

EMC TEST REPORT

No. 2012281STO-101

Electromagnetic disturbances

EQUIPMENT UNDER TEST

Equipment: Luminaire for furniture with LED
Type/Model: L2009 Lindshult
Manufacturer: Producer AB
Tested by request of: HFB 10 Lighting

SUMMARY

Referring to the emission limits, and the operating mode during the tests specified in this report, the equipment complies with the requirements according to the following standards:

FCC 47 CFR Part 15: Radio frequency devices, Subpart B: Unintentional radiators. Class B equipment.

ICES-005 Issue 5: Lighting Equipment, Class B. (2018)

For details, see clause 2 – 4.

Date of issue: April 29, 2020

Tested by:


Anna Pogosian

Approved by:


Per Granberg

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Revision History

Test report number	Date	Description	Changes
2012281STO-101	April 29, 2020	First release	

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1. CLIENT INFORMATION

The EUT has been tested by request of

Company	IKEA of Sweden HFB 10 Lighting Box 702 343 81 Älmhult Sweden
Name of contact	Markus Mauritzon

2. EQUIPMENT UNDER TEST (EUT)

2.1 Identification of the EUT

Equipment	Luminaire for furniture with LED
Type/Model	L2009 Lindshult
Brand name	IKEA
Serial Number	-
Manufacturer	IKEA of Sweden
Rating	24 V DC, 1.5 W
Class	III
Highest clock frequency	< 108 MHz
Software/Firmware version	-
FCC ID	FHO-L2009

 <p>Intertek</p> <p>???????</p> <p>Type No. L2009</p> <p>Lindshult</p> <p>Made in</p>	<p>FCC ID: FHO-L2009</p> <p>Conforms to:UL Std 1598 Certified to:CSA Std C22.2 No. 250.0 CAN ICES-005 (B) / NMB-005 (B) This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.</p>	<p>Sup. No.00000</p> 
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Rating plate (draft)

2.2 Test set up and EUT photos

Test set up and EUT photos are enclosed in Annex 1 No 2012281STO-103 to this test report.

2.3 Additional information about the EUT

The EUT is a dimmable luminaire for furniture with LED supplied by an external LED driver, tested in a table-top configuration.

The EUT was equipped with the following cables:

Port	Type	Length [m]	Specifications
DC input	Two core	3,5	

2.4 Peripheral equipment

Peripheral equipment is equipment needed for correct operation of the EUT, but not included as part of the testing and evaluation of the EUT.

Equipment	Type / Model	Manufacturer	Serial no.
LED driver	ICPSLC24-30NA-IL-1	IKEA	-
LED driver	ICPSLC24-10NA-IL-1	IKEA	-

3. TEST SPECIFICATIONS

3.1 Standards

Requirements:

FCC 47 CFR Part 15: Radio frequency devices, Subpart B: Unintentional radiators.

ICES-005 Issue 5: Lighting Equipment (2018).

Test methods:

ANSI C63.4: 2014: American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

3.2 Additions, deviations and exclusions from standards and accreditation

No additions, deviations or exclusions have been made from standards and accreditation.

3.3 Test site

Measurements were performed at:

Intertek Semko AB.
Torshamnsgatan 43,
P.O. Box 1103
SE-164 22 Kista

Intertek Semko AB is a FCC listed test site with site registration number 90913
Intertek Semko AB is a FCC accredited conformity assessment body with designation number SE0002
Intertek Semko AB is an Industry Canada listed test facility with IC assigned code 2042G

Measurement chambers

Measurement Chamber	Type of chamber	IC Site filing #
STORA HALLEN	Semi-anechoic 10 m and 3 m	2042G-2

3.4 Mode of operation during the test

The EUT was tested with 120 V, 60 Hz.

The EUT was measured with the dimmer regulation set to max luminous intensity, min luminous intensity and in standby mode with two alternative LED drivers, type ICPSLC24-30NA-IL-1 and ICPSLC24-10NA-IL-1.

3.5 Compliance

The EUT shall comply with the emission limits according to the standards as listed below

Conducted emission requirements:

The EUT shall meet the limits for the standards.

Reference: 47 CFR §15.107
ICES-005, section 5.5.2

Limits for conducted emission according to FCC and ICES-005

Class B

Frequency range [MHz]	Limits [dBµV]	
	Quasi-Peak	Average
0.15 – 0.50	66 – 56	56 – 46
0.50 – 5.00	56	46
5.00 – 30.0	60	50

Radiated Emission requirements:

The EUT shall meet the limits for the standards.

Reference: 47 CFR §15.109
ICES-005, section 5.5.3

Limits for radiated emission according to FCC

Class B

Frequency range [MHz]	Field strength at 3 m (dBµV/m)	Field strength at 10 m (dBµV/m)	Detector
30 – 88	40.0	29.5	Quasi Peak
88 – 216	43.5	33.1	Quasi Peak
216 – 960	46.0	35.6	Quasi Peak
960 – 1000	54.0	43.5	Quasi Peak
Above 1000	54.0 / 74.0	43.5 / 63.5	Average / Peak

The values for 10 m measuring distance are calculated by subtracting 10.5 dB from the 3 m limit. (i.e. an extrapolation factor of 20 dB/decade according to §15.31(f)(1))

Limits for radiated emission according to ICES-005

Class B

Frequency range [MHz]	Field strength at 3 m (dBµV/m)	Field strength at 10 m (dBµV/m)	Detector
30 – 88	40.0	29.5	Quasi Peak
88 – 216	43.5	33.1	Quasi Peak
216 – 1000	46.0	35.6	Quasi Peak

4. TEST SUMMARY

The results in this report apply only to sample tested:

Standard	Description	Result
	Emission	
FCC Part 15 subpart B ICES-005	Conducted continuous emission in the frequency range 0.150 – 30 MHz, AC Power input port The EUT complies with the Class B limits. The margin to the limit was at least 11.7 dB at 0.605 MHz See clause 5.4.	PASS
FCC Part 15 subpart B ICES-005	Radiated emission of electromagnetic fields in the frequency range 30 – 1000 MHz The EUT complies with the Class B limits. The margin to the limit was at least 10.2 dB at 49.800 MHz See clause 6.6.	PASS
FCC Part 15 subpart B ICES-005	Radiated emission of electromagnetic fields in the frequency range > 1 GHz Not applicable. The highest clock frequency of the EUT is below 108 MHz.	N/A

5. CONDUCTED CONTINUOUS DISTURBANCES in the frequency-range 0.15 – 30 MHz

5.1 Operating environment

Date of test:	Temperature:	Relative Humidity:
April 6, 2020	22 [°C]	27 [%]

5.2 Test setup and test procedure

The test method is in accordance with ANSI C63.4.

