TEST REPORT

Test Report No.: UL-RPT-RP-15128132-116

Applicant *	:	Braun GmbH
Model No. / PMN *	:	3795 / iO6
FCC ID *	:	USQ3795
ISED Certification No.	:	IC: 6856A-3795
Technology *	:	Bluetooth Low Energy
Test Standard(s)	:	**FCC Parts 15.207, 15.209(a) & 15.247** **RSS-247 Issue 3 August 2023** **RSS-Gen Issue 5 February 2021** For details of applied tests refer to test result summary

1. This test report shall not be reproduced in full or partial, without the written approval of UL International Germany GmbH.
2. The results in this report apply only to the sample tested.
3. The test results in this report are traceable to the national or international standards.
4. **Test Report Version 1.2 supersede Version 1.1 with immediate effect**
   Test Report No. UL-RPT-RP-15128132-116 Version 1.2, Issue Date 14 November 2024 replaces
   Test Report No. UL-RPT-RP-15128132-116 Version 1.1, Issue Date 11 November 2024, which is no longer valid.
5. All information marked with a (*) were provided by customer / applicant or authorized representative

Prepared by: Yixiang Lin
Title: Project Engineer
Date: 14 November 2024

Authorized by: Muhammad Faiq Khan
Title: Project Engineer
Date: 14 November 2024

DAkkS Deutsche Akkreditierungsstelle D-PL-19381-02-00

This laboratory is accredited by DAkkS.
The tests reported herein have been performed in accordance with its' terms of accreditation.

UL INTERNATIONAL GERMANY GMBH
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1. Customer Information *

1.1. Applicant Information

Company Name:	Braun GmbH
Company Address:	Frankfurter Straße 145, 61476 Kronberg/Taunus Germany
Contact Person:	Aida Ayoubzadeh
Contact E-Mail Address:	Ayoubzadeh.a.4@pg.com
Contact Phone No.:	+496173305403

1.2. Manufacturer Information

Company Name:	Braun GmbH
Company Address:	Frankfurter Straße 145, 61476 Kronberg/Taunus Germany
Contact Person:	Aida Ayoubzadeh
Contact E-Mail Address:	Ayoubzadeh.a.4@pg.com
Contact Phone No.:	+496173305403

2. Summary of Testing

2.1. General Information

Applied Standards

Specification Reference:	47CFR15.247
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.247
Specification Reference:	47CFR15.207 and 47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209
Specification Reference:	RSS-Gen Issue 5 February 2021
Specification Title:	General Requirements for Compliance of Radio Apparatus
Specification Reference:	RSS-247 Issue 3 August 2023
Specification Title:	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

Location

Location of Testing:	UL International Germany GmbH Hedelfinger Strasse. 61, 70327 Stuttgart, GERMANY
Registration Number:	399704
Designation No.:	DE0019
ISED Company Number	22511
ISED CABID:	DE0008

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Date Information

Order Date:	04 January 2024
EUT Arrived:	06 February 2024
Test Dates:	25 March 2024 to 29 April 2024

2.2. Summary of Test Results

DIGITAL TRANSMISSION SYSTEMS (DTS): 2400-2483.5 MHz			
FCC Clause	**ISED Clause**	**Compliance Test Description**	**Test Result**
15.207	RSS-Gen 8.8	Transmitter AC Power Line Conducted Emissions	C
N/A	RSS-Gen 6.7	Transmitter 99% Occupied Bandwidth	C
Part 15.247(a)(2)	RSS-Gen 6.7 / RSS-247 5.2(a)	Transmitter Minimum 6 dB Bandwidth	C
Part 15.35(c)	RSS-Gen 8.2	Transmitter Duty Cycle(1)	N.P.
Part 15.247(e)	RSS-247 5.2(b)	Transmitter Power Spectral Density(2)	N.P.
Part 15.247(b)(3)	RSS-Gen 6.12 / RSS-247 5.4(d)	Transmitter Maximum (Peak) Output Power	C
15.247(d) & 15.209(a)	RSS-Gen 6.13 / RSS-247 5.5	Transmitter Radiated Emissions	C
15.247(d) & 15.209(a)	RSS-Gen 6.13 / RSS-247 5.5	Transmitter Band Edge Radiated Emissions	C
C: COMPLIED | N.C.: NOT COMPLIED | N.P.: NOT PERFORMED | N.A.: NOT APPLICABLE			
Decision rule: Where not otherwise specified or communicated in writing, statements of conformity (e.g. Pass/Fail) are established according to the following decision rule: considering the ILAC G8:2019 chapter 4.2.1 (simple acceptance rule). This leads to a maximum 50% of false accept or false reject when the measured value equals the tolerance limit. See ILAC-G8:09/2019 for further details.			

