

Prüfbericht-Nr.: <i>Test Report No.:</i>	CN22TV2K 001	Auftrags-Nr.: <i>Order No.:</i>	244406010	Seite 1 von 21 <i>Page 1 of 21</i>
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	1288983	Auftragsdatum: <i>Order date.:</i>	2022-01-29	
Auftraggeber: <i>Client:</i>	IKEA of Sweden AB Box 702, SE-343 81 Älmhult, Sweden			
Prüfgegenstand: <i>Test item:</i>	4m RGBW Flex Lighting Strip			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	L2112 ORMANÄS			
Auftrags-Inhalt: <i>Order content:</i>	TÜV Rheinland EMC service			
Prüfgrundlage: <i>Test specification:</i>	FCC 47 CFR Part 15, Subpart B:2020 Class B ICES-005:2018			
Wareneingangsdatum: <i>Date of receipt:</i>	2022-01-28	Refer to the EUT photos file		
Prüfmuster-Nr.: <i>Test sample No.:</i>	A003207407-001			
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: / tested by: Jessie Xu		genehmigt von: / authorized by: Hexiong Liu		
Datum: / Date: 2022-11-11 <i>Jessie Xu</i>		Datum: / Date: 2022-11-11 <i>Hexiong Liu</i>		
Stellung: / Position: Project manager		Stellung: / Position: Department manager		
Sonstiges / Other:	FCC ID: FHO-L2112 Test Firm Registration Number: 958801			
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* 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 specifications(s) F(ail) = failed a.m. test specifications(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. <i>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>				

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 4m RGBW flex lighting strip for lighting and similar use. For the further information, refer to the user's manual.

2.2 Ratings and System Details

System input : DC 24 V 5 W
Protection class : III

This product is a RGBW light strip. It contains a 4 m RGBW flexible strip, a 3.5 m cable with control box supplied by approved Class 2 power unit ICPSW24-7-3. The information of power unit as below:

Manufacturer/ trademark	Type/model	Technical data
IKEA OF SWEDEN AB	ICPSW24-7-3	Input: 100-240 VAC; 50/60 Hz; 0,11A; 10 W; PF \geq 0,6; Output: 24 VDC; Max.0,29 A; Max.7 W

2.3 Independent Operation Modes

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

2.4 Description of interconnecting cables

No.	Interface and name	Shielded or not	Specified length (m)
1	Control line	Unshielded	0.35

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.

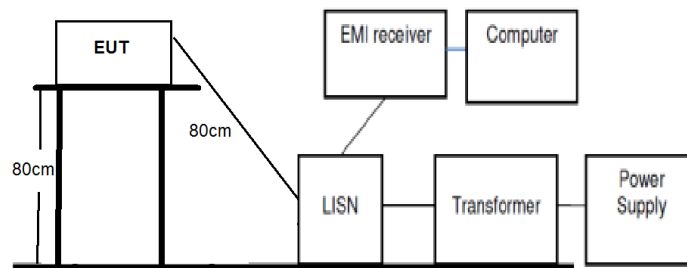
Refer to the related paragraph of this report.

The sequence of testing:

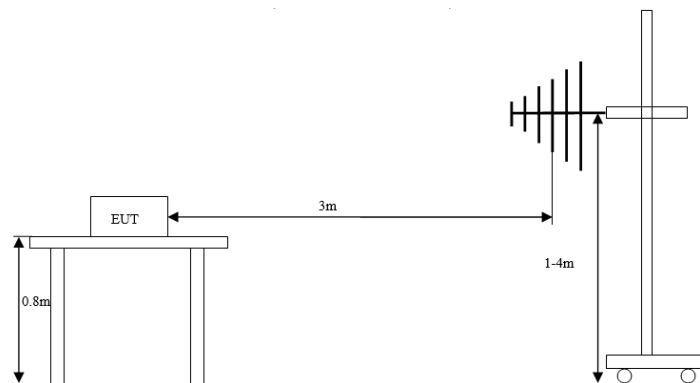
1. Radiated emission tests were performed on 2022-03-21~2022-03-25.
2. Conducted emission tests were performed on 2022-06-21.