The EUT was connected to the power via Artificial Mains Networks AMN.

The EUT was placed on an insulating support 0.8 m above the floor, 0.4 m from the vertical reference ground plane (RGP) and 0.8 m from the AMN.

Overview sweeps were performed for each lead.

During the tests the EUT was operated according to the mode of operation mentioned in clause 3.4.

5.3 Measurement uncertainty

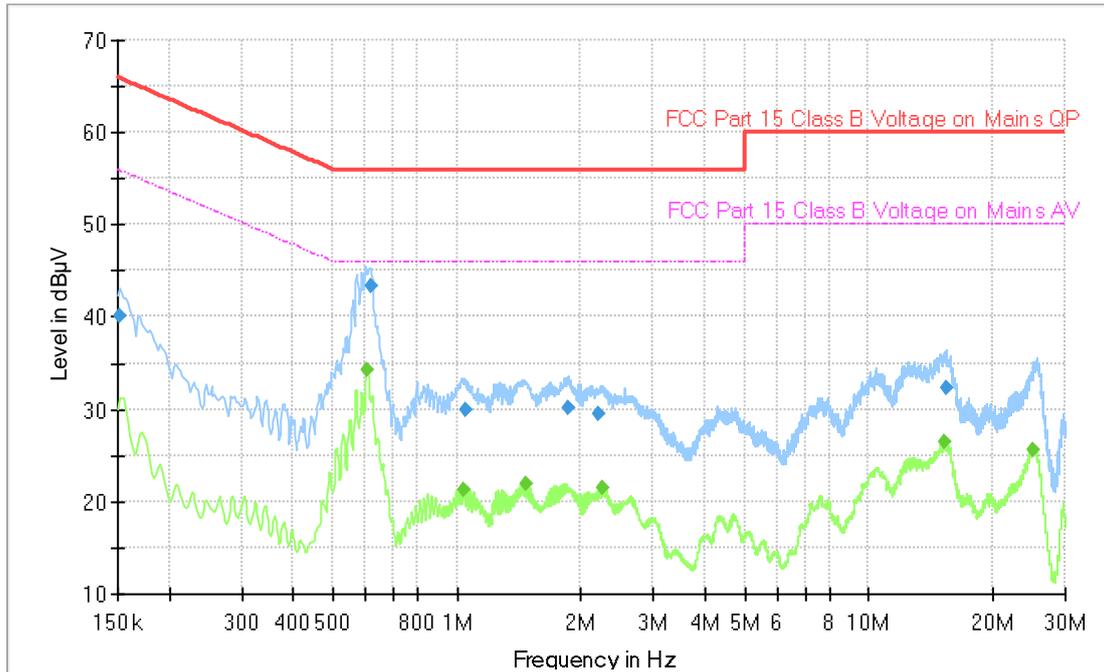
Continuous conducted disturbances with AMN
in the frequency range 150 kHz to 30 MHz

± 3.3 dB

Measurement uncertainty is calculated in accordance with CISPR 16-4-2:2011.

The measurement uncertainty is given with a confidence of 95 %.

5.4 Test results, AC Power input port, Class B, ICPSLC24-10NA-IL-1, max intensity



Diagram, Peak and Average overview sweep

Measurement results, Quasi-peak, Class B

Frequency [MHz]	Result [dBµV]	Limit [dBµV]	Line L/N	Margin [dB]
0.616	43.4	56.0	L	12.6

All other measured disturbances have a margin of more than 20 dB to the limits.

