Prüfbericht - Produkte
Test report - Products

Certificate #4301.01

Prüfbericht-Nr.: *Test Report No.:*	**CN246QUV 001**	**Auftrags-Nr.:** *Order No.:*	**326030199**	**Seite 1 von 22** *Page 1 of 22*
Kunden-Referenz-Nr.: *Client Reference No.:*	**1288983**	**Auftragsdatum:** *Order date.:*	**2024-06-11**	
Auftraggeber: *Client:*	**IKEA of Sweden AB** Box 702, SE-343 81, Älmhult Sweden			
Prüfgegenstand: *Test item:*	**NATTBAD (Bluetooth speaker)**			
Bezeichnung / Typ-Nr.: *Identification / Type No.:*	**E2405**			
Auftrags-Inhalt: *Order content:*	**TÜV Rheinland EMC service**			
Prüfgrundlage: *Test specification:*	**FCC 47 CFR Part 15, Subpart B:2022 Class B** **ICES-003:2020**			
Wareneingangsdatum: *Date of receipt:*	**2024-06-24**	Refer to the EUT photos file		
Prüfmuster-Nr.: *Test sample No.:*	**A003752346-005**			
Prüfzeitraum: *Testing period:*	**Refer to test report**			
Ort der Prüfung: *Place of testing:*	**Refer to clause 1.1**			
Prüflaboratorium: *Testing laboratory:*	**TÜV Rheinland (Shanghai) Co., Ltd.**			
Prüfergebnis*: *Test result*:*	**Pass**			

geprüft von: / *tested by:*

Datum: / *Date:* 2024-11-07 Xuelan zhang

Stellung: / *Position:* Project engineer

genehmigt von: / *authorized by:*

Datum: / *Date:* 2024-11-07 Jessie Xu

Stellung: / *Position:* Reviewer

Sonstiges / *Other:*	FCC ID: FHO-E2405 IC: 10912A-E2405 Test Firm Name: TUV Rheinland (Shanghai) Co., Ltd. Designation Number: CN1396 Test Firm Registration Number: 930979

Zustand des Prüfgegenstandes bei Anlieferung: *Condition of the test item at delivery:* **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 specifications(s) F(ail) = failed a.m. test specifications(s) N/A = not applicable N/T = not tested

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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.

Prüfbericht - Nr.: CN246QUV 001
Test Report No.:

Anmerkungen
Remarks

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Revision history of test report:

Report number	Issue date	Contents and reason for change if appropriate
CN246QUV 001	2024-11-07	Initial release.

Contents

1 TEST SITES 5

1.1 TEST FACILITIES 5

2 GENERAL PRODUCT INFORMATION 6

2.1 PRODUCT FUNCTION AND INTENDED USE 6
2.2 RATINGS AND SYSTEM DETAILS 6
2.3 INDEPENDENT OPERATION MODESS 6
2.4 DESCRIPTION OF INTERCONNECTING CABLES 6
2.5 NOISE GENERATING AND NOISE SUPPRESSING PARTS 6
2.6 HIGHEST FREQUENCY GENERATED OR USED IN THE DEVICE OR ON WHICH THE DEVICE OPERATES OR TUNES 6
2.7 SUBMITTED DOCUMENTS 6

3 TEST SET-UP AND OPERATION MODES 7

3.1 PRINCIPLE OF CONFIGURATION SELECTION 7
3.2 EQUIPMENT AND CABLE ARRANGEMENT 7
3.3 TEST SOFTWARE 8
3.4 SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT 8
3.5 COUNTERMEASURES TO ACHIEVE EMC COMPLIANCE 8

4 CONFORMITY DECISION RULE 9

5 TEST RESULTS E M I S S I O N 10

5.1 EMISSION IN THE FREQUENCY RANGE UP TO 30 MHZ 10
5.1.1 Mains Terminal Continuous Disturbance Voltage 10
5.2 EMISSION IN THE FREQUENCY RANGE ABOVE 30 MHZ 14
5.2.1 Radiated emission （30 MHz - 1 GHz） 14
5.2.2 Radiated emission (Above 1 GHz) 18

6 LIST OF TEST AND MEASUREMENT INSTRUMENTS 21

7 LIST OF FIGURES 22

1 Test Sites

1.1 Test Facilities

Laboratory: TÜV Rheinland (Shanghai) Co., Ltd.
Address: Workshop14, North Half of Workshop 10 and Workshop 16, Pingqian (Taicang) Modern Industrial Park, No.525, Yuewang Lingang South Road, Shaxi, Taicang, Jiangsu, China

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

Refer to Clause 6 for test and measurement instruments.