3.2 Equipment and cable arrangement

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



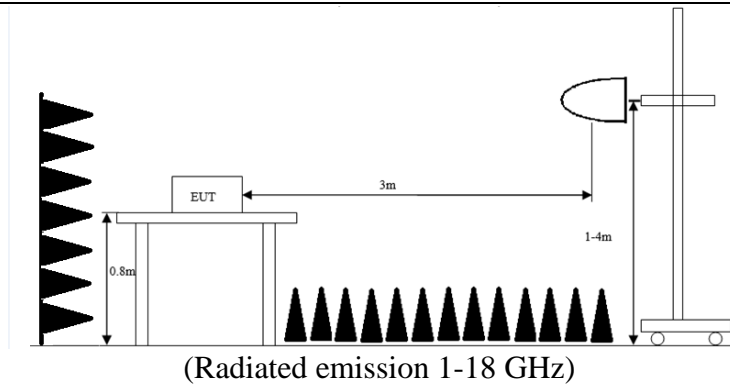
(Conducted emission)



(Radiated emission 30-1000 MHz)

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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 adapter and computer were used as auxiliary equipment.

3.5 Countermeasures to achieve EMC Compliance

No other special measure is employed to achieve the requirement.

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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	: 2022-06-21
Test procedure	: FCC 47 CFR Part 15, Subpart B:2020, 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 for power supply
Operational mode	: Power on
Ambient condition	: Temperature: 22.3 °C; Relative humidity: 58.3 %
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 an “*” means Average Value results.

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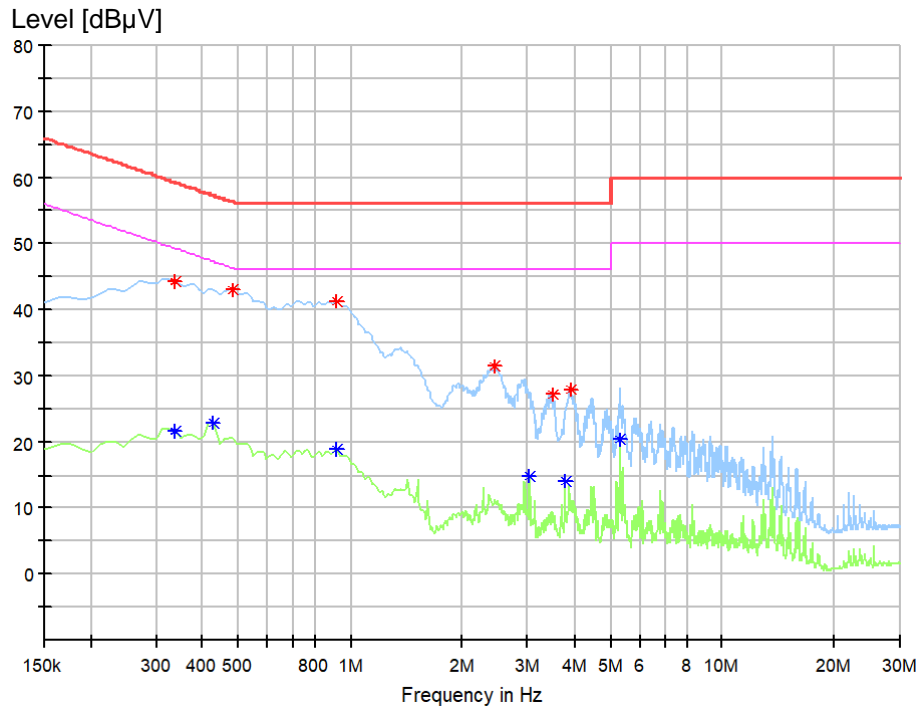
Notes on following tables of conducted emission results and conversions:

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



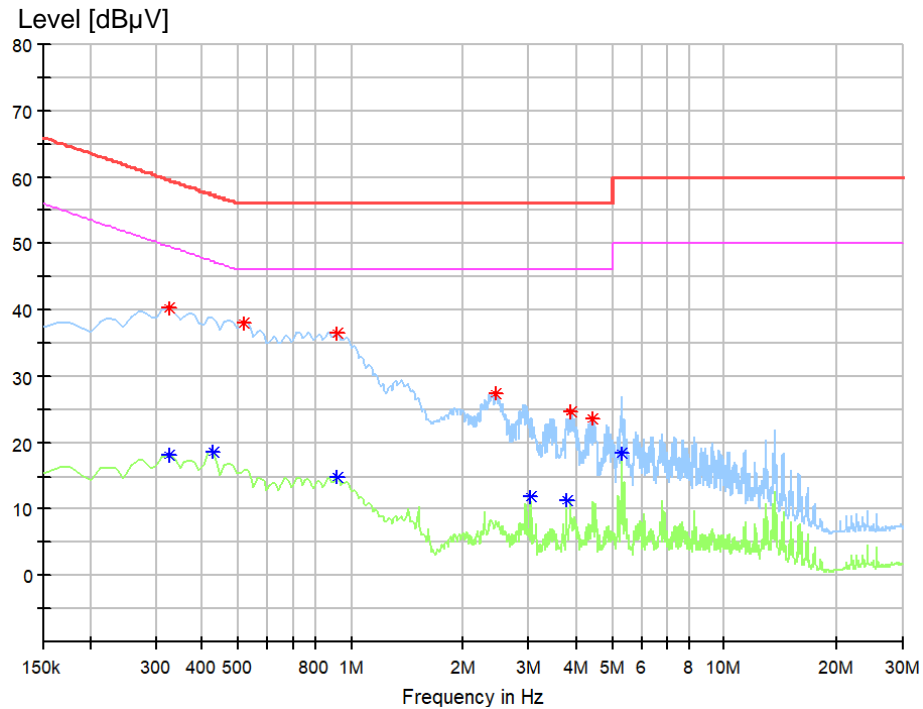
Final Quasi-peak measurement result:

Frequency (MHz)	QuasiPeak (dBµV)	Limit (dBµV)	Margin (dB)	Line
3.485625	27.32	56.00	28.68	L1
3.924375	27.86	56.00	28.14	L1
2.439375	31.39	56.00	24.61	L1
0.920625	41.20	56.00	14.80	L1
0.481875	42.93	56.31	13.38	L1
0.335625	44.34	59.31	14.97	L1

Final Average measurement result:

Frequency (MHz)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line
0.335625	21.72	49.31	27.59	L1
0.425625	22.84	47.34	24.50	L1
0.920625	18.79	46.00	27.21	L1
3.024375	14.88	46.00	31.12	L1
3.789375	14.25	46.00	31.75	L1
5.296875	20.33	50.00	29.67	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
4.453125	23.66	56.00	32.34	N
3.868125	24.80	56.00	31.20	N
2.439375	27.58	56.00	28.42	N
0.920625	36.49	56.00	19.51	N
0.515625	38.08	56.00	17.92	N
0.324375	40.20	59.59	19.40	N

Final Average measurement result:

Frequency (MHz)	Average (dBuV)	Limit (dBuV)	Margin (dB)	Line
0.324375	18.15	49.59	31.45	N
0.425625	18.61	47.34	28.73	N
0.920625	14.91	46.00	31.09	N
3.024375	11.78	46.00	34.22	N
3.789375	11.29	46.00	34.71	N
5.296875	18.34	50.00	31.66	N

5.2 Emission in the Frequency Range above 30 MHz

5.2.1 Radiated emission (30-1000 MHz)

Result:	Passed
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Date of testing	: 2022-03-25
Test procedure	: FCC 47 CFR Part 15, Subpart B:2020, 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 (for power supply)
Operational mode	: Power on
Ambient condition	: Temperature: 21.1 °C; Relative humidity: 57.1 %
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.