Note(s):

1. As the EUT continuous transmission of the EUT (D $\geqslant$ 98%) can be achieved and EUT was transmitting continuously with a constant 100% Duty Cycle, Duty cycle test result is not included in this report.
2. In accordance with ANSI C63.10-2013 Section 11.10.1, PSD is not required if the maximum conducted output power is less than the PSD limit of 8 dBm / 3 kHz. The PSD level is therefore deemed to be equal to the measured total output power.

2.3. Methods and Procedures

Reference:	ANSI C63.10-2013
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
Reference:	FCC KDB 558074 D01 DTS Meas. Guidance v05r02 April 2, 2019
Title:	Guidance for compliance measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section 15.247 of the FCC rules
Reference:	FCC KDB 174176 D01 Line Conducted FAQ v01r01 June 3, 2015
Title:	AC Power-Line Conducted Emissions Frequently Asked Questions

2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT) *

Brand Name:	BRAUN
Model Name / PMN:	3795 / iO6
Test Sample Serial Number:	eM6-0644 (Radiated Test Sample)
Hardware Version Number:	3795
Firmware Version Number:	N/A
HVIN:	3795
FVIN:	N/A
FCC ID:	USQ3795
ISED Certification No.:	IC: 6856A-3795

Brand Name:	BRAUN
Model Name / PMN:	3795 / iO6
Test Sample Serial Number:	eM6-0582 (RF Conducted Test Sample)
Hardware Version Number:	3795
Firmware Version Number:	N/A
HVIN:	3795
FVIN:	N/A
FCC ID:	USQ3795
ISED Certification No.:	IC: 6856A-3795

3.2. Description of EUT *

The equipment under test was a Wireless Toothbrush, Model: 3795, supporting Bluetooth LE technology.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing *

Technology Tested:	Bluetooth Low Energy		
Type of Radio Device:	Transceiver		
Power Supply Requirement(s):	Nominal	3.6 V DC Li-Ion Battery Powered	
Tested Data rate:	1 Mbps		
Nominal Channel Bandwidth:	1 MHz		
Declared Antenna Gain:	0.29 dBi		
Antenna Type:	Inverted F antenna		
Antenna Details:	PCB trace antenna		
Transmit Frequency Range:	2402 MHz to 2480 MHz		
Transmit Channels Tested:	**Channel ID**	**Channel Number**	**Frequency (MHz)**
	Bottom	37	2402
	Middle	17	2440
	Top	39	2480

3.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

A. Support Equipment (In-house)

Item	Description	Brand Name	Model Name or Number	Serial Number
1	-/-	-/-	-/-	-/-

B. Support Equipment (Manufacturer supplied) *

Item	Description	Brand Name	Model Name or Number	Serial Number
1	Wireless Charger	Braun	3757	-/-

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):
☒ Transmitter / Modulated Carrier Continuous Transmissions Mode Bluetooth Low Energy, • BTLE: 1 Mbps | Bottom / Middle / Top Channel | MAX PWR

4.2. Configuration and Peripherals

The EUT was tested in the following configuration(s):

EUT Power Supply:

- The EUT was powered by internal 3.6V DC Li-Ion Battery.

Test Mode Activation:

- The EUT was prepared by customer to Transmit continuously on the different channels when powered on. The channels can be switched using the button on the EUT.

AC Conducted Emissions Measurements:

- The EUT radiated sample was used for AC conducted emissions measurements in charging mode via the wireless charger.
- The measurements were carried out with 120 VAC/60Hz & 240 VAC/60Hz.