2 General Product Information

2.1 Product Function and Intended Use

The EUT (equipment under test) is a NATTBAD (Bluetooth speaker). For the further information, refer to the user's manual.

2.2 Ratings and System Details

Rated input	:	AC 100-240 V, 50-60 Hz; 250-140 mA
Protection class	:	II

2.3 Independent Operation Modess

The basic operation mode is continuous playing 1 kHz audio signal by Bluetooth.

2.4 Description of interconnecting cables

None.

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 2.4 GHz.

2.7 Submitted Documents

Circuit diagram, user's manual and rating label.

3 Test Set-up and Operation Modes

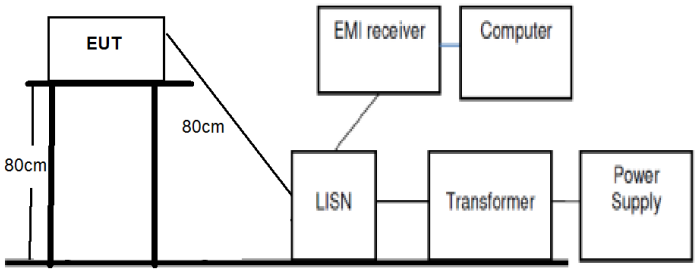
3.1 Principle of Configuration Selection

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.

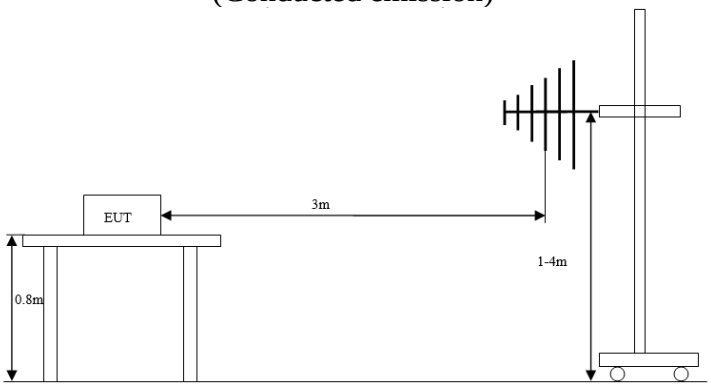
Refer to the related paragraph of this report.
The sequence of testing:
1. Radiated emission tests were performed on 2024-07-23~2024-08-02.
2. Conducted emission tests were performed on 2024-07-05.

3.2 Equipment and cable arrangement

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



(Conducted emission)



(Radiated emission)

3.3 Test Software

No special test software was used during the tests.

3.4 Special Accessories and Auxiliary Equipment

During the tests, the below equipment were used.

No.	Equipment	Model	Manufacturer
1	Cell phone	STF-AL10	Huawei

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 E M I S S I O N

5.1 Emission in the Frequency Range up to 30 MHz

5.1.1 Mains Terminal Continuous Disturbance Voltage

Result:	**Passed**

Date of testing	:	2024-07-05
Test procedure	:	FCC 47 CFR Part 15, Subpart B:2022, ICES-003:2020, 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 dBµV (decrease with the logarithm of frequency); 0.5 - 5 MHz, 56 dBµV; 5 - 30 MHz, 60 dBµV Average limit: 0.15 - 0.5 MHz, 56 to 46 dBµV (decrease with the logarithm of frequency); 0.5 – 5 MHz, 46 dBµV; 5 – 30 MHz, 50 dBµV
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	:	Mode as defined in clause 2.3
Ambient condition	:	Temperature: 21.5 °C; Relative humidity: 52 %
Expanded measurement uncertainty (*k*=2)	:	2.33 dB