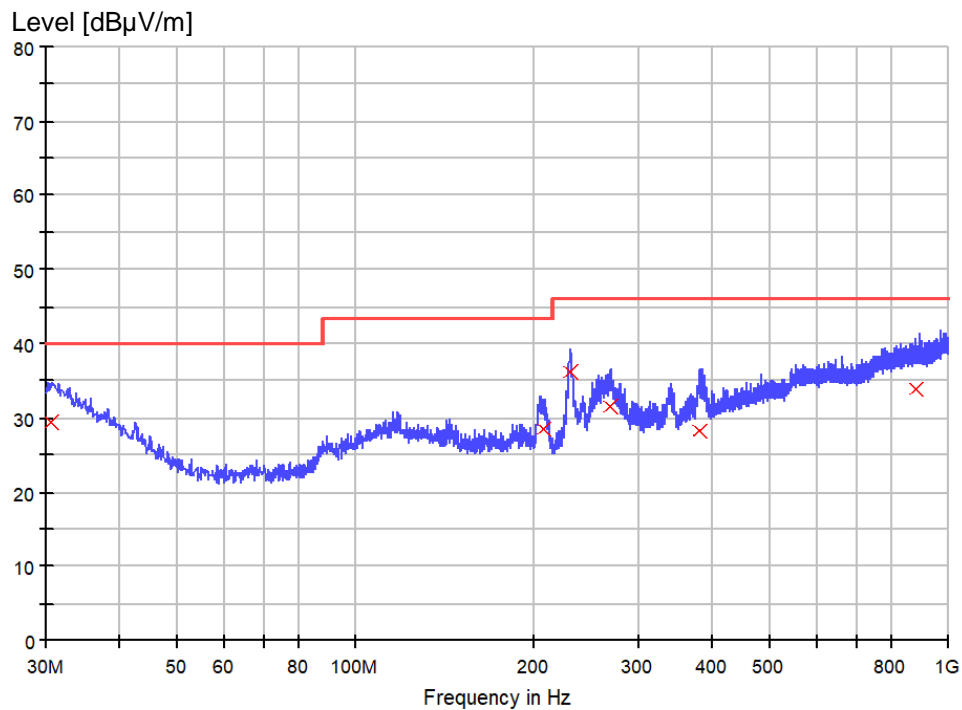
The following figures and tables were those measured by an automatic measurement system. A preview test was firstly performed with peak detector. The final test was performed with quasi-peak at those critical frequencies during the preview test. In the following spectral diagram, “x” means quasi-peak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

Note: The class B limits of ICES-005:2018 is stricter than those FCC 47 CFR Part 15, Subpart B:2020 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)

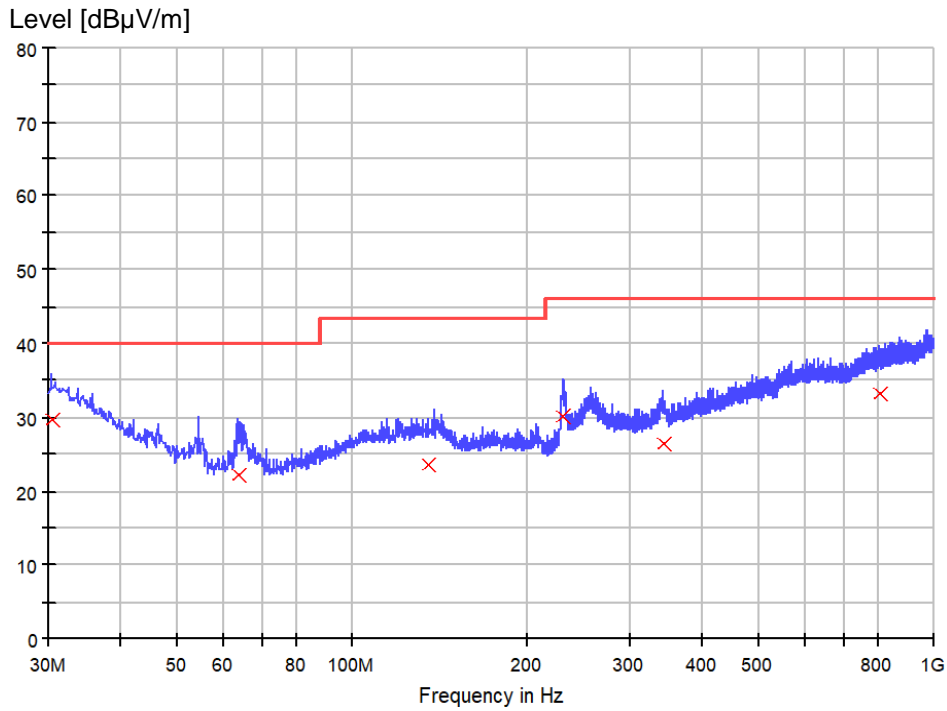
Figure 3: Spectral Diagrams, Radiated Emission, 30 MHz – 1000 MHz, Horizontal polarization