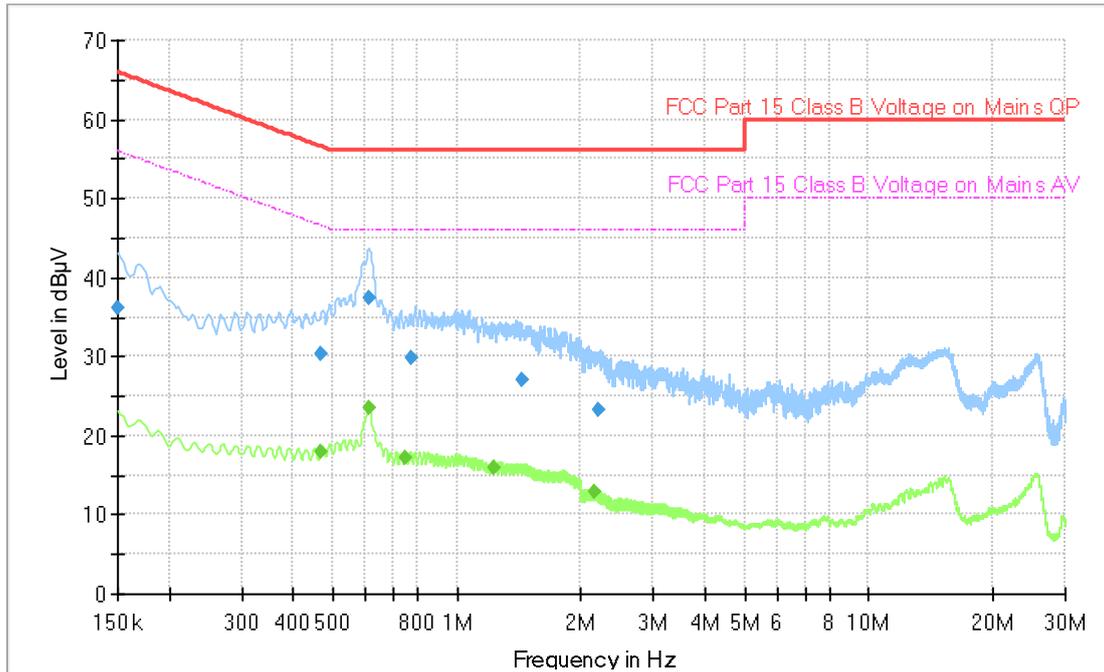
Measurement results, Average, Class B

Frequency [MHz]	Result [dBµV]	Limit [dBµV]	Line L/N	Margin [dB]
0.605	34.3	46.0	L	11.7

All other measured disturbances have a margin of more than 20 dB to the limits.

Result [dBµV] = Analyser reading [dBµV] + cable loss [dB] + LISN insertion loss [dB]

5.5 Test results, AC Power input port, Class B, ICPSLC24-10NA-IL-1, min intensity



Diagram, Peak and Average overview sweep

Measurement results, Quasi-peak, Class B

Frequency [MHz]	Result [dBµV]	Limit [dBµV]	Line L/N	Margin [dB]
0.614	37.3	56,0	L	18.7

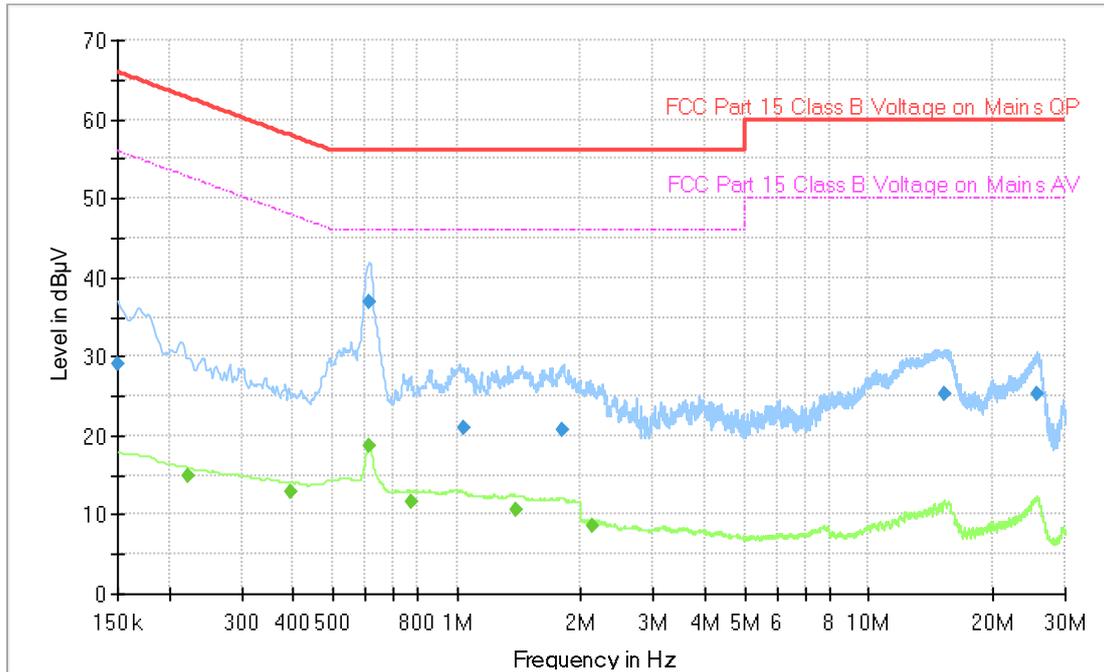
All other measured disturbances have a margin of more than 20 dB to the limits.

Measurement results, Average, Class B

The margin to the limit is at least 20 dB for all frequencies.

$$\text{Result [dBµV]} = \text{Analyser reading [dBµV]} + \text{cable loss [dB]} + \text{LISN insertion loss [dB]}$$

5.6 Test results, AC Power input port, Class B, ICPSLC24-10NA-IL-1, standby



Diagram, Peak and Average overview sweep

Measurement results, Quasi-peak, Class B

Frequency [MHz]	Result [dBµV]	Limit [dBµV]	Line L/N	Margin [dB]
0.614	36.8	56.0	L	19.2

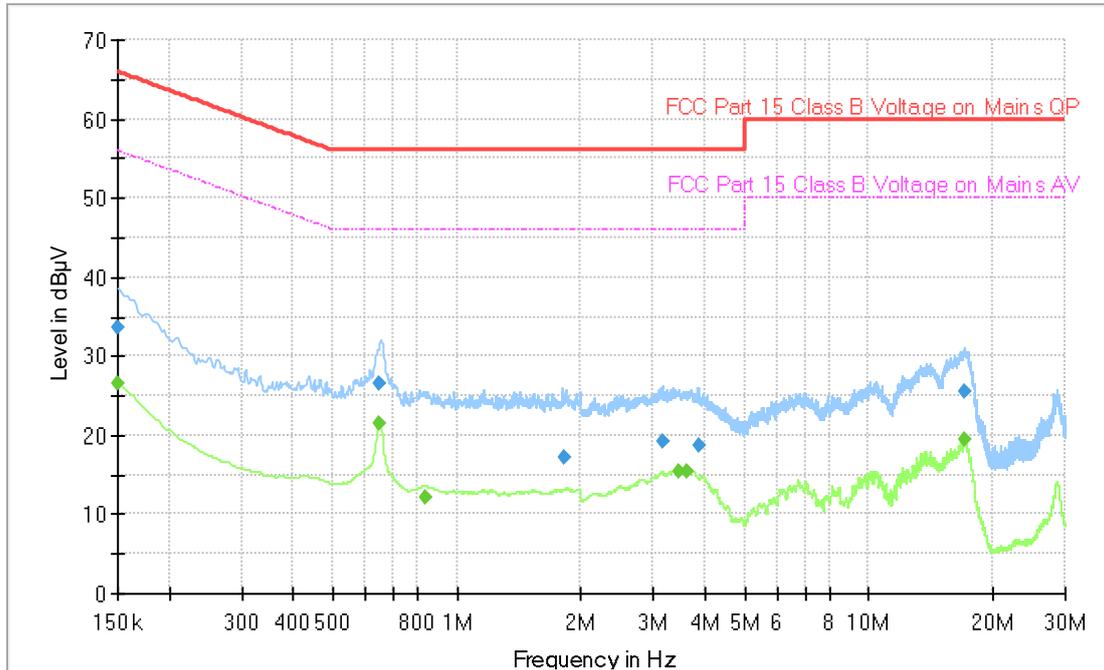
All other measured disturbances have a margin of more than 20 dB to the limits.