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

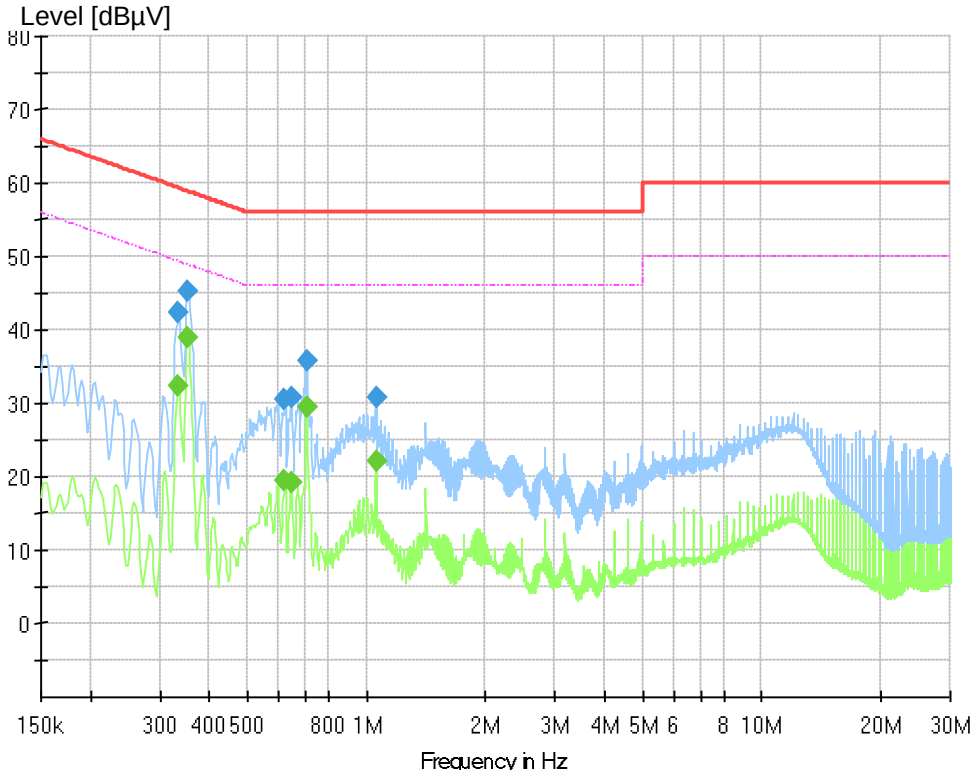
The measurement equipment like test rece1ivers, quasi-peak detector and artificial mains network (AMN) are in compliance with CISPR 16-1 series standards.
The tested object was set-up on a wooden support. The EUT was set 0.8 m away from the AMN. The cord longer than necessary to be connected to the AMN 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, "◆" mean Quasi-Peak Value and "◆" mean Average Value results.

Notes on following tables of conducted emission results and conversions:

Level (dBµV): 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 (dBµV) - Level (dBµV)

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



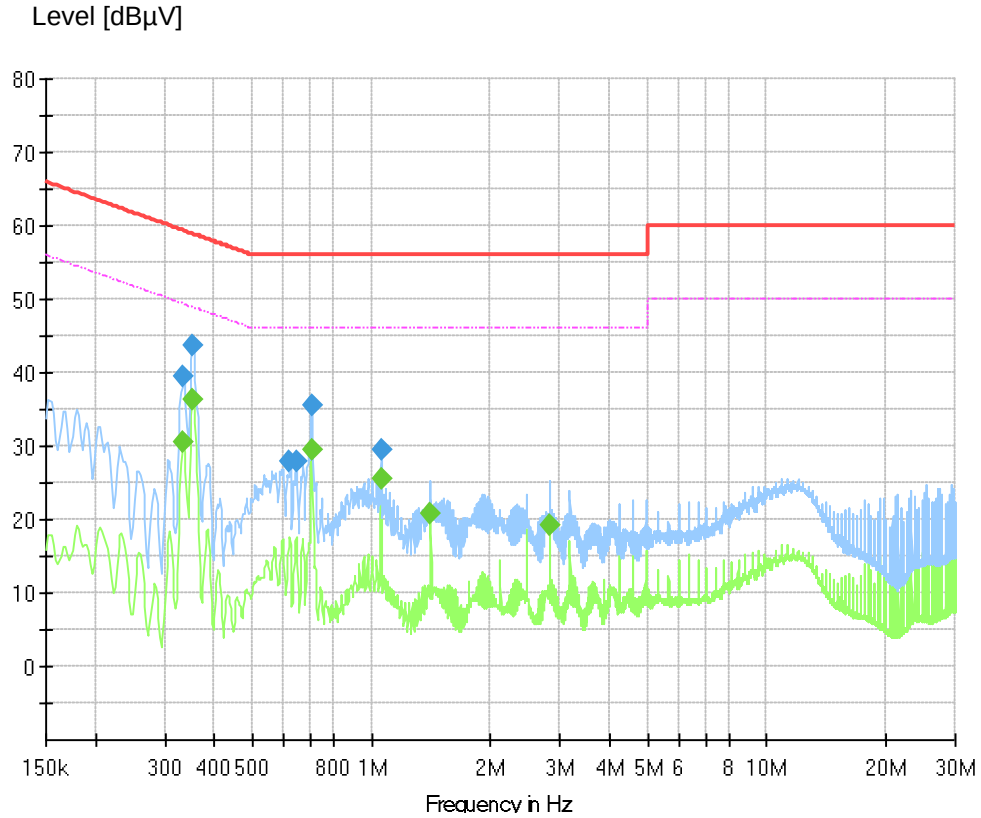
Final Quasi-peak measurement result:

Frequency (MHz)	QuasiPeak (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.334500	42.28	59.34	17.05	1000.0	9.000	L1	10.3
0.352500	45.37	58.90	13.53	1000.0	9.000	L1	10.3
0.620250	30.58	56.00	25.42	1000.0	9.000	L1	10.3
0.645000	30.67	56.00	25.33	1000.0	9.000	L1	10.3
0.705750	35.91	56.00	20.09	1000.0	9.000	L1	10.3
1.059000	30.74	56.00	25.26	1000.0	9.000	L1	10.7

Final Average measurement result:

Frequency (MHz)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.334500	32.50	49.34	16.84	1000.0	9.000	L1	10.3
0.352500	39.01	48.90	9.90	1000.0	9.000	L1	10.3
0.620250	19.41	46.00	26.59	1000.0	9.000	L1	10.3
0.645000	19.19	46.00	26.81	1000.0	9.000	L1	10.3
0.705750	29.57	46.00	16.43	1000.0	9.000	L1	10.3
1.059000	22.22	46.00	23.78	1000.0	9.000	L1	10.7

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



Final Quasi-peak measurement result:

Frequency (MHz)	QuasiPeak (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.334500	39.41	59.34	19.93	1000.0	9.000	N	10.5
0.352500	43.70	58.90	15.20	1000.0	9.000	N	10.4
0.620250	27.76	56.00	28.24	1000.0	9.000	N	10.3
0.645000	27.87	56.00	28.13	1000.0	9.000	N	10.4
0.705750	35.43	56.00	20.57	1000.0	9.000	N	10.4
1.059000	29.47	56.00	26.53	1000.0	9.000	N	10.4

Final Average measurement result:

Frequency (MHz)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.334500	30.51	49.34	18.83	1000.0	9.000	N	10.5
0.352500	36.38	48.90	12.53	1000.0	9.000	N	10.4
0.705750	29.54	46.00	16.46	1000.0	9.000	N	10.4
1.059000	25.49	46.00	20.51	1000.0	9.000	N	10.4
1.412250	20.82	46.00	25.18	1000.0	9.000	N	10.4
2.823000	19.30	46.00	26.70	1000.0	9.000	N	10.6

5.2 Emission in the Frequency Range above 30 MHz

5.2.1 Radiated emission （30 MHz - 1 GHz）

Result:	**Passed**

Date of testing	:	2024-07-23~2024-08-02
Test procedure	:	FCC 47 CFR Part 15, Subpart B:2022, ICES-003:2020, ANSI C63.4-2014 and CISPR 16-2-3
Frequency range	:	30 – 1000 MHz
Limits	:	Quasi-peak limits (3 m distance): 30 – 88 MHz, 40 dBμV/m; 88 – 216 MHz, 43.5 dBμV/m; 216 – 1000 MHz, 46 dBμV/m
Bandwidth of EMI receiver for final measurement	:	120 kHz
Measurement time for final measurement	:	1 s
Kind of test site	:	Semi-anechoic chamber
Operational mode	:	Mode as defined in clause 2.3
Input voltage	:	AC 120 V; 60 Hz
Ambient condition	:	Temperature: 20.5 °C; Relative humidity: 45 %
Expanded measurement uncertainty (*k*=2)	:	5.40 dB