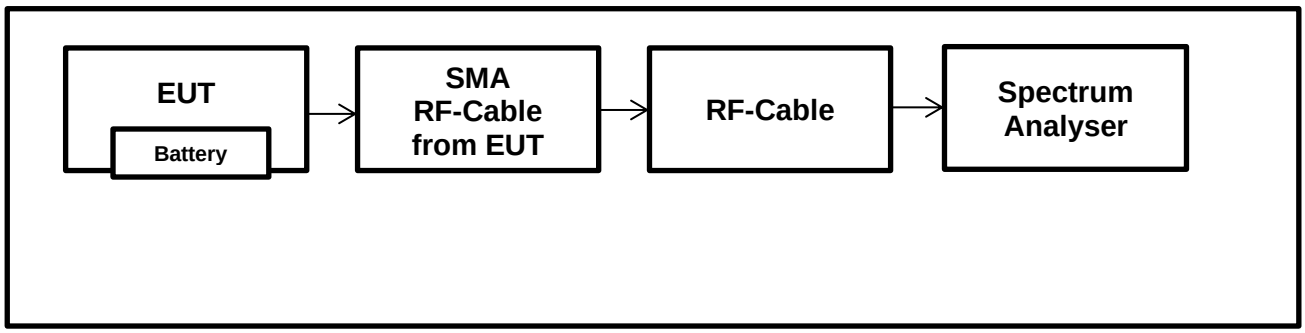
Radiated Measurements:

- For radiated measurements were performed with the radiated test sample.
- Before starting final radiated spurious emission measurements “worst case verification” with the EUT in Standing-position & Laying-position was performed by Lab.
- The EUT in Laying-position was found to be the worst case, Therefore, this report includes relevant results.
- As the EUT continuous transmission of the EUT (D ≥ 98%) can be achieved and EUT was transmitting continuously with a constant Duty Cycle of 98% duty cycle (duty cycle variations are less than ±2%). Therefore, no Duty Cycle Correction Factors was added to all average measurements to compute the corrected average values of the emissions that would have been measured had the test been performed at 100% Duty Cycle.
- Radiated measurements below 30 MHz were performed with the EUT positioned on the turn table and rotating 360 degrees while the loop antenna height was set at 100 cm. The table start rotating as soon as the measurement is started. The measurements are performed with the Antenna in perpendicular position first, after the pre-scan the polarization of the Antenna is changed and the measurements are continued. After the pre-scan the software combines the results of both antenna polarization and save the worst-case results for each frequency. The critical frequencies are then selected and a re-measurement is started. With the table rotating continuously the Antenna in perpendicular position performed final measurements on the frequencies selected. The polarization of the Antenna is changed to Parallel and again the final measurement are performed at selected frequencies. The software then combines all the results and represent the worst-case values measured for each frequency.

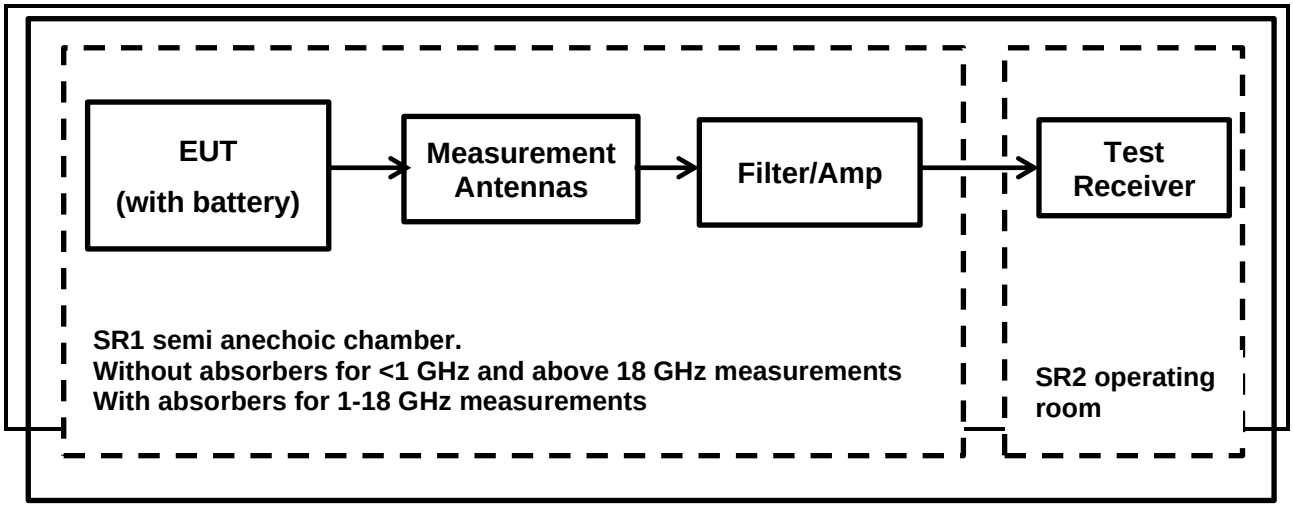
- Radiated measurements above 30 MHz were performed with the EUT positioned on the turn table and rotating 360° while the antenna height varies from 1 to 4 m over the measurement frequency range. The table start rotating as soon as the measurement is started. The measurements are performed with the Antenna at 1m height in Vertical position first, after the pre-scan the polarization of the Antenna is changed and the measurements are continued. After the pre-scan the software combines the results of both antenna polarization and save the worst-case results for each frequency. The critical frequencies are then selected and a re-measurement is started. With the table rotating continuously the Antenna moves from 1m to 4m height with 20 cm steps with vertical position and performed final measurements on the frequencies selected. After reaching 4m the Antenna changes its polarization to horizontal and moves down to 1m with 20 cm steps again performing the final measurement at selected frequencies. After 1m height reached the software combines all the results and represent the worst-case values measured for each frequency during the height search.

