
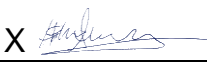


Prüfbericht-Nr.: <i>Test report no.:</i>	SE24EEOP-001	Auftrags-Nr.: <i>Order no.:</i>	290100495	Seite 1 von 22 <i>Page 1 of 22</i>
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	1774198	Auftragsdatum: <i>Order date:</i>	2023.10.25	
Auftraggeber: <i>Client:</i>	IKEA of Sweden AB			
Prüfgegenstand: <i>Test item:</i>	Hub for smart products			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	DIRIGERA / E2315 / FCC ID: FHO-E2315			
Auftrags-Inhalt: <i>Order content:</i>	Accredited testing			
Prüfgrundlage: <i>Test specification:</i>	FCC 47 CFR Part 15B with parts 15.107 & 15.109 ANSI C63.4: 2014			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2023.12.06			
Prüfmuster-Nr.: <i>Test sample no.:</i>	A003618316-004			
Prüfzeitraum: <i>Testing period:</i>	2024.01.15 - 2024.03.01			
Ort der Prüfung: <i>Place of testing:</i>	Lund, Sweden			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland Sweden			
Prüfergebnis*: <i>Test result*:</i>	Pass			
überprüft von: <i>reviewed by:</i>	X 	genehmigt von: <i>authorized by:</i>	X 	
Datum: 2024.04.15 <i>Date:</i>	Signed by: Fariborz Abasi	Datum: 2024.04.15 <i>Date:</i>	Signed by: Hakan Ahlberg	
Stellung / Position:	Technical Expert	Stellung / Position:	Lab Manager	
Sonstiges / Other:				
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:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend N/A = nicht anwendbar	4 = ausreichend N/T = nicht getestet
* Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory N/A = not applicable	4 = sufficient N/T = not tested
<p>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.</i></p>				

Revision History SE24EEOP-001 SE24EEOP-001

REVISION	DATE	REMARKS	AUTHOR
001	2024.04.15	First release	Fariborz Abasi

Note: Latest revision report will replace all previous reports
This report based on FCC Part 15B no JBP Template version 1.3

Summary of Test Results

FCC 47 CFR Rule Part	Test Description	Applicability	Report Section	RESULT	REMARKS
15.107	AC Power Line Conducted Emissions (Unintentional Radiators)	YES	4.1	PASS	
15.109	Radiated Emissions (Unintentional Radiators)	YES	4.2	PASS	

Possible test case verdicts:

- Test case does not apply to the test object: N/A
- Test object complies with the requirement: PASS or COMPLIANT
- Test object does not meet the requirement: FAIL or NOT COMPLIANT
- Test case not performed on the test object: N.P.

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1. GENERAL INFORMATION

1.1 Test Site

Test Facility:	TÜV Rheinland Sweden AB
Address:	Mobilvägen 10
	223 62 Lund
	Sweden
Swedac Registration Number:	10325
FCC Test Firm Registration Number:	517458
ISED Test Site Registration Number:	24753

1.2 Client Information

Company Name:	IKEA of Sweden AB
Address:	Tulpanvägen 8
	343 34 Älmhult
	Sweden
Contact Person:	Gurudeep Manjulgud Devraj
Contact e-Mail / Telephone	gurudeep.manjulgud.devraj@inter.ikea.com

2. PRODUCT INFORMATION

2.1 General Description

Model name:	DIRIGERA
Manufacturer:	IKEA of Sweden AB, SE-343 81 Älmhult
Model number / Marketing name:	E2315
FCC ID:	FHO-E2315
Description:	Hub for smart products
Ancillary Equipment:	See section 2.7

The device incorporates two separate pre-certified modules:

- Silicon Labs MGM210L22F “No. 1” (FCC ID: QOQMGM210L) for ZigBee 802.15.4
- Silicon Labs MGM210L22F “No. 2” (FCC ID: QOQMGM210L) for Thread 802.15.4

Each module uses its own built-in antenna

2.2 Device Characteristics

Device Class for 47 CFR Part 15 B	B
Type of Power Supply	USB Power Supply (via AC/DC Adapter)
Nominal Supply Voltage	120V or 230V AC (Adapter) / 5V DC (USB)
Supply Voltage Range	100-240V AC
Operating Temperature Range	0°C - 40 °C
Operating Air Humidity Range	-
Highest Internal Frequency Source	2480 MHz

2.3 Test Samples

EUT #	EUT ID	Description	Used For:
1	A003618316-004	DUT Conducted Radio 2	- Conducted Emissions - Radiated Emissions

2.4 Wireless Technologies and Bands Supported by the EUT

Technology	Band	Frequency Range (Tx)	Evaluation Performed*
ZigBee 802.15.4 (MGM210L22F22F No.1)	2.4 GHz	2405 MHz – 2480 MHz	YES
Thread 802.15.4 (MGM210L22F22F No.2)	2.4 GHz	2405 MHz – 2480 MHz	YES

*This statement refers only to this report. Other wireless technologies may be covered by other reports.