Measurement results, Average, Class B

The margin to the limit is at least 20 dB for all frequencies.

$$\text{Result [dBµV]} = \text{Analyser reading [dBµV]} + \text{cable loss [dB]} + \text{LISN insertion loss [dB]}$$

5.7 Test results, AC Power input port, Class B, ICPSLC24-30NA-IL-1, max intensity



Diagram, Peak and Average overview sweep

Measurement results, Quasi-peak, Class B

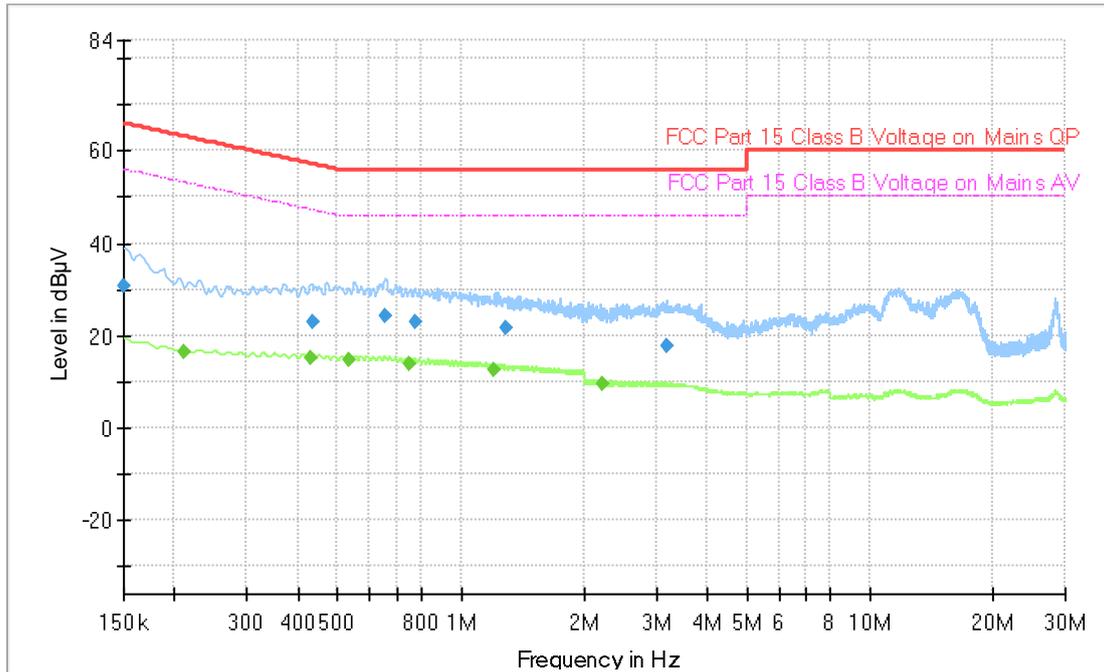
The margin to the limit is at least 20 dB for all frequencies.

Measurement results, Average, Class B

The margin to the limit is at least 20 dB for all frequencies.

$$\text{Result [dB}\mu\text{V]} = \text{Analyser reading [dB}\mu\text{V]} + \text{cable loss [dB]} + \text{LISN insertion loss [dB]}$$

5.8 Test results, AC Power input port, Class B, ICPSLC24-30NA-IL-1, min intensity



Diagram, Peak and Average overview sweep

Measurement results, Quasi-peak, Class B

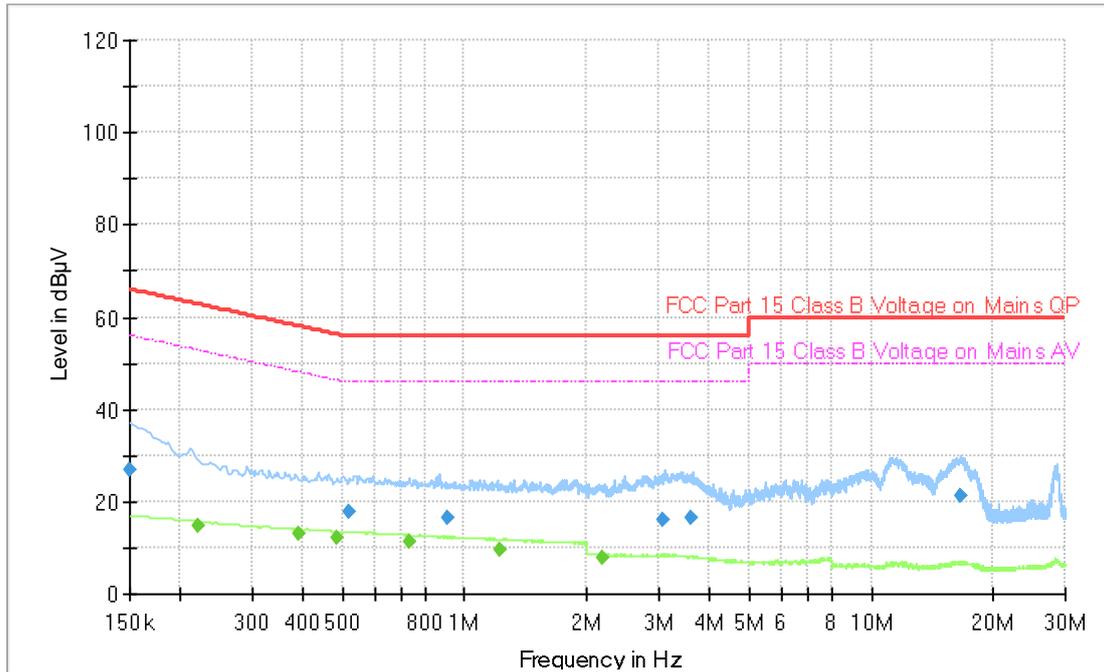
The margin to the limit is at least 20 dB for all frequencies.