4.3.Test Setup Diagrams

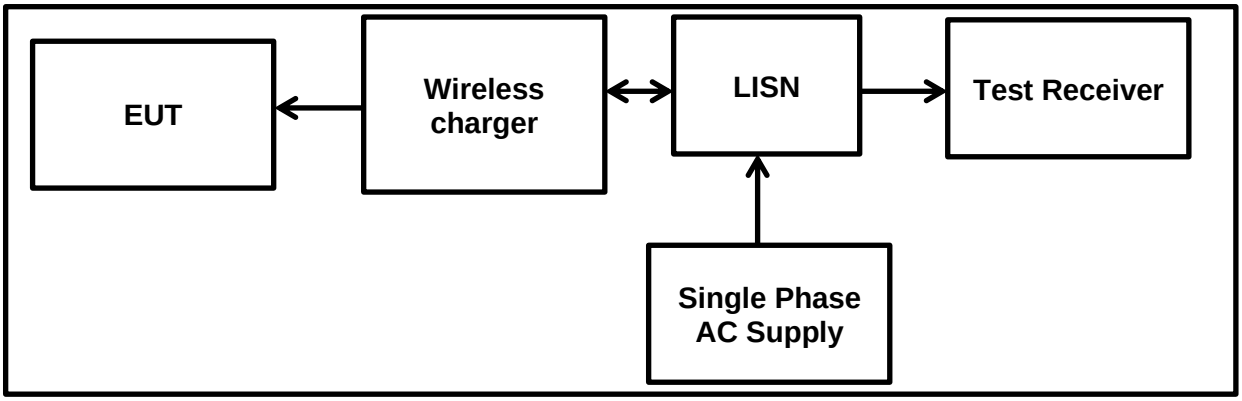
Test Setup for all Conducted Tests:



Test Setup for Transmitter Radiated Emissions



Test Setup Transmitter AC Conducted Emissions:



5. Measurements, Examinations and Derived Results

5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to Section 6 *Measurement Uncertainty* for details.

In accordance with DAkkS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

5.2. Test Results

5.2.1. Transmitter AC Conducted Emissions

Test Summary:

Test Engineer:	Muhammad Faiq Khan	**Test Date:**	25 March 2024 to 27 March 2024
Test Sample Serial Number:	eM6-0644 (Radiated Test Sample)		
Test Site Identification	SR 7/8		

FCC Reference:	Part 15.207
ISED Canada Reference:	RSS-Gen 8.8
Test Method Used:	ANSI C63.10 Section 6.2 / FCC KDB 174176 and notes below

Environmental Conditions:

Temperature (°C):	22.7 to 23.2
Relative Humidity (%):	37.8 to 40.0

Settings of the Instrument

Detector	Quasi Peak/ Average

Note(s):

1. In accordance with FCC KDB 174176 Q4, tests were also performed with a 240 VAC 60 Hz single phase supply as this was within the voltage range marked on the 100-240 VAC~50/60 Hz power supply.
2. Pre-scans were performed, and markers placed on the highest live and neutral measured levels. Final measurements were performed on the marker frequencies and the results entered into the tables below.
3. The final measured value, for the given emission, in the table below incorporates the cable loss.
4. All other emissions shown on the pre-scan plot were investigated. Only the highest 6 emissions have been reported in the tables below in accordance with ANSI C63.10 section 6.2.5.
5. Measurements were performed in shielded room (SR7/ 8 Asset Number 1603671). The EUT was placed at a height of 80 cm above the reference ground plane and in a distance of 40 cm from the vertical ground plane at the edge of the table.