2.5 Antenna Information

Technology	Band	Number of Antennas	Antenna Type(s)	Gain
ZigBee 802.15.4 (MGM210L22F No.1)	2.4 GHz	1	Inverted F PCB Trace	0.50
Thread 802.15.4 (MGM210L22F No.2)	2.4 GHz	1	Inverted F PCB Trace	0.50

2.6 Wireless Technology Details

Technology	Band	Modulation Type(s)	No. of Channels	Channel Spacing	Adaptivity
ZigBee 802.15.4 (MGM210L No.1)	2.4 GHz	O-QPSK	16	5 MHz	-
Thread 802.15.4 (MGM210L No.2)	2.4 GHz	O-QPSK	16	5 MHz	-

2.7 Ancillary Equipment

ID	Description
A003625200-001	5W Power supply
A003623398-003	USB C cable
A003623398-007	UTP Ethernet cable
A003618316-002	5W Power supply
A003618316-006	USB C cable
A003618316-013	UTP Ethernet cable

2.8 EUT Diagrams

N/A

3. TEST METHODS

3.1 Test Standards

Testing was performed according to the following standards / references

Standard	Version	Description
FCC 47 CFR 15.107	-	Conducted limits
FCC 47 CFR 15.109	-	Radiated emission limits

3.2 Additional references

The following standards / references were also considered for the testing

Standard	Version	Description
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

3.3 Limits

FCC 47 CFR Rule Part	Test Description	Limit Reference (FCC 47 CFR Reference)
15.107	AC Power Line Conducted Emissions (Unintentional Radiators)	15.107 (a) for Class B Devices
15.109	Radiated Emissions (Unintentional Radiators)	15.109 (a) for Class B Devices *See Note 1

Interpretation of the measurement results has been performed in accordance with ANSI C63.4 section 10.2.8.2

Compliance with the requirements has been based on the results of the measurements compared to the specified limits, not taking into account measurement instrumentation uncertainty.

Measurement Uncertainty figures are stated in section 6

Note 1

Radiated Emissions limits in the tables from 47 CFR sections 15.109 are presented in $\mu\text{V}/\text{m}$. Measurements on the test system are made in $\text{dB}\mu\text{V}/\text{m}$. To convert between these, the following adjustment is used:

$$\text{New Limit} = 20 \log \left(\frac{\text{Original Limit}}{10^6} \right) + 120$$

Example: from 15.209(a) the limit for 30MHz – 88MHz is $100\mu\text{V}/\text{m}$ at 3m. This gives:

$$\text{New Limit} = 20 \log \left(\frac{100}{10^6} \right) + 120 = 40\text{dB}\mu\text{V}/\text{m} \text{ at } 3\text{m}$$

Additionally, in some cases testing has been performed at distances other than those specified in the tables. When this has occurred, the limits have been adjusted in accordance with the requirements in 47 CFR 15.31, using an extrapolation factor of 40dB/decade at frequencies below 30MHz and 20dB/decade at or above 30MHz

Example: from 15.209(a) the limit for 1.705MHz – 30MHz is $30\mu\text{V}/\text{m}$ (=29.54 $\text{dB}\mu\text{V}/\text{m}$) at 30m

$$\text{Limit}@3\text{m} = \text{Limit}@30\text{m} + 40 \log \left(\frac{30}{3} \right) = 29.54 + 40.00 = 69.54 \text{ dB}\mu\text{V}/\text{m} \text{ at } 3\text{m}$$

Example: from 15.209(a) the limit for 1GHz – 18GHz is $500\mu\text{V}/\text{m}$ (=53.98 $\text{dB}\mu\text{V}/\text{m}$) at 3m

$$\text{Limit}@1\text{m} = \text{Limit}@3\text{m} + 20 \log \left(\frac{3}{1} \right) = 53.98 + 9.54 = 63.52 \text{ dB}\mu\text{V}/\text{m} \text{ at } 1\text{m}$$

3.4 Description of Test Methods and Equipment Setup

3.4.1 General Description

Testing was performed in accordance with the various requirements of ANSI C63.4 and ANSI C63.10. Any deviations from the test methods are described in section 3.7

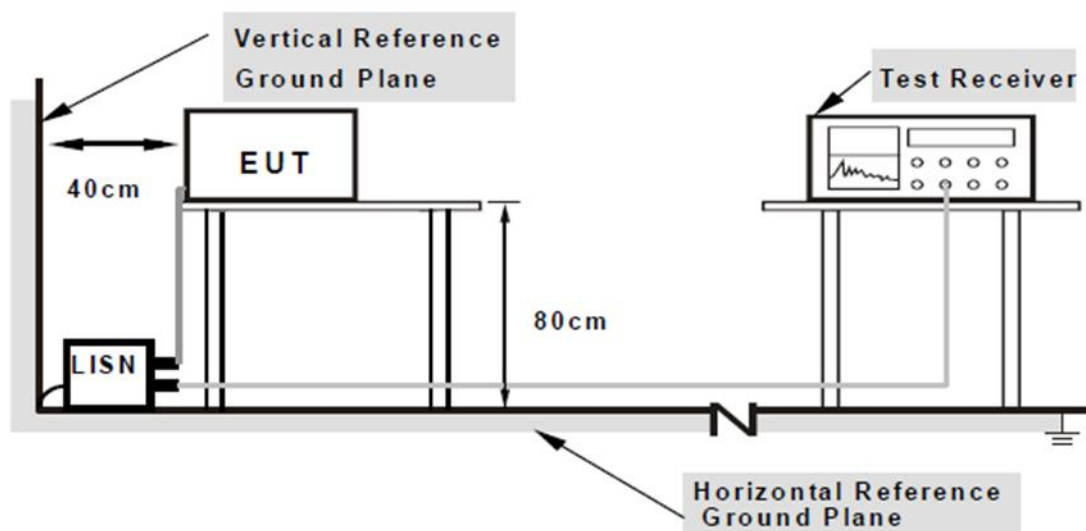
Where different arrangements of equipment were used for different types of measurements, these are tabulated in section 3.4.2 and details of each arrangement are included in subsequent sections

3.4.2 Test Equipment Setup Used by Test Type

FCC 47 CFR Rule Part	Test Description	Test Equipment Used
15.107	AC Power Line Conducted Emissions (Unintentional Radiators)	Conducted Emissions
15.109	Radiated Emissions (Unintentional Radiators)	SAC5

3.4.3 Test Equipment Setup – Conducted Emissions

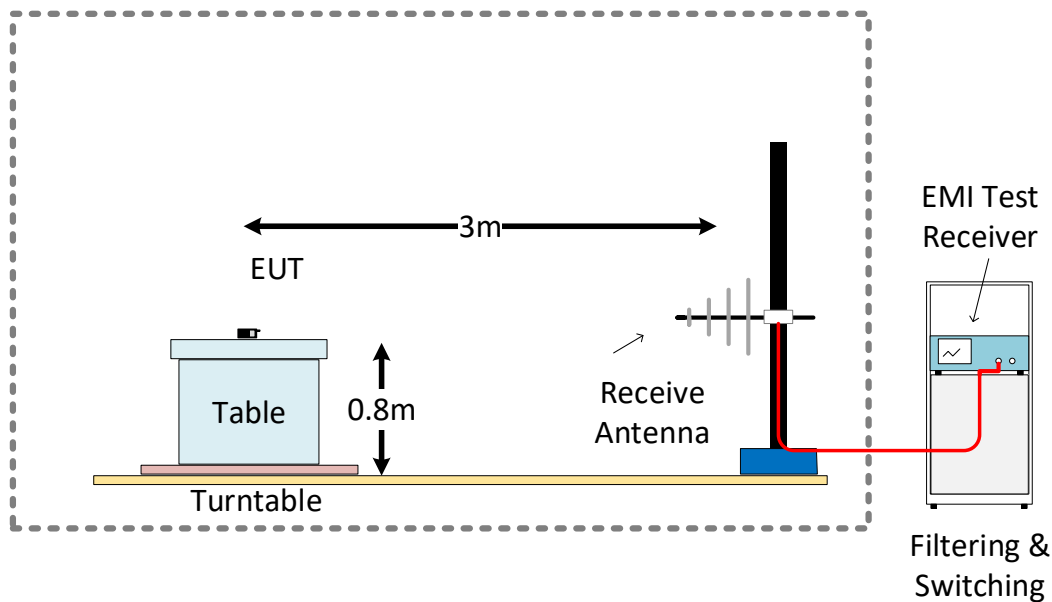
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The LISNs provide 50Ω/ 50μH of coupling impedance for the measuring instrument.
- The lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz was searched. Emission levels over 10 dB under the prescribed limits could not be reported.



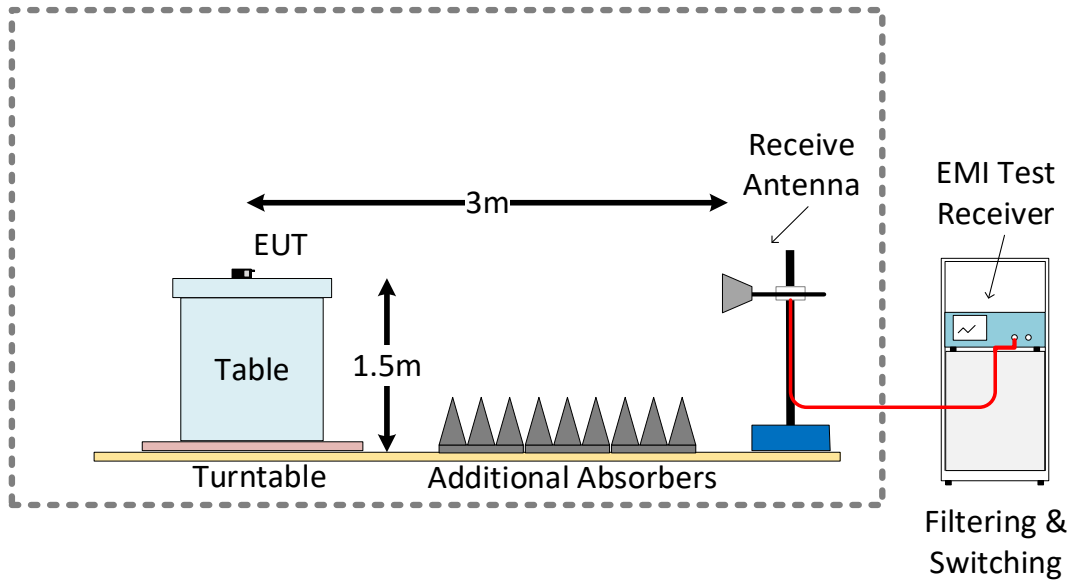
3.4.4 Test Equipment Setup – SAC 5 (Radiated Emissions)

- For frequency range 30MHz-1GHz Log-Periodic Antenna was used. Antenna elevated from 100 cm from floor to 400 cm from floor, and was placed at 3 m from center of turntable in tilted position. The equipment under test (EUT) was placed at the middle of the turntable at 80 cm height from floor. The antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained.
- For frequency range 1GHz-18GHz horn Antenna was used. Antenna elevated from 100 cm from floor to 200 cm from floor, and was placed at 3 m from center of turntable. The equipment under test (EUT) was placed at the middle of the turntable at 150 cm height from floor. The antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained.
- For frequency range 18GHz-40GHz double horn Antenna was used. Antenna's height was adjusted to 150 cm from floor, and 1 m distance to center of turntable. The equipment under test (EUT) was placed at the middle of the turntable on at 150 cm height from floor.
- For all frequency ranges the turntable was rotated 360° for obtaining the maximum emission.