Measurement results, Average, Class B

The margin to the limit is at least 20 dB for all frequencies.

$$\text{Result [dB}\mu\text{V]} = \text{Analyser reading [dB}\mu\text{V]} + \text{cable loss [dB]} + \text{LISN insertion loss [dB]}$$

5.9 Test results, AC Power input port, Class B, ICPSLC24-30NA-IL-1, standby



Diagram, Peak and Average overview sweep

Measurement results, Quasi-peak, Class B

The margin to the limit is at least 20 dB for all frequencies.

Measurement results, Average, Class B

The margin to the limit is at least 20 dB for all frequencies.

$$\text{Result [dB}\mu\text{V]} = \text{Analyser reading [dB}\mu\text{V]} + \text{cable loss [dB]} + \text{LISN insertion loss [dB]}$$

5.10 Test equipment

Equipment type	Manufacturer	Model	Inv. No.	Last Cal. date	Cal. interval
Measurement software	Rohde & Schwarz	EMC32	--	--	--
Receiver	Rohde & Schwarz	ESU8	12866	06-2019	1 year
AMN / LISN	Rohde & Schwarz	ESH3-Z5	2728	06-2019	1 year
Pulse limiter	Rohde & Schwarz	ESH3-Z3	4623	03-2019	13 months
Cable	Huber+Suhner	RG223/U	9815	06-2019	1 year
Cable	Surhner	GO3232D-01	9701	06-2019	1 year

6. RADIATED RF EMISSION IN THE FREQUENCY-RANGE 30 MHZ – 1 GHZ

6.1 Operating environment

Date of test:	Temperature:	Relative Humidity:
April 14, 2020	20 [°C]	17 [%]
April 20, 2020	20 [°C]	31 [%]

6.2 Test setup and test procedure

The test method is in accordance with ANSI C63.4.

The EUT was set up according to the standard

The EUT was placed on an insulating support 0.8 m above the turntable which is part of the reference ground plane.

Overview sweeps were performed with the measurement receiver in max-hold mode and the peak detector activated in the frequency-range 30 – 1000 MHz.

6.3 Test conditions

Test setup:	30 – 1000 MHz		
Test receiver set-up:			
Preview test:	Peak,	RBW 120 kHz	VBW 1 MHz
Final test:	Quasi-Peak,	RBW 120 kHz	
Measuring distance:	3 m		
Measuring angle:	0 – 359°		
Antenna			
Height above ground plane:	1 – 4 m		
Polarisation:	Vertical and Horizontal		
Type:	Bilog		

6.4 Measurement uncertainty

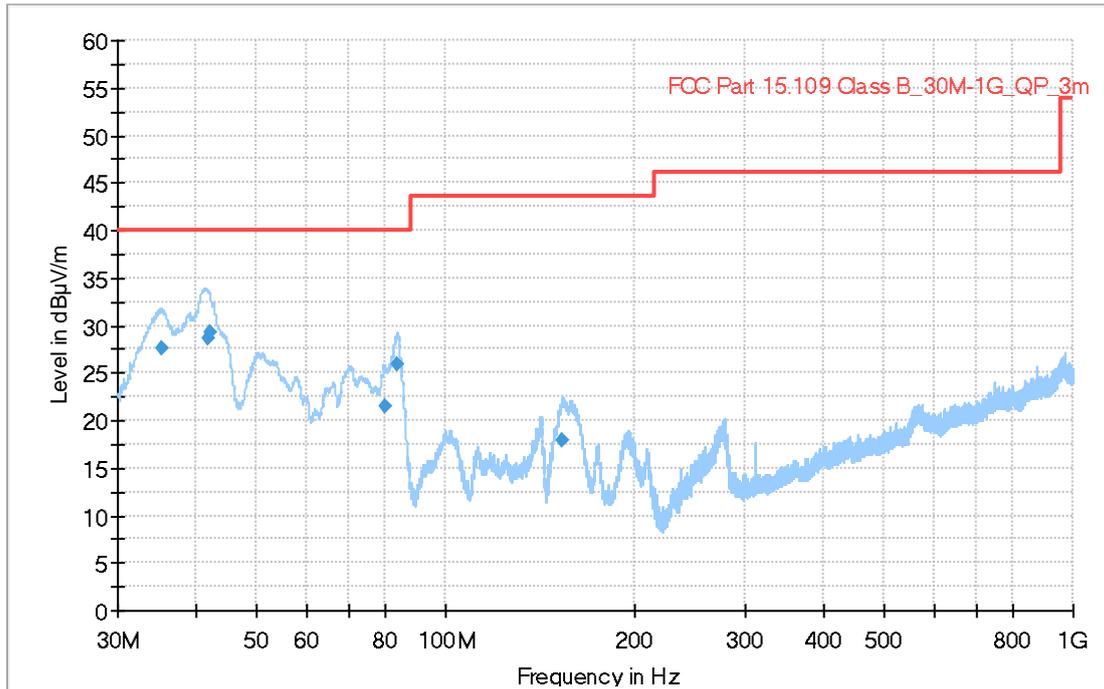
Measurement uncertainty for radiated disturbance

 Uncertainty for the frequency range 30 to 1000 MHz at 3 m ± 5.1 dB

Measurement uncertainty is calculated in accordance with CISPR 16-4-2:2011.