Transmitter AC Conducted Emissions (continued)

Results: BTLE

Results: Live / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.21033	Live	35.2	63.2	28.0	Complied
0.41296	Live	28.4	57.6	29.2	Complied
1.04685	Live	16.8	56.0	39.2	Complied
1.40672	Live	18.8	56.0	37.2	Complied
3.45705	Live	12.8	56.0	43.2	Complied
6.96367	Live	12.1	60.0	47.9	Complied

Results: Live / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.21033	Live	31.5	53.2	21.7	Complied
0.41296	Live	23.5	47.6	24.1	Complied
1.04685	Live	8.9	46.0	37.1	Complied
1.40672	Live	11.7	46.0	34.3	Complied
3.45705	Live	6.8	46.0	39.2	Complied
6.96367	Live	6.8	50.0	43.2	Complied

Results: Neutral / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.29386	Neutral	28.4	60.4	32.0	Complied
0.58278	Neutral	22.0	56.0	34.0	Complied
2.46038	Neutral	14.1	56.0	41.9	Complied
5.17089	Neutral	12.1	60.0	47.9	Complied
10.43217	Neutral	10.2	60.0	49.8	Complied
21.62042	Neutral	10.5	60.0	49.5	Complied

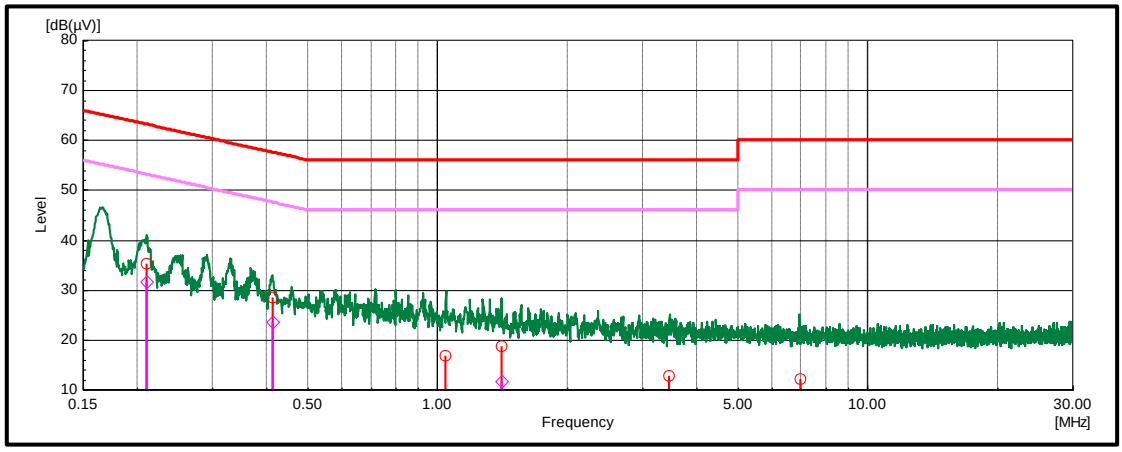
Transmitter AC Conducted Spurious Emissions (continued)

Results: BTLE

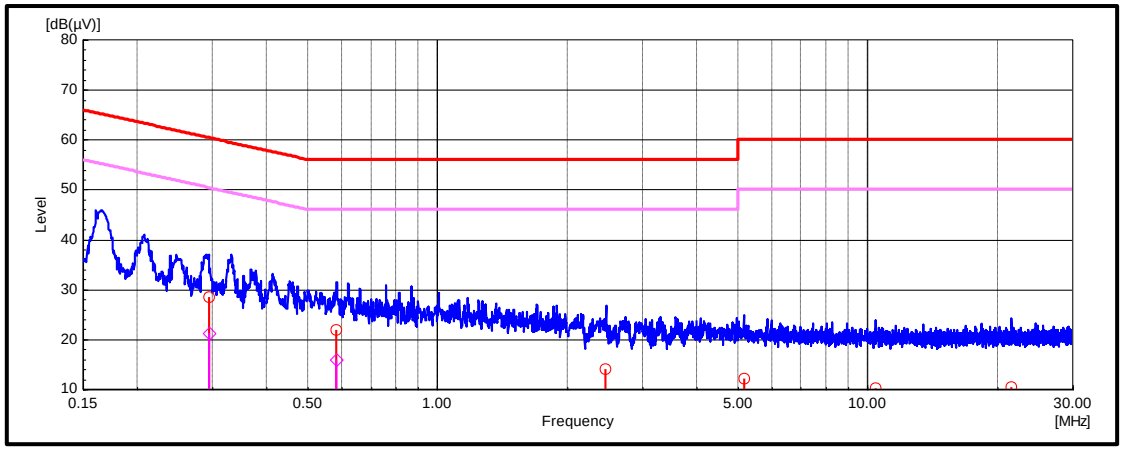
Results: Neutral / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.29386	Neutral	21.3	50.4	29.1	Complied
0.58278	Neutral	15.9	46.0	30.1	Complied
2.46038	Neutral	7.5	46.0	38.5	Complied
5.17089	Neutral	7.5	50.0	42.5	Complied
10.43217	Neutral	5.5	50.0	44.5	Complied
21.62042	Neutral	5.8	50.0	44.2	Complied