Final quasi-peak measurement results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
30.727500	29.5	1000.0	120.000	100.0	H	12.0	25.0	10.5	40.0
206.782500	28.5	1000.0	120.000	100.0	H	45.0	16.1	15.0	43.5
230.183750	36.2	1000.0	120.000	120.0	H	0.0	16.9	9.8	46.0
269.347500	31.6	1000.0	120.000	120.0	H	0.0	19.8	14.4	46.0
379.563750	28.4	1000.0	120.000	150.0	H	156.0	22.0	17.6	46.0
878.992500	33.9	1000.0	120.000	150.0	H	60.0	28.0	12.1	46.0

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



Final quasi-peak measurement results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
30.363750	29.7	1000.0	120.000	100.0	V	45.0	25.2	10.3	40.0
63.707500	22.3	1000.0	120.000	100.0	V	0.0	12.8	17.7	40.0
135.487500	23.6	1000.0	120.000	100.0	V	150.0	18.4	19.9	43.5
229.941250	30.2	1000.0	120.000	100.0	V	63.0	16.9	15.8	46.0
341.855000	26.5	1000.0	120.000	110.0	V	48.0	20.8	19.5	46.0
806.848750	33.1	1000.0	120.000	105.0	V	160.0	27.4	12.9	46.0

5.2.2 Radiated Emission (1-18 GHz)

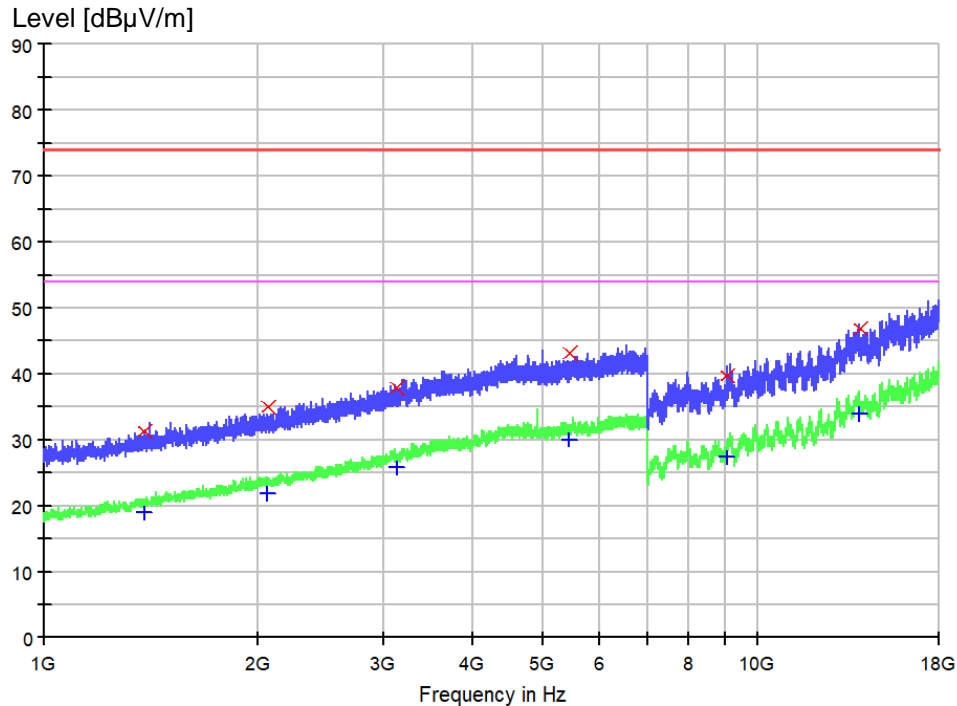
Result:	Passed
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Date of testing	: 2022-03-21
Port	: Enclosure
Test procedure	: FCC 47 CFR Part 15, Subpart B:2020, ANSI C63.4-2014 and CISPR 16-2-3
Product classification	: Class B
Limit	: MaxPeak limits (3 m distance): 1-18 GHz, 74 dB μ V/m Average 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 GHz. 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 for power supply
Operational mode	: Power on
Ambient condition	: Temperature: 21.1 °C; Relative humidity: 57.1 %
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 – 18 GHz, horizontal polarization