The measurement uncertainty is given with a confidence of 95 %.

6.5 Test results, 30 – 1000 MHz, FCC, Class B, ICPSLC24-10NA-IL-1, max intensity



Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance.

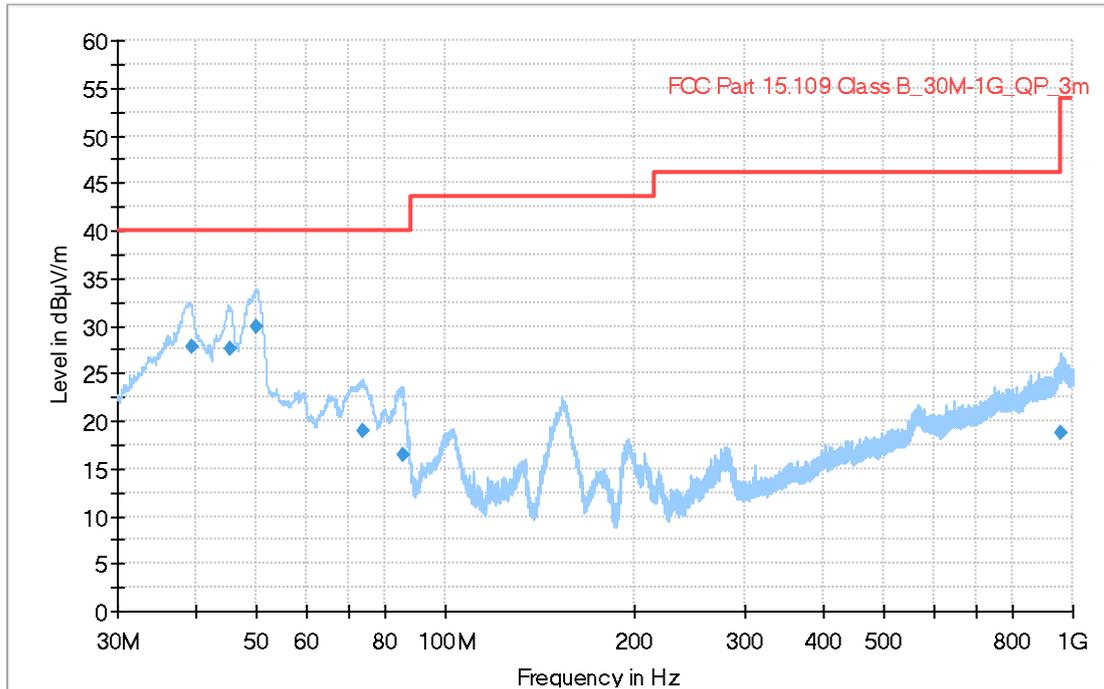
Measurement results, Quasi Peak, Class B

Frequency [MHz]	Result [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]
35.220	27.5	40.0	V	12.5
41.790	28.7	40.0	V	11.3
42.060	29.3	40.0	V	10.7
79.830	21.6	40.0	V	18.4
83.730	25.9	40.0	V	14.1
153.720	17.9	43.5	V	25.6

Result [dBµV/m] = Analyser reading [dBµV] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

The EUT also fulfils the limit for ICES-005, see limit table, clause 3.5 Compliance in this test report.

6.6 Test results, 30 – 1000 MHz, FCC, Class B, ICPSLC24-10NA-IL-1, min intensity



Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance.

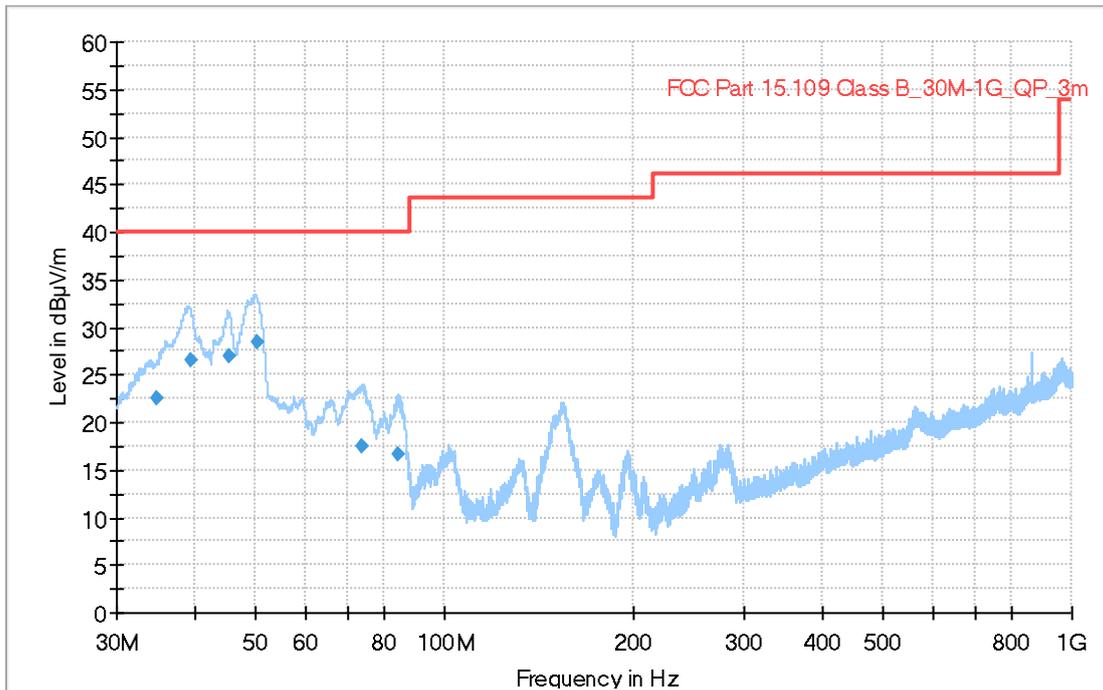
Measurement results, Quasi Peak, Class B

Frequency [MHz]	Result [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]
39.330	27.8	40.0	V	12.2
45.390	27.5	40.0	V	12.5
49.800	29.8	40.0	V	10.2
73.890	18.9	40.0	V	21.1
85.350	16.4	40.0	V	23.6
956.160	18.8	46.0	H	27.2

Result [dBµV/m] = Analyser reading [dBµV] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

The EUT also fulfils the limit for ICES-005, see limit table, clause 3.5 Compliance in this test report.