Plot: Live Line / 120 VAC 60 Hz



Plot: Neutral Line / 120 VAC 60 Hz



Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Transmitter AC Conducted Spurious Emissions (continued)

Results: BTLE

Results: Live / Quasi Peak / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.19191	Live	43.1	64.0	20.9	Complied
0.23939	Live	38.3	62.1	23.8	Complied
0.42627	Live	30.4	57.3	26.9	Complied
1.10438	Live	15.9	56.0	40.1	Complied
2.12988	Live	13.7	56.0	42.3	Complied
5.38797	Live	11.9	60.0	48.1	Complied

Results: Live / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.19191	Live	41.3	54.0	12.7	Complied
0.23939	Live	36.1	52.1	16.0	Complied
0.42627	Live	28.7	47.3	18.6	Complied
1.10438	Live	8.9	46.0	37.1	Complied
2.12988	Live	7.4	46.0	38.6	Complied
5.38797	Live	6.2	50.0	43.8	Complied

Results: Neutral / Quasi Peak / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.19038	Neutral	44.0	64.0	20.0	Complied
0.43042	Neutral	29.0	57.2	28.2	Complied
0.97785	Neutral	16.4	56.0	39.6	Complied
1.70806	Neutral	14.3	56.0	41.7	Complied
5.93261	Neutral	11.9	60.0	48.1	Complied
19.72940	Neutral	10.0	60.0	50.0	Complied

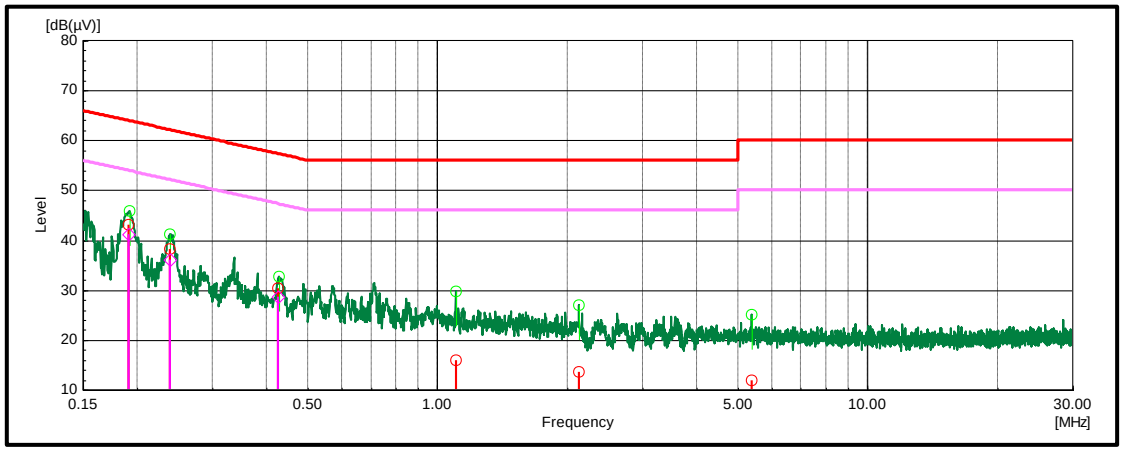
Transmitter AC Conducted Spurious Emissions (continued)