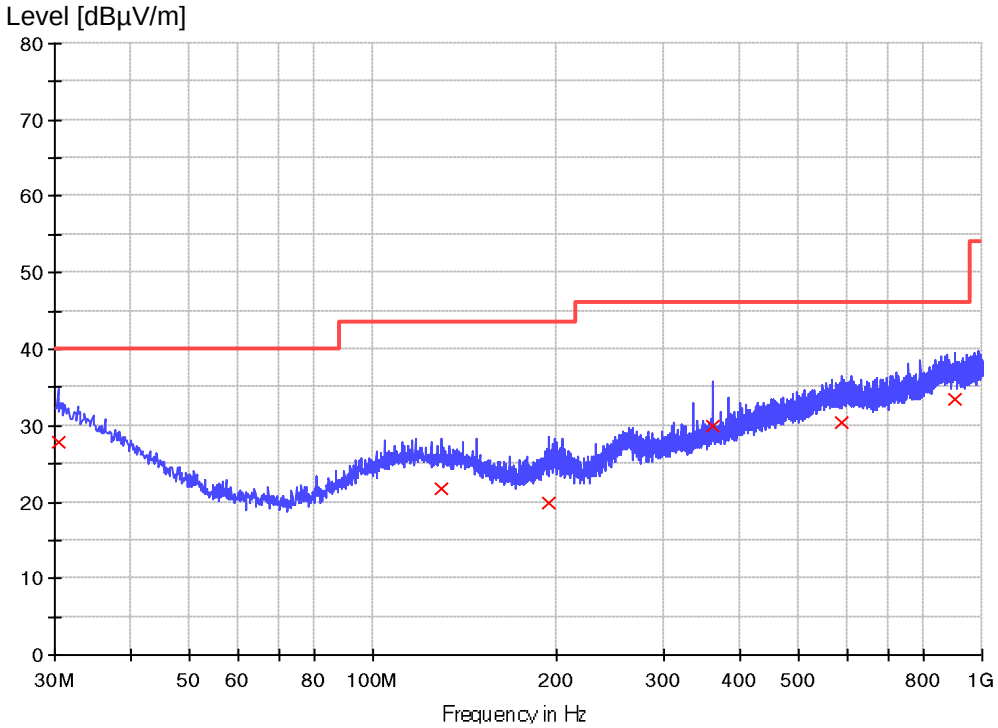
The radiated disturbance test was carried out in a semi-anechoic chamber. The test distance from the receiving antenna to the EUT is 3 m. The normalized site attenuation of the semi-anechoic chamber is regularly calibrated to ensure the radiated disturbance test results are valid. During the test, the EUT was placed on a 0.8 m high wooden table above the reference ground plane. The wooden table 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, “×” means quasi-peak test results.

Notes on following tables of radiated emission results and conversions:

QuasiPeak (dBµV/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 (dBµV/m) - QuasiPeak (dBµV/m)

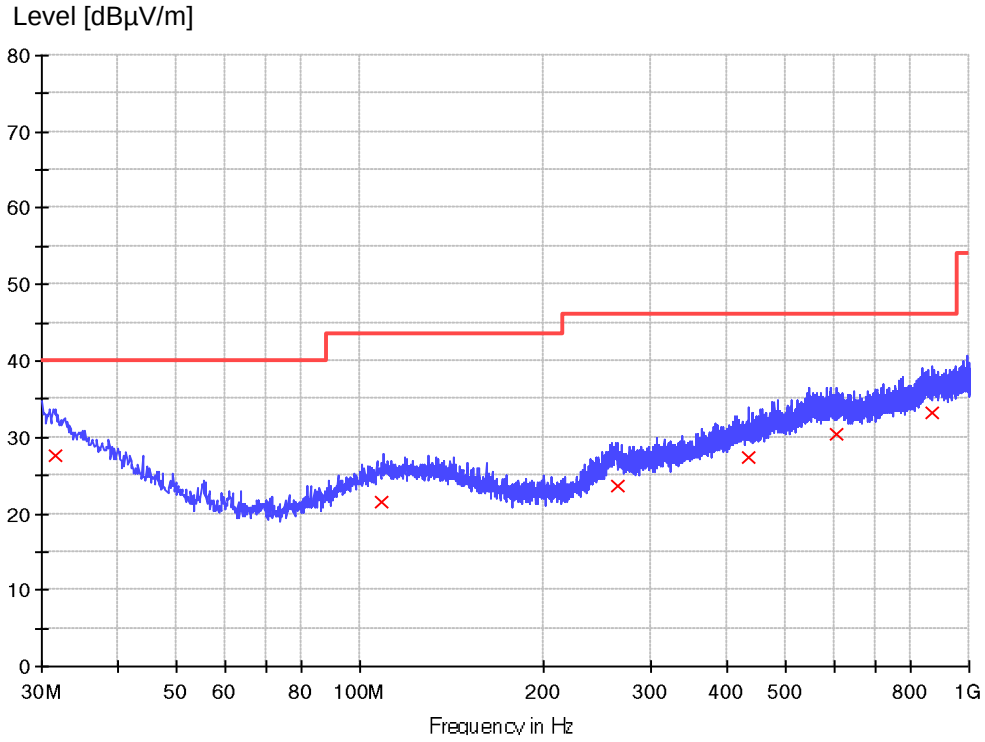
Figure 3: Spectral Diagrams and measurement results, horizontal polarization (30 MHz to 1 GHz)



