-5.6	32.8	74.0
11200.625000	43.0	1000.000	150.0	H	-118.0	-1.2	31.0	74.0
14375.500000	46.0	1000.000	150.0	H	-118.0	2.5	28.0	74.0

Final average measurement result:

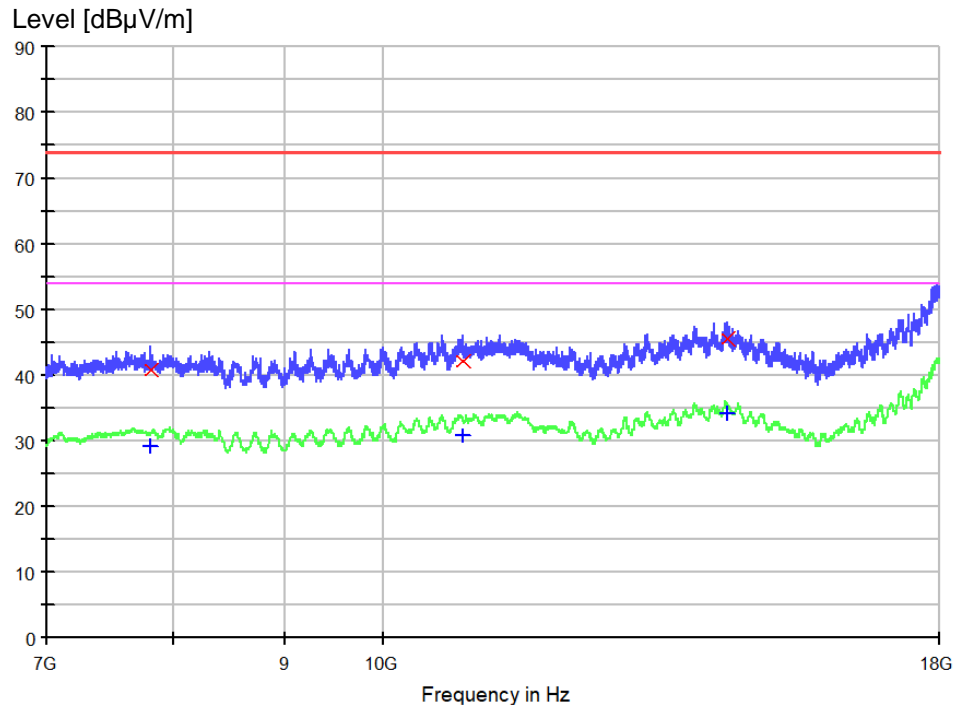
Frequency (MHz)	Average (dBµV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
8551.000000	29.0	1000.000	150.0	H	-118.0	-5.6	45.0	74.0
11200.625000	30.9	1000.000	150.0	H	-118.0	-1.2	43.1	74.0
14375.500000	34.0	1000.000	150.0	H	-118.0	2.5	40.0	74.0

Figure 7: Spectral Diagrams and measurement results, 1 GHz – 7 GHz, vertical polarization

Final maxpeak measurement result:

Frequency (MHz)	MaxPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
1490.500000	31.4	1000.000	150.0	V	-111.0	-19.2	42.6	74.0
2609.500000	33.7	1000.000	150.0	V	-111.0	-15.6	40.3	74.0
4813.000000	38.9	1000.000	150.0	V	-111.0	-10.6	35.1	74.0

Final average measurement result:

Frequency (MHz)	Average (dBµV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
1490.500000	19.2	1000.000	150.0	V	-111.0	-19.2	54.8	74.0
2609.500000	21.9	1000.000	150.0	V	-111.0	-15.6	52.1	74.0
4813.000000	30.6	1000.000	150.0	V	-111.0	-10.6	43.4	74.0

Figure 8: Spectral Diagrams and measurement results, 7 GHz – 18 GHz, vertical polarization

Final maxpeak measurement result:

Frequency (MHz)	MaxPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
7812.625000	40.9	1000.000	150.0	V	180.0	-5.5	33.1	74.0
10874.750000	42.2	1000.000	150.0	V	180.0	-1.2	31.8	74.0
14372.750000	45.5	1000.000	150.0	V	180.0	2.5	28.5	74.0

Final average measurement result:

Frequency (MHz)	Average (dBµV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
7812.625000	29.3	1000.000	150.0	V	180.0	-5.5	44.7	74.0
10874.750000	30.8	1000.000	150.0	V	180.0	-1.2	43.2	74.0
14372.750000	34.1	1000.000	150.0	V	180.0	2.5	39.9	74.0

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6 Photographs of the Test Set-Up

Refer to the test setup file.

7 List of Test and Measurement Instruments

Equip.	Description	Model	Manufacturer	Last Date DD.MM.YYYY	Due Date DD.MM.YYYY
G1824845	EMC measurement software	EMC32 (Ver 10.20.01)	Rohde&Schwarz	N/A	N/A
9023229	EMI test receiver	ESR3	Rohde&Schwarz	11.08.2022	11.08.2023
G1811403	Artificial mains network	ENV216	Rohde&Schwarz	19.10.2022	19.10.2023
G1824248	Dual display multimeter	F45	Fluke	08.10.2022	08.10.2024
G1811378	3m modified semi-anechoic chamber	SAC3	Frankonia	10.06.2021	10.06.2024
G1811391	EMI test receiver	ESCI	Rohde&Schwarz	29.09.2022	29.09.2023
G1811425	Bilog antenna	CBL 6112D	Teseq	10.03.2020	10.03.2023
G1822702	Spectrum analyser	FSV40	Rohde&Schwarz	04.11.2021	04.11.2023
G1825371	Preamplifier	EMC051845SE	Taiwan EMCI	14.05.2021	14.05.2023
G1822694	Double ridged broadband horn antenna	BBHA 9120 D	Schwarzbeck	24.03.2021	24.03.2026

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End of test report