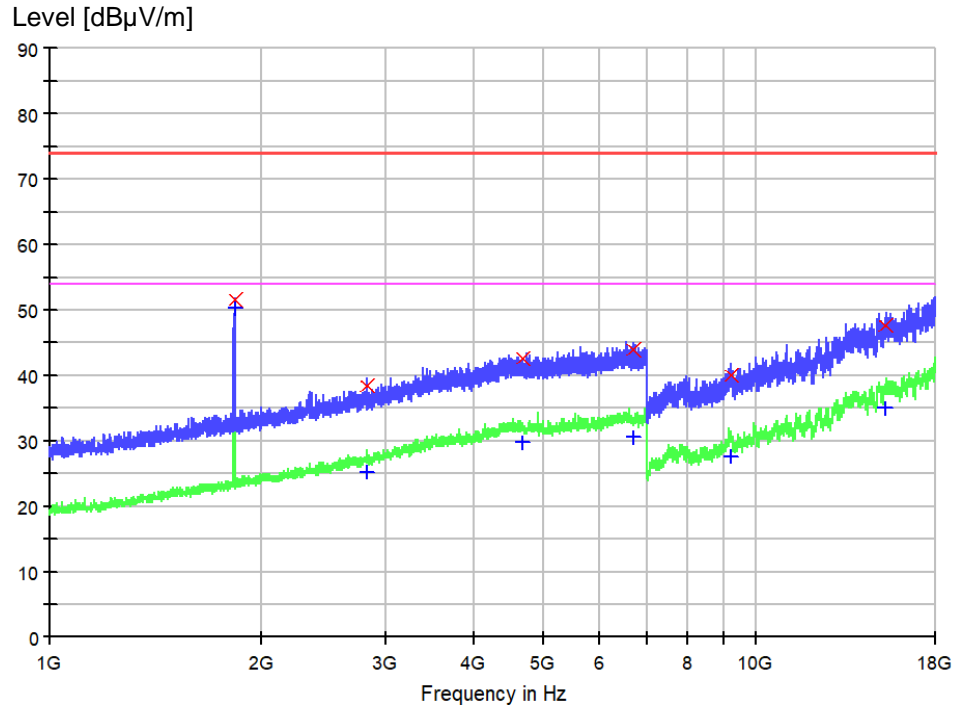
Final maxpeak measurement result:

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
1380.906250	31.4	1000.0	1000.000	100.0	H	12.0	-19.9	42.6	74.0
2063.562500	34.9	1000.0	1000.000	100.0	H	5.0	-16.0	39.1	74.0
3125.000000	38.0	1000.0	1000.000	100.0	H	46.0	-11.1	36.0	74.0
5452.406250	43.2	1000.0	1000.000	100.0	H	120.0	-5.8	30.8	74.0
9077.125000	39.7	1000.0	1000.000	100.0	H	33.0	-1.0	34.3	74.0
13929.562500	46.8	1000.0	1000.000	100.0	H	15.0	4.6	27.2	74.0

Final average measurement result:

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
1380.906250	18.9	1000.0	1000.000	100.0	H	12.0	-19.9	35.1	54.0
2063.562500	21.9	1000.0	1000.000	100.0	H	5.0	-16.0	32.1	54.0
3125.000000	25.7	1000.0	1000.000	100.0	H	46.0	-11.1	28.3	54.0
5452.406250	30.0	1000.0	1000.000	100.0	H	120.0	-5.8	24.0	54.0
9077.125000	27.4	1000.0	1000.000	100.0	H	33.0	-1.0	26.6	54.0
13929.562500	33.9	1000.0	1000.000	100.0	H	15.0	4.6	20.1	54.0

Figure 6: Spectral Diagrams and measurement results, 1 GHz – 18 GHz, vertical polarization



Final maxpeak measurement result:

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
1828.218750	51.7	1000.0	1000.000	100.0	V	12.0	-17.3	22.3	74.0
2811.562500	38.3	1000.0	1000.000	100.0	V	35.0	-12.6	35.7	74.0
4673.062500	42.6	1000.0	1000.000	100.0	V	69.0	-6.5	31.4	74.0
6731.656250	44.0	1000.0	1000.000	100.0	V	120.0	-4.8	30.0	74.0
9260.937500	40.0	1000.0	1000.000	100.0	V	60.0	-0.8	34.0	74.0
15215.187500	47.7	1000.0	1000.000	100.0	V	10.0	6.4	26.3	74.0

Final average measurement result:

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
1828.218750	50.3	1000.0	1000.000	100.0	V	12.0	-17.3	3.7	54.0
2811.562500	25.2	1000.0	1000.000	100.0	V	35.0	-12.6	28.8	54.0
4673.062500	29.8	1000.0	1000.000	100.0	V	69.0	-6.5	24.2	54.0
6731.656250	30.5	1000.0	1000.000	100.0	V	120.0	-4.8	23.5	54.0
9260.937500	27.6	1000.0	1000.000	100.0	V	60.0	-0.8	26.4	54.0
15215.187500	35.0	1000.0	1000.000	100.0	V	10.0	6.4	19.0	54.0

6 Photographs of the Test Set-Up

Refer to the test setup file.

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7 List of Test and Measurement Instruments

Equip.	Description	Model	Manufacturer	Last Date DD.MM.YYYY	Due Date DD.MM.YYYY
9023229	EMI test receiver	ESR3	Rohde&Schwarz	22.03.2021	31.08.2022
G1830003	Artificial mains network	ENV216	Rohde&Schwarz	04.11.2021	04.11.2022
G1824845	EMC measurement software	EMC32 (Ver 10.20.01)	Rohde&Schwarz	N/A	N/A
G1824248	Dual display multimeter	F45	Fluke	18.09.2020	18.09.2022
G1811378	3m modified semi-anechoic chamber	SAC3	Frankonia	27.06.2019	27.06.2022
G1811402	EMI test receiver	ESCI	Rohde&Schwarz	01.09.2021	01.09.2022
G1811425	Bilog antenna	CBL 6112D	Teseq	10.03.2020	10.03.2023
G1811417	Log periodic antenna	HL050	Rohde&Schwarz	10.03.2020	10.03.2023
G1822702	Spectrum analyser	FSV40	Rohde&Schwarz	04.11.2021	04.11.2023
G1824845	EMC measurement software	EMC32 (Ver 10.20.01)	Rohde&Schwarz	N/A	N/A
G1825371	Preamplifier	EMC051845SE	Taiwan EMCI	14.05.2021	14.05.2023

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