Final Quasi-peak measurement result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
30.363750	27.9	120.000	150	H	-111	24.6	12.1	40.0
129.425000	21.7	120.000	100	H	89	18.7	21.8	43.5
194.657500	19.9	120.000	150	H	-92	15.9	23.7	43.5
360.042500	30.0	120.000	120	H	97	21.9	16.1	46.0
589.205000	30.4	120.000	140	H	-119	26.7	15.6	46.0
903.727500	33.4	120.000	110	H	59	28.9	12.6	46.0

Figure 4: Spectral Diagrams and measurement results, vertical polarization (30 MHz to 1 GHz)



Final Quasi-peak measurement result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
31.697500	27.6	120.000	140	V	-166	24.0	12.4	40.0
108.448750	21.4	120.000	130	V	-152	18.5	22.1	43.5
265.588750	23.6	120.000	140	V	171	20.6	22.4	46.0
435.581250	27.3	120.000	150	V	136	24.0	18.7	46.0
606.786250	30.4	120.000	120	V	-70	27.0	15.6	46.0
869.171250	33.2	120.000	130	V	91	28.7	12.8	46.0

5.2.2 Radiated emission (Above 1 GHz)

Result:	**Passed**

Date of testing	:	2024-07-23~2024-08-02
Port	:	Enclosure
Test procedure	:	FCC 47 CFR Part 15, Subpart B:2022, ANSI C63.4-2014 and CISPR 16-2-3 ICES-003:2020
Limit	:	Above 1 GHz, Peak limit: 74 dBµV/m; Average limit: 54 dBµV/m
Frequency range	:	1-18 GHz Note: The highest frequency in the EUT is 2.4 GHz. According to FCC Part 15 subpart B §15.33 (b) (1), the upper frequency for radiated emission measurement is 12 GHz. The actual test frequency is up to 18 GHz.
Bandwidth of EMI receiver for final measurement	:	1000 kHz
Measurement time for final measurement	:	1 s
Test distance	:	3 m
Kind of test site	:	Semi-anechoic chamber
Operational mode	:	Mode as defined in clause 2.3
Input voltage	:	AC 120 V; 60 Hz
Earthing	:	No earthing
Ambient condition	:	Temperature: 20.5 °C; Relative humidity: 45 %