6.7 Test results, 30 – 1000 MHz, FCC, Class B, ICPSLC24-10NA-IL-1, standby



Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance.

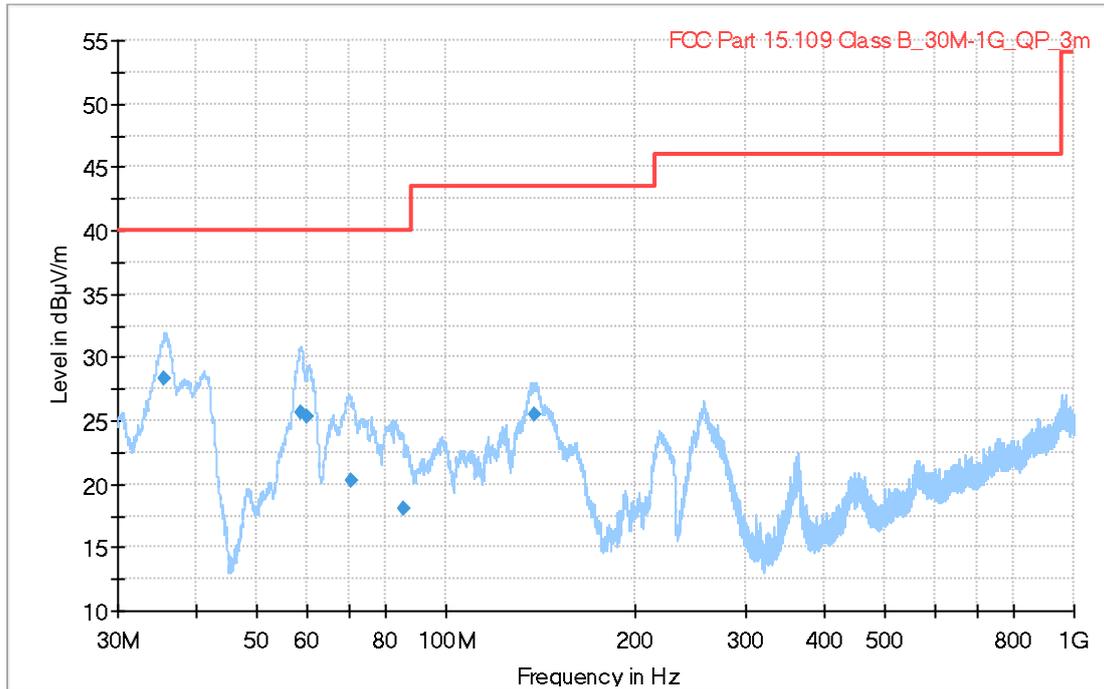
Measurement results, Quasi Peak, Class B

Frequency [MHz]	Result [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]
34.680	22.4	40.0	V	17.6
39.300	26.5	40.0	V	13.5
45.270	26.9	40.0	V	13.1
50.250	28.4	40.0	V	11.6
73.830	17.6	40.0	V	22.4
84.060	16.6	40.0	V	23.4

Result [dBµV/m] = Analyser reading [dBµV] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

The EUT also fulfils the limit for ICES-005, see limit table, clause 3.5 Compliance in this test report.

6.8 Test results, 30 – 1000 MHz, FCC, Class B, ICPSLC24-30NA-IL-1, max intensity



Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance.

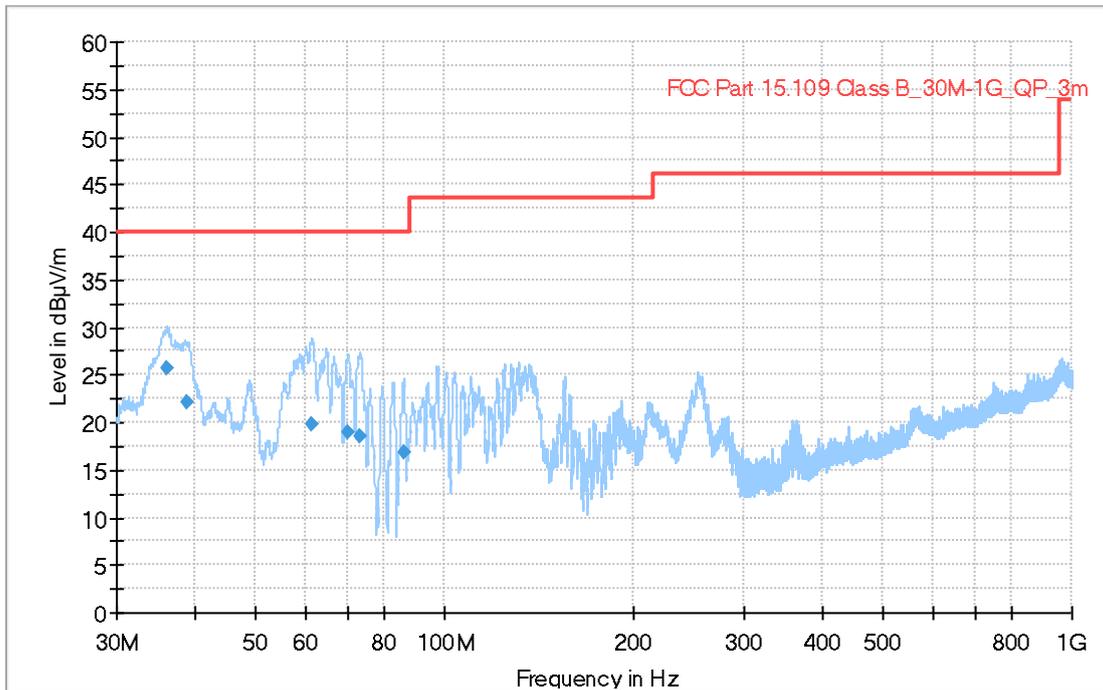
Measurement results, Quasi Peak, Class B