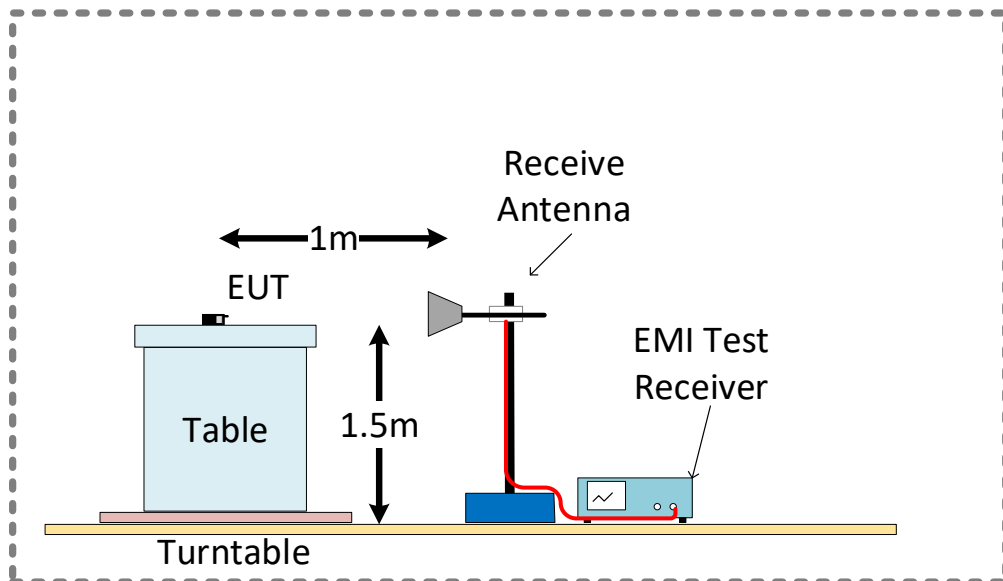
SAC 5 Test Setup Configuration 30MHz – 1GHz



SAC 5 Test Setup Configuration 1GHz – 18GHz



SAC 5 Test Setup Configuration 18GHz – 40GHz



3.5 EUT Configuration During Test

AC Power Line Conducted Emissions

For AC power line conducted emissions testing, the device was connected to the USB Charger and set to continuous transmit mode on the mid channel with appropriate modulation. A LAN cable was connected between the device and a laptop PC placed outside of the test area. Conducted emissions tests were run on the Mains AC connection to the charger. See test setup photographs for more detail.

Radiated Emissions

For radiated emissions testing, the device was connected to the USB Charger and set to continuous transmit mode on an appropriate channel, with appropriate modulation. A LAN cable was connected between the device and a laptop PC placed outside of the test area.

3.6 EUT Operation Modes

Operation mode	Description
Idle	The device was set to RX mode by below command in “ETS application” “Ets_app cert_zibee_idle”

3.7 Deviations from the Test Standard

This product is based on pre-certified modules as described in section 2.1, hence a limited test scope has been verified.

Measurement data from certification reports for the modules was used in determining which tests to include or exclude from the scope. A comparison of conducted output power between the module and the device covered by this report is included in section 4.13

3.8 Environmental Conditions

3.8.1 Environmental Conditions – Conducted Emissions System

Date	Time	Temperature (°C)	Relative Humidity (%)
2024.01.17	09:16	20.6	23

3.8.2 Environmental Conditions – SAC5 (Radiated Emissions)

Date	Time	Temperature (°C)	Relative Humidity (%)
2024.01.15	09:30	19.2	29 %
2024.01.16	08:17	18.2	28 %
2024.03.01	09:15	19.0	31 %

4. TEST RESULTS

4.1 Test Results – AC Power Line Conducted Emissions (Unintentional Trans.)

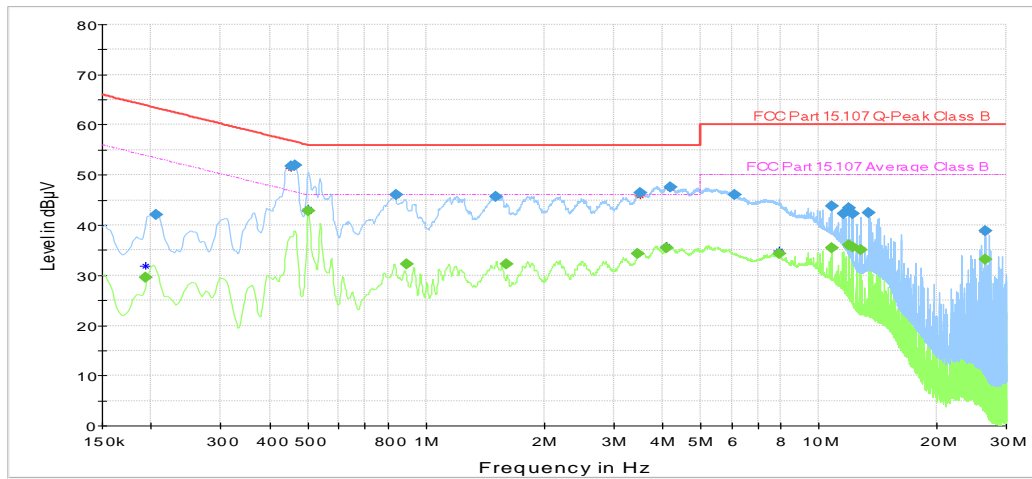
4.1.1 AC Power Line Conducted Emissions (Unintentional) – Test Summary

Test Specification	FCC 47 CFR 15.107 (Part 15 Subpart B)	
Test Engineer & Date	Fariborz Abasi	2024.01.17
EUT IDs	A003618316-004	
Ancillary Equipment IDs	- 5W Power supply A003625200-001 - USB C cable A003623398-003 - UTP Ethernet cable A003623398-007	
EUT Operation Mode(s)	Idle	
EUT Wireless Configuration(s)	Ets_app cert_zibee_idle	
EUT Hardware Configuration(s)	Attached to charger with USB-C cable. Attached with ethernet to computer	
Overall Result	Pass	
Test Parameter	Frequency Range	Result*
AC Power Line Emissions - Idle Mode	150 kHz – 30 MHz	Pass

* For detailed measurements, see tables and graphs in sections below

4.1.2 AC Power Line Conducted Emissions (Unintentional) – Test Details

Test mode condition	Conducted Emissions	
Sweep frequency	150 kHz – 30 MHz	
Standard	FCC 47 Part 15.107	
EUT	A003618316-004	
Ancillary Equipment	- 5W Power supply A003625200-001 - USB C cable A003623398-003 - UTP Ethernet cable A003623398-007	
Test Engineer	Fariborz Abasi	Date: 2024.01.17



— Preview Result 2-CAV — Preview Result 1-QPK
* Critical_Freqs CAV * Critical_Freqs QPK
— FCC Part 15.107 Q-Peak Class B — FCC Part 15.107 Average Class B
◆ Final_Result QPK ◆ Final_Result CAV

Frequency (MHz)	QuasiPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.192750	---	29.58	53.92	24.34	1000.0	9.000	L1	ON	9.6
0.206250	42.07	---	63.36	21.29	1000.0	9.000	L1	ON	9.6
0.453750	51.83	---	56.81	4.98	1000.0	9.000	L1	ON	9.6
0.465000	52.02	---	56.60	4.58	1000.0	9.000	L1	ON	9.6
0.503250	---	42.79	46.00	3.21	1000.0	9.000	L1	ON	9.6
0.838500	46.01	---	56.00	9.99	1000.0	9.000	L1	ON	9.6
0.890250	---	32.18	46.00	13.82	1000.0	9.000	L1	ON	9.6
1.506750	45.76	---	56.00	10.24	1000.0	9.000	L1	ON	9.7
1.599000	---	32.20	46.00	13.80	1000.0	9.000	L1	ON	9.7
3.444000	---	34.30	46.00	11.70	1000.0	9.000	L1	ON	9.7
3.516000	46.39	---	56.00	9.61	1000.0	9.000	L1	ON	9.7
4.083000	---	35.53	46.00	10.47	1000.0	9.000	L1	ON	9.7
4.179750	47.56	---	56.00	8.44	1000.0	9.000	L1	ON	9.7
6.112500	46.01	---	60.00	13.99	1000.0	9.000	L1	ON	9.7
7.923750	---	34.35	50.00	15.65	1000.0	9.000	L1	ON	9.7
10.792500	43.72	---	60.00	16.28	1000.0	9.000	L1	ON	9.8
10.792500	---	35.47	50.00	14.53	1000.0	9.000	L1	ON	9.8
11.586750	42.26	---	60.00	17.74	1000.0	9.000	L1	ON	9.8
11.892750	43.43	---	60.00	16.57	1000.0	9.000	L1	ON	9.8
11.892750	---	35.98	50.00	14.02	1000.0	9.000	L1	ON	9.8
12.198750	---	35.61	50.00	14.39	1000.0	9.000	L1	ON	9.8
12.198750	42.29	---	60.00	17.71	1000.0	9.000	L1	ON	9.8
12.747750	---	35.07	50.00	14.93	1000.0	9.000	L1	ON	9.8
13.418250	42.47	---	60.00	17.53	1000.0	9.000	N	ON	9.8
26.610000	---	33.15	50.00	16.85	1000.0	9.000	L1	ON	9.8
26.610000	38.77	---	60.00	21.23	1000.0	9.000	L1	ON	9.8

4.2 Test Results – Radiated Emissions (Unintentional Transmitter)

4.2.1 Radiated Emissions (Unintentional) – Test Summary

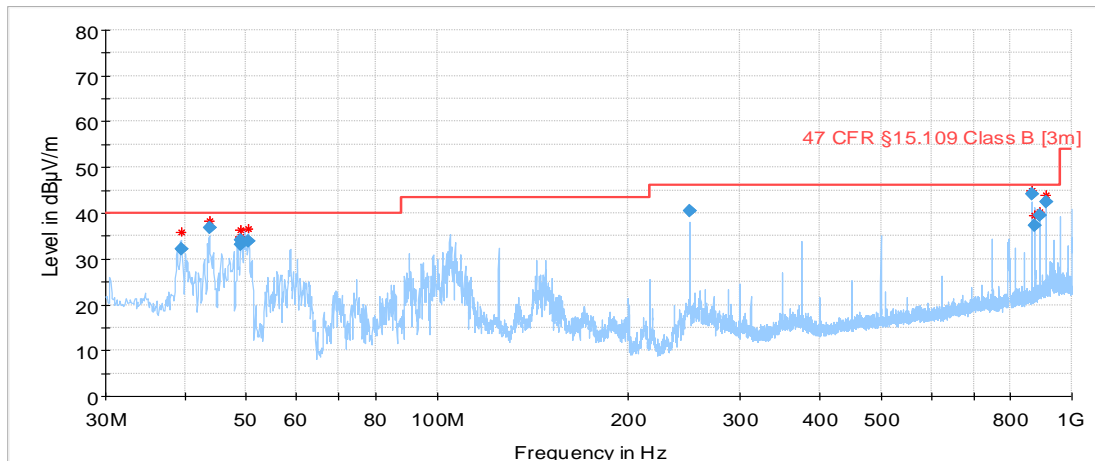
Test Specification	FCC 47 CFR 15.109 (Part 15 Subpart B)	
Test Engineer & Date	Fariborz Abasi	2024.01.15 2024.01.16 2024.03.01
EUT and Ancillary Equipment IDs	A003618316-004	- 5W Power supply A003625200-001 - USB C cable A003623398-003 - UTP Ethernet cable A003623398-007 - 5W Power supply A003618316-002 - USB C cable A003618316-006 - UTP Ethernet cable A003618316-013
EUT Operation Mode(s)	Idle	
EUT Wireless Configuration(s)	Ets_app cert_zigbee_idle	
EUT Hardware Configuration(s)	Attached to charger with USB-C cable. Attached with ethernet to computer	
Overall Result	Pass	

Test Parameter	Frequency Range	Result*
Radiated Emissions - Idle Mode	30 MHz – 1 GHz	Pass
Radiated Emissions - Idle Mode	1 GHz – 18 GHz	Pass
Radiated Emissions - Idle Mode	18 GHz – 40 GHz	Pass

* For detailed measurements, see tables and graphs in sections below

4.2.2 Radiated Emissions (Unintentional) – Test Details
30MHz – 1GHz

Test mode condition	Idle mode	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	30 MHz – 1 GHz	
Standard	47 CFR FCC Part 15 subpart B	
EUT	A003618316-004	
Ancillary Equipment	- 5W Power supply A003625200-001 - USB C cable A003623398-003 - UTP Ethernet cable A003623398-007	
Test Engineer	Fariborz Abasi	Date: 2024.01.15
Chamber details	Chamber: SAC 5	

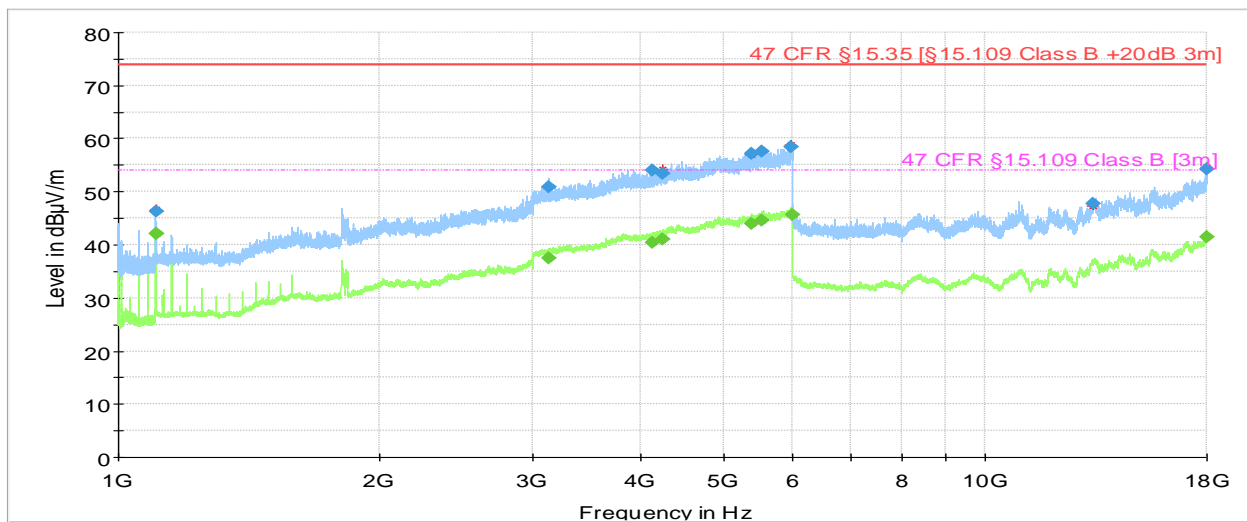


- Preview Result 2-AVG
- * Critical_Freqs AVG
- * Critical_Freqs PK+
- * Critical_Freqs AVG
- * Critical_Freqs PK+
- ◆ Final_Result QPK
- ◆ Final_Result AVG
- x MaxPeak-PK+ (Single)
- + QuasiPeak-QPK (Single)
- x Average-AVG (Single)
- + QuasiPeak-QPK (Single)
- ◆ Final_Result QPK
- ◆ Final_Result AVG
- 47 CFR §15.109 Class B [3m]

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
39.464000	32.16	40.00	7.84	1000.0	120.000	100.0	V	41.0	-35.0
43.798240	36.89	40.00	3.11	1000.0	120.000	100.0	V	22.0	-38.3
49.019080	34.23	40.00	5.77	1000.0	120.000	125.0	V	334.0	-41.9
49.031200	33.01	40.00	6.99	1000.0	120.000	125.0	V	338.0	-41.9
50.435280	33.95	40.00	6.05	1000.0	120.000	129.0	V	323.0	-42.8
250.001880	40.40	46.02	5.62	1000.0	120.000	104.0	H	292.0	-40.8
863.991360	44.27	46.02	1.75	1000.0	120.000	104.0	H	68.0	-27.2
875.009520	37.18	46.02	8.84	1000.0	120.000	125.0	V	292.0	-27.5
887.995400	39.50	46.02	6.52	1000.0	120.000	100.0	H	267.0	-27.3
911.999040	42.48	46.02	3.54	1000.0	120.000	100.0	H	53.0	-26.8

1GHz – 18GHz

Test mode condition	Idle mode	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	1 GHz – 18 GHz	
Standard	47 CFR FCC Part 15 subpart B	
EUT	A003618316-004	
Ancillary Equipment	- 5W Power supply A003625200-001 - USB C cable A003623398-003 - UTP Ethernet cable A003623398-007	
Test Engineer	Fariborz Abasi	Date: 2024.01.16
Chamber details	Chamber: SAC 5	

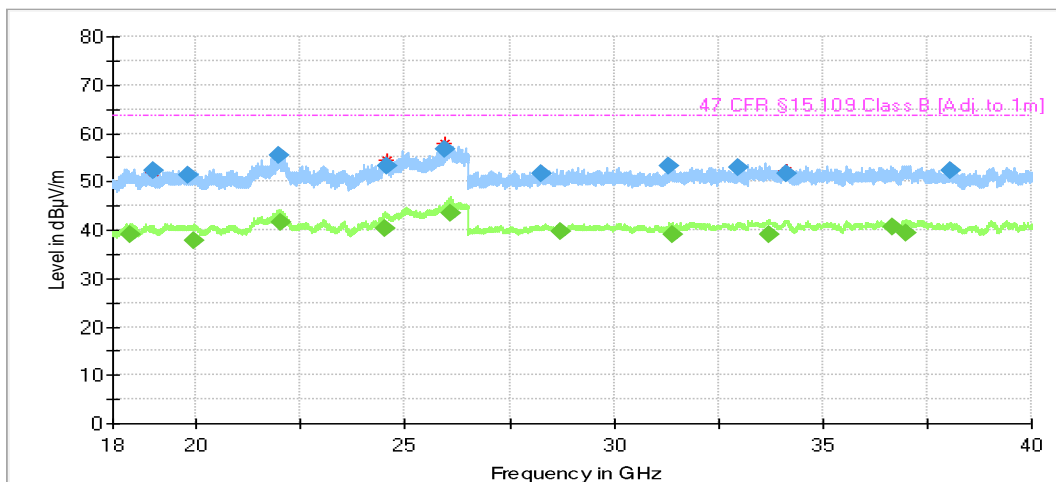


- Preview Result 2-AVG
- * Critical_Freqs AVG
- 47 CFR §15.35 [§15.109 Class B +20dB 3m]
- ◆ Final_Result PK+
- Preview Result 1-PK+
- * Critical_Freqs PK+
- 47 CFR §15.109 Class B [3m]
- ◆ Final_Result AVG

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1103.967920	---	42.11	53.98	11.87	1000.0	1000.000	385.0	V	308.0	-21.6
1103.973200	---	42.09	53.98	11.89	1000.0	1000.000	385.0	V	308.0	-21.6
1104.006640	46.35	---	73.98	27.63	1000.0	1000.000	100.0	V	322.0	-21.6
3132.806000	50.86	---	73.98	23.12	1000.0	1000.000	239.0	H	38.0	-8.9
3135.882000	---	37.57	53.98	16.40	1000.0	1000.000	215.0	H	312.0	-8.9
4127.083000	53.96	---	73.98	20.01	1000.0	1000.000	104.0	V	82.0	-5.9
4134.482000	---	40.48	53.98	13.50	1000.0	1000.000	165.0	H	38.0	-5.8
4239.235000	---	40.98	53.98	13.00	1000.0	1000.000	104.0	H	142.0	-5.2
4240.836000	53.41	---	73.98	20.57	1000.0	1000.000	104.0	H	308.0	-5.2
5369.867000	57.19	---	73.98	16.79	1000.0	1000.000	239.0	V	232.0	-2.5
5370.399000	---	43.97	53.98	10.01	1000.0	1000.000	104.0	V	322.0	-2.5
5529.683000	57.69	---	73.98	16.29	1000.0	1000.000	335.0	V	188.0	-2.3
5531.639000	---	44.51	53.98	9.47	1000.0	1000.000	139.0	V	86.0	-2.3
5962.371000	58.49	---	73.98	15.49	1000.0	1000.000	215.0	V	218.0	-1.6
5979.914000	---	45.57	53.98	8.41	1000.0	1000.000	104.0	H	38.0	-1.5
13292.821000	47.65	---	73.98	26.33	1000.0	1000.000	165.0	H	218.0	11.3
17978.473000	54.20	---	73.98	19.77	1000.0	1000.000	165.0	V	98.0	22.1
17986.211000	---	41.46	53.98	12.52	1000.0	1000.000	315.0	V	225.0	22.2

18 GHz – 40 GHz

Test mode condition	Idle mode	
Antenna orientation	Horizontal and Vertical	
Sweep frequency	18 GHz – 40 GHz	
Standard	47 CFR FCC Part 15 subpart B	
EUT	A003618316-004	
Ancillary Equipment	- 5W Power supply A003618316-002 - USB C cable A003618316-006 - UTP Ethernet cable A003618316-013	
Test Engineer	Fariborz Abasi	Date: 2024.03.01
Chamber details	Chamber: SAC 5	



- ◆ Preview Result 2-AVG
- ◆ Preview Result 1-PK+
- * Critical_Freqs AVG
- * Critical_Freqs PK+
- 47 CFR §15.35 [§15.109 Class B +20dB Adj. to 1m]
- - - 47 CFR §15.109 Class B [Adj. to 1m]
- ◆ Final_Result PK+
- ◆ Final_Result AVG

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
18413.300000	---	39.21	63.52	24.31	1000.0	1000.000	155.0	H		
18958.260000	52.43	---	83.52	31.09	1000.0	1000.000	155.0	H		
19825.360000	51.47	---	83.52	32.05	1000.0	1000.000	155.0	V		
19958.902000	---	37.82	63.52	25.70	1000.0	1000.000	155.0	V		
21952.284000	55.38	---	83.52	28.14	1000.0	1000.000	155.0	H		
21998.376000	---	41.56	63.52	21.97	1000.0	1000.000	155.0	V		
24524.914000	---	40.43	63.52	23.09	1000.0	1000.000	155.0	V		
24553.223000	53.15	---	83.52	30.37	1000.0	1000.000	155.0	H		
25968.600000	56.64	---	83.52	26.89	1000.0	1000.000	155.0	H		
26069.702000	---	43.60	63.52	19.92	1000.0	1000.000	155.0	V		
28273.637000	51.72	---	83.52	31.80	1000.0	1000.000	155.0	H		
28710.618000	---	39.56	63.52	23.96	1000.0	1000.000	155.0	H		
31309.334000	53.25	---	83.52	30.27	1000.0	1000.000	155.0	H		
31408.032000	---	39.06	63.52	24.46	1000.0	1000.000	155.0	V		
32963.468000	52.81	---	83.52	30.71	1000.0	1000.000	155.0	V		
33709.710000	---	39.20	63.52	24.32	1000.0	1000.000	155.0	V		

5. TEST EQUIPMENT STATUS

5.1 List of Hardware with Calibration Dates

5.1.1 Hardware List – Conducted Emissions System

Type	Manufacturer	Model	Serial Number / ID	Calibration Date	Calibration Due
Two-Line V-network	Rohde & Schwarz	ENV216	101090 2704076	2023.07.03	2024.07.03
Test Receiver 9KHz to 3.5 GHz	Rohde & Schwarz	ESR3	101674 2704016	2023.06.29	2024.06.29
Humidity Temperature Probe	Lufft	OPUS 20	146.0216.0802.030 2703980	2022.07.27	2024.07.27

5.1.2 Hardware List – SAC5 System

Type	Manufacturer	Model	Serial Number / ID	Calibration Date	Calibration Due
EMI Test Receiver	Rohde & Schwarz	ESW44	101760 2881044	2023.08.04	2024.08.04
Ultra Broadband Antenna	Rohde & Schwarz	HL562E	100988 2823181	2023.07.18	2025.07.18
Double Ridged Waveguide Horn Antenna	Rohde & Schwarz	HF907	102678 2823164	2023.07.27	2025.07.27
Control Device	Maturo	NCD	NCD/393/2372.01 2884216	N/A	N/A
Open Switch & Control Unit	Rohde & Schwarz	OSP150	100081 2884198	2023.08.29	2024.08.29
Open Switch & Control Unit	Rohde & Schwarz	OSP120	100084 2761253	2023.08.29	2024.08.29
Shielded Filter Unit	Rohde & Schwarz	OSP-F Extension 1	101333 2761265	2023.08.29	2024.08.29
Shielded Filter Unit	Rohde & Schwarz	OSP-F Extension 2	101335 2761266	2023.08.29	2024.08.29
Shielded Filter Unit	Rohde & Schwarz	OSP-F Base Unit	101330 2761262	2023.08.29	2024.08.29
Humidity Temperature Probe	Lufft	OPUS 20	146.0216.0802.030 2703980	2022.07.27	2024.07.27
Horn Antenna 40GHz	ETS Lindgren	UG-600A/U	20623 2814834	2022.07.26	2024.07.26
Horn Antenna	ETS Lindgren	UG-596A/U	20898 2814839	2022.07.26	2024.07.26

5.2 Software / Firmware Versions

Equipment	Software / Firmware Name	Version
Conducted Emissions System	EMC 32	V10.60.20
SAC 5	EMC 32	V10.60.20

6. MEASUREMENT UNCERTAINTY

6.1 Measurement Uncertainty for Conducted Emissions

Parameter	Uncertainty (Coverage Factor k=2)
Conducted emissions with LISN 150KHz to 30 MHz	2.98 dB

6.2 Measurement Uncertainty for SAC 5 (Radiated Emissions & Band Edge)

Parameter	Uncertainty (Coverage Factor k=2)
Field Strength 10 Hz -9 kHz	3.38 dB
Field Strength 9 kHz -30 MHz	3.38 dB
Field Strength 30 MHz -1000 MHz	3.38 dB
Field Strength 1 GHz -18 GHz	4.88 dB
Field Strength 18 GHz - 40 GHz	5.14 dB

7. PHOTOGRAPHS

7.1 Photographs of the EUT

For photographs, see Appendix 1