Results: BTLE

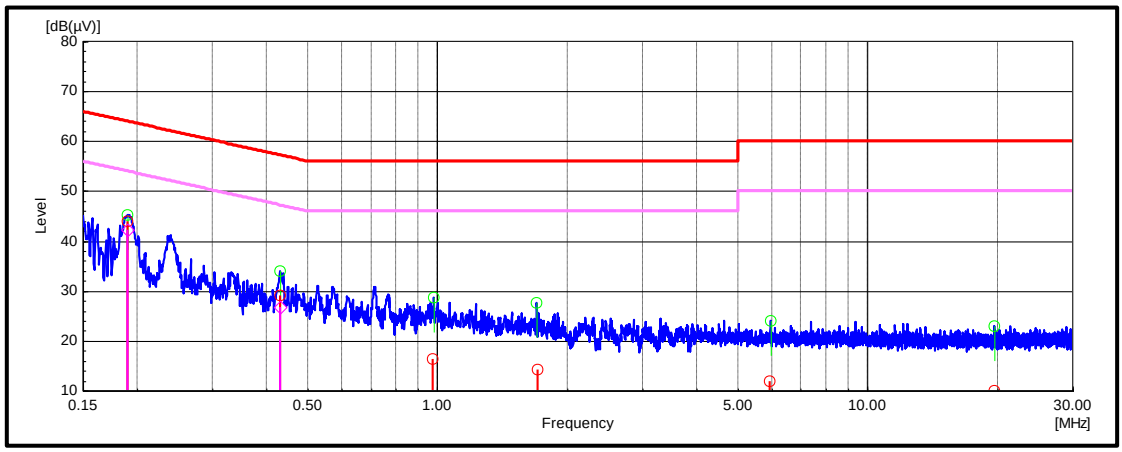
Results: Neutral / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.19038	Neutral	42.3	54.0	11.7	Complied
0.43042	Neutral	26.7	47.2	20.5	Complied
0.97785	Neutral	8.9	46.0	37.1	Complied
1.70806	Neutral	8.0	46.0	38.0	Complied
5.93261	Neutral	6.9	50.0	43.1	Complied
19.72940	Neutral	5.8	50.0	44.2	Complied

Plot: Live and Neutral Line / 240 VAC 60 Hz



Plot: Live and Neutral Line / 240 VAC 60 Hz



Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

5.2.2.Transmitter 99% Occupied Bandwidth

Test Summary:

Test Engineer:	Abbas Al-Hussainy	**Test Date:**	12 March 2024
Test Sample Serial Number:	eM7-0542 (RF Conducted Test Sample)		
Test Site Identification	SR 9		

FCC Reference:	N/A
ISED Canada Reference:	RSS-Gen 6.7
Test Method Used:	RSS-Gen 6.7 and Notes below

Environmental Conditions:

Temperature (°C):	24.2
Relative Humidity (%):	37.4

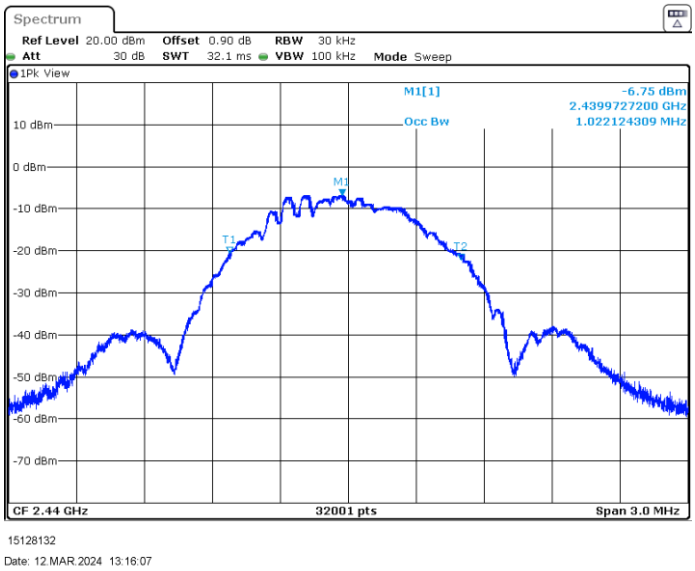
Note(s):

1. The 99% emission bandwidth was measured using the signal analyser occupied bandwidth function. The resolution bandwidth was set in the range of 1% to 5% of the occupied bandwidth and the video bandwidth set to 3 times the resolution bandwidth. The span was set to capture all products of the modulation process including emission skirts.
2. The RF port on the EUT was connected to the spectrum analyser using suitable attenuation and RF cable. The measured values takes into consideration the external attenuation correction factors.
   The RF cable attenuation maximum 0.9 dB@2.4GHz from the EUT to Analyzer.
   Therefore, total a reference level offset 0.9 dB was added to each of the at the tested frequencies conducted plots.
3. Example plots of each modulation on middle channel, for one antenna configuration, can be seen below to show setting parameters comply with testing method/procedure. All other plots are archived on the UL IT server and available for inspection if required.