Frequency [MHz]	Result [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]
35.580	28.2	40.0	V	11.8
58.770	25.6	40.0	V	14.4
60.060	25.3	40.0	V	14.7
70.650	20.2	40.0	V	19.8
85.860	18.0	40.0	V	22.0
138.390	25.4	43.5	V	18.1

Result [dBµV/m] = Analyser reading [dBµV] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

The EUT also fulfils the limit for ICES-005, see limit table, clause 3.5 Compliance in this test report.

6.9 Test results, 30 – 1000 MHz, FCC, Class B, ICPSLC24-30NA-IL-1, min intensity



Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance.

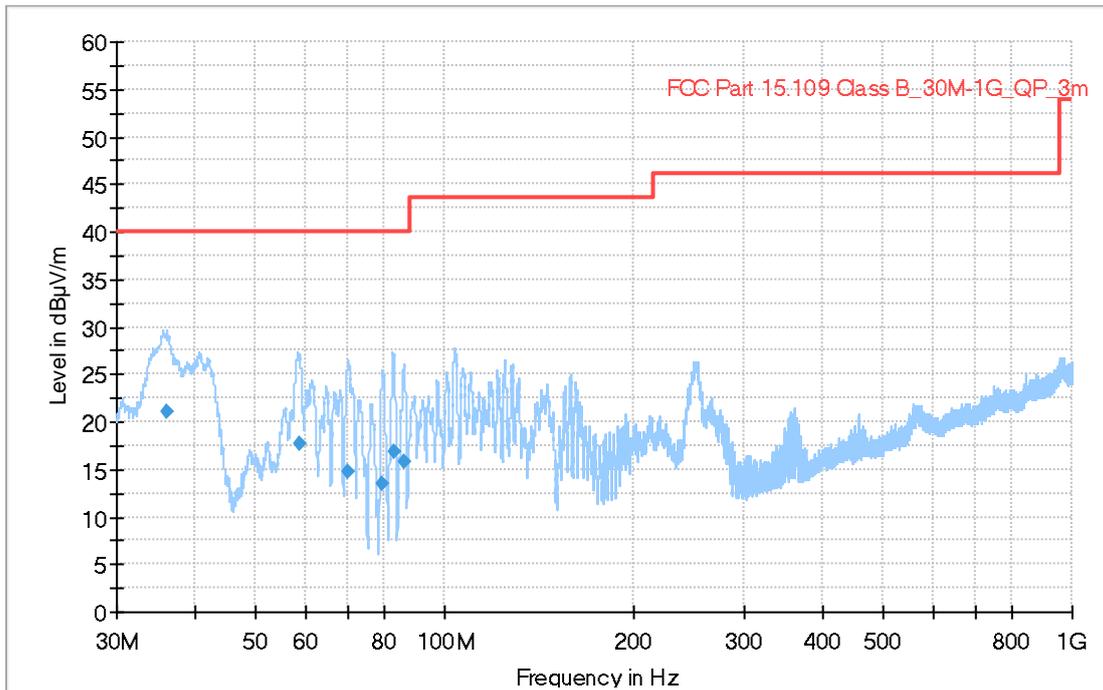
Measurement results, Quasi Peak, Class B

Frequency [MHz]	Result [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]
36.120	25.8	40.0	V	14.2
38.970	22.0	40.0	V	18.0
61.260	19.8	40.0	V	20.2
70.110	18.9	40.0	V	21.1
73.380	18.6	40.0	V	21.4
86.010	16.9	40.0	V	23.1

Result [dBµV/m] = Analyser reading [dBµV] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

The EUT also fulfils the limit for ICES-005, see limit table, clause 3.5 Compliance in this test report.

6.10 Test results, 30 – 1000 MHz, FCC, Class B, ICPSLC24-30NA-IL-1, standby



Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance.

Measurement results, Quasi Peak, Class B

Frequency [MHz]	Result [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]
36.120	21.0	40.0	V	19.0
58.590	17.8	40.0	V	22.2
70.290	14.7	40.0	V	25.3
79.680	13.5	40.0	V	26.5
82.860	16.8	40.0	V	23.2
86.190	15.9	40.0	V	24.1

Result [dBµV/m] = Analyser reading [dBµV] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

The EUT also fulfils the limit for ICES-005, see limit table, clause 3.5 Compliance in this test report.

6.11 Test equipment

Equipment type	Manufacturer	Model	Inv. No.	Last Cal. date	Cal. interval
Measurement software	Rohde & Schwarz	EMC32	--	--	--
Measurement Receiver	Rohde & Schwarz	ESU 44	33890	06-2019	1 year
Antenna bilog	Teseq	CBL6111D	34200	03-2020	3 years
Preamplifier	Semko	AM1331	7992	24-04-2019	1 year
Pulse limiter	Rohde & Schwarz	ESH3-Z2	32457	06-2019	1 year
Measurement cable	Rosenberger	LA5-S003-1000	39163	23-04-2019	1 year
Measurement cable	Rosenberger	LA5-S003-8500	39148	01-04-2020	1 year
Measurement cable	Huber+suhner	SUCOFLEX 106	39122	16-04-2020	1 year
Measurement cable	Suhner	RG 214/U	9798	01-2020	1 year