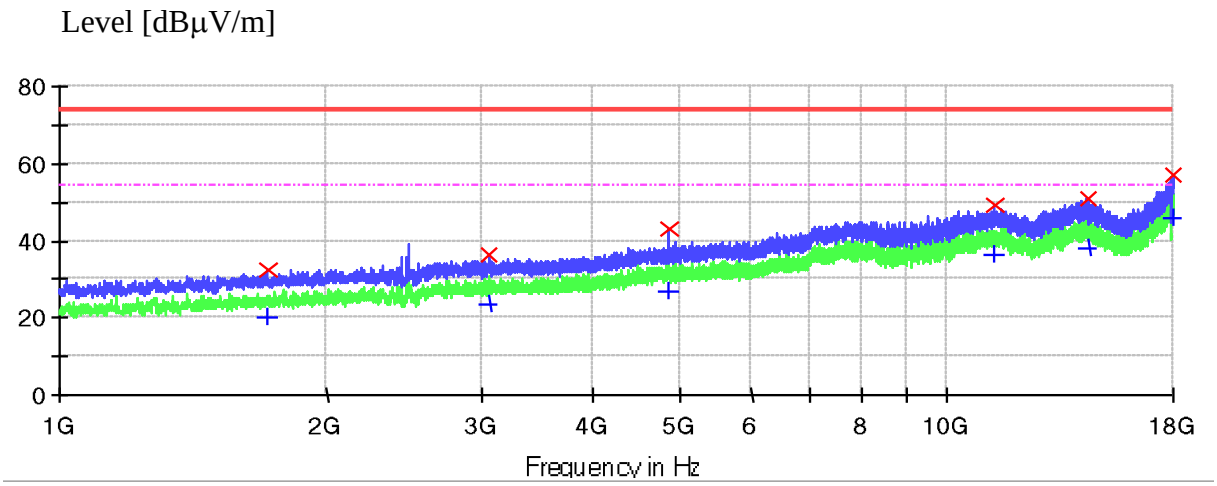
The radiated disturbance test was carried out in a semi-anechoic chamber. The test distance from the receiving antenna to the EUT is 3 m. The normalized site attenuation of the semi-anechoic chamber is regularly calibrated to ensure the radiated disturbance test results are valid. During the test, the EUT was placed on a poly table, which is 0.8 m high. The wooden table was rotated 360° around and 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, “x(red)” means measurement results with peak detector and “+ (blue)” means measurement results with average detector.

Notes on following tables of radiated emission results and conversions:

Peak (dBµV/m): final measurement results by using peak detector
Average (dBµV/m): final measurement results by using average detector
Corr. (dB): correction factor including: antenna factor, cable loss, and gain of pre-amplifier (if used)
Margin: Limit PK (dBµV/m) - Peak (dBµV/m)
Limit CAV (dBµV/m) – Average (dBµV/m

Figure 5: Spectral Diagrams and measurement results, 1-18 GHz, horizontal polarization



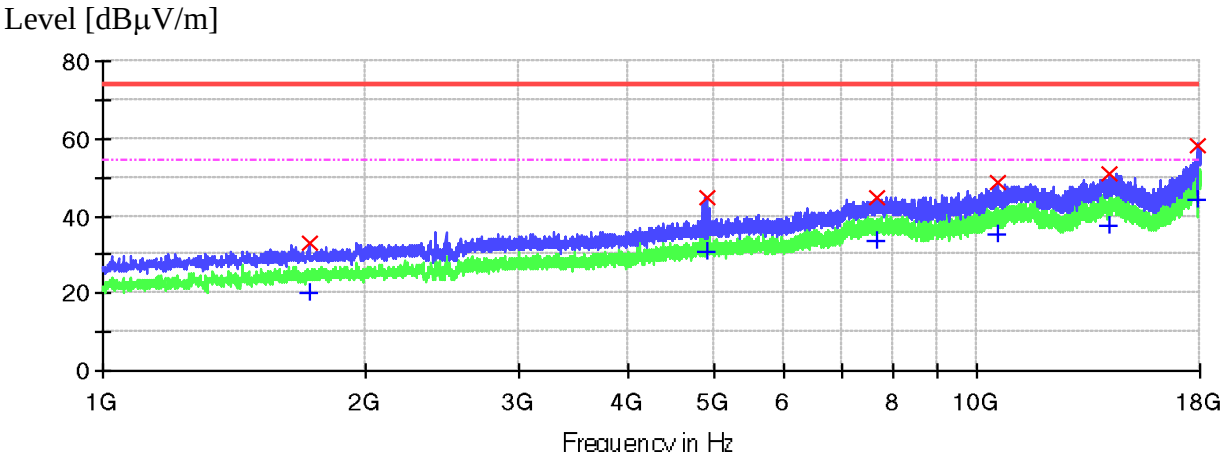
Final Peak measurement results:

Frequency (MHz)	MaxPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
1708.900000	32.6	1000.000	100.0	H	180.0	-18.1	41.4	74.0
3049.350000	36.3	1000.000	100.0	H	180.0	-14.0	37.7	74.0
4842.000000	43.1	1000.000	100.0	H	180.0	-10.0	30.9	74.0
11272.250000	49.4	1000.000	100.0	H	180.0	-0.2	24.6	74.0
14435.950000	50.6	1000.000	100.0	H	180.0	3.6	23.4	74.0
17979.600000	57.0	1000.000	100.0	H	180.0	13.4	17.0	74.0