Transmitter 99% Occupied Bandwidth (continued)

Results: BTLE

Channel	99% Occupied Bandwidth (kHz)
Bottom	1019.686
Middle	1022.124
Top	1021.374



Middle Channel

5.2.3. Transmitter Minimum 6 dB Bandwidth

Test Summary:

Test Engineer:	Abbas Al-Hussainy	**Test Date:**	12 March 2024
Test Sample Serial Number:	eM6-0582 (RF Conducted Test Sample)		
Test Site Identification	SR 9		

FCC Reference:	Part 15.247(a)(2)
ISED Canada Reference:	RSS-Gen 6.7 / RSS-247 5.2(a)
Test Method Used:	FCC KDB 558074 Section 8.2 referencing ANSI C63.10:2013 Section 11.8.1 Option 1

Environmental Conditions:

Temperature (°C):	24.2
Relative Humidity (%):	37.4

Notes:

1. The measurements were performed using the above configurations on the bottom, middle and top channels in accordance FCC KDB 558074 Section 8.2 referencing ANSI C63.10 Section 11.8 (11.8.1 Option 1 measurement procedure).
2. The spectrum analyser resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The DTS bandwidth was measured at 6 dB down from the peak of the signal.
3. The RF port on the EUT was connected to the spectrum analyser using suitable attenuation and RF cable. The measured values takes into consideration the external attenuation correction factors.

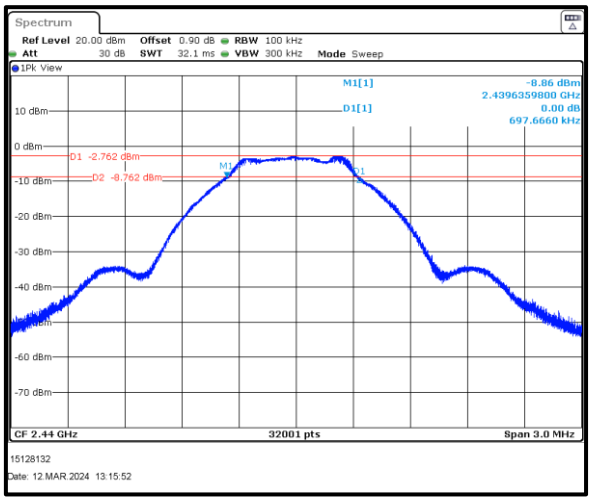
   The RF cable attenuation maximum 0.9 dB@2.4GHz from the EUT to Analyzer

   Therefore, total a reference level offset 0.9 dB was added to each of the at the tested frequencies conducted plots.
4. Example plots of each modulation on middle channel, for one antenna configuration, can be seen below to show setting parameters comply with testing method/procedure. All other plots are archived on the UL IT server and available for inspection if required.

Transmitter Minimum 6 dB Bandwidth (continued)

Results: BTLE

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	699.0720	≥ 500	199.072	Complied
Middle	697.6660	≥ 500	197.666	Complied
Top	701.4160	≥ 500	201.416	Complied



Middle Channel

5.2.4. Transmitter Maximum (Peak) Output Power

Test Summary:

Test Engineer:	Abbas Al-Hussainy	**Test Date:**	12 March 2024
Test Sample Serial Number:	eM6-0582 (RF Conducted Test Sample)		
Test Site Identification	SR 9		

FCC Reference:	Part 15.247(b)(3)
ISED Canada Reference:	RSS-Gen 6.12 / RSS-247 5.4(d)
Test Method Used:	FCC KDB 558074 Section 8.3.1.3 referencing ANSI C63.10 Sections 11.9.1.1

Environmental Conditions:

Temperature (°C):	24.2
Relative Humidity (%):	37.4

Notes:

1. Final measurements were performed using the below configurations on the bottom, middle and top channels.
   - BTLE: 1 Mbps | Bottom / Middle / Top Channel | MAX PWR
2. The EUT was transmitting at 100% duty cycle and testing was performed in accordance with ANSI C63.10 Section 11.9.1.1.
3. The RF port on the EUT was connected to the spectrum analyser using suitable attenuation and RF cable. The measured values takes into consideration the external attenuation correction factors.
   - The RF cable attenuation maximum 0.9