Final Average measurement results:

Frequency (MHz)	Average (dBµV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
1708.900000	20.1	1000.000	100.0	H	180.0	-18.1	33.9	54.0
3049.350000	23.3	1000.000	100.0	H	180.0	-14.0	30.7	54.0
4842.000000	26.8	1000.000	100.0	H	180.0	-10.0	27.2	54.0
11272.250000	36.6	1000.000	100.0	H	180.0	-0.2	17.4	54.0
14435.950000	38.1	1000.000	100.0	H	180.0	3.6	15.9	54.0
17979.600000	45.8	1000.000	100.0	H	180.0	13.4	8.2	54.0

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



Final Peak measurement results:

Frequency (MHz)	MaxPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
1719.950000	32.8	1000.000	100.0	V	-180.0	-18.0	41.2	74.0
4899.800000	44.6	1000.000	100.0	V	-180.0	-10.0	29.4	74.0
7674.200000	44.8	1000.000	100.0	V	-180.0	-4.7	29.2	74.0
10568.450000	48.6	1000.000	100.0	V	-180.0	-0.3	25.4	74.0
14200.500000	50.6	1000.000	100.0	V	-180.0	3.0	23.4	74.0
17938.800000	58.2	1000.000	100.0	V	-180.0	12.6	15.9	74.0

Final Average measurement results:

Frequency (MHz)	Average (dBµV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
1719.950000	20.3	1000.000	100.0	V	-180.0	-18.0	33.7	54.0
4899.800000	30.7	1000.000	100.0	V	-180.0	-10.0	23.3	54.0
7674.200000	33.3	1000.000	100.0	V	-180.0	-4.7	20.7	54.0
10568.450000	35.2	1000.000	100.0	V	-180.0	-0.3	18.9	54.0
14200.500000	37.6	1000.000	100.0	V	-180.0	3.0	16.4	54.0
17938.800000	44.1	1000.000	100.0	V	-180.0	12.6	9.9	54.0

6 List of Test and Measurement Instruments

Equip.	Description	Model	Manufacturer	Last Date DD.MM.YYYY	Due Date DD.MM.YYYY
9061503	Shielded enclosure	10.055x3.605x3.000	Frankonia	08.11.2023	08.11.2028
9023229	EMI test receiver	ESR3	Rohde&Schwarz	03.08.2024	03.08.2025
G1830003	Artificial mains network	ENV432	Rohde&Schwarz	16.10.2023	16.10.2024
G1824248	Dual display multimeter	F45	Fluke	28.06.2024	28.06.2025
9062744	EMI measurement software	EMC32-E+(10.60.20)	Rohde&Schwarz	N/A	N/A
G1811378	3m semi-anechoic chamber	SAC3	Frankonia	03.12.2023	03.12.2026
G1811391	EMI test receiver	ESCI	Rohde&Schwarz	16.10.2023	16.10.2024
G1811425	Bilog antenna	CBL 6112D	Teseq	20.04.2023	20.04.2026
9062745	EMI measurement software	EMC32-MEB (10.60.20)	Rohde&Schwarz	N/A	N/A
9042162	EMI test receiver	ESR7	Rohde&Schwarz	05.02.2024	05.02.2025
9053499	Signal conditioning unit	SCU18F	Rohde & Schwarz	25.10.2023	25.10.2024
G1822702	Spectrum analyser	FSV40	Rohde&Schwarz	06.05.2023	06.05.2025
G1825371	Preamplifier	EMC051845SE	Taiwan EMCI	20.06.2023	20.06.2025
G1822694	Double ridged broadband horn antenna	BBHA 9120 D	Schwarzbeck	24.03.2021	24.03.2026

7 List of Figures

Figure 1: Spectral Diagrams, Conducted Emission, 150 kHz – 30 MHz, L 12
Figure 2: Spectral Diagrams, Conducted Emission, 150 kHz – 30 MHz, N 13
Figure 3: Spectral Diagrams and measurement results, horizontal polarization (30 MHz to 1 GHz) 16
Figure 4: Spectral Diagrams and measurement results, vertical polarization (30 MHz to 1 GHz) 17
Figure 5: Spectral Diagrams and measurement results, 1-18 GHz, horizontal polarization 19
Figure 6: Spectral Diagrams and measurement results, 1-18 GHz, vertical polarization 20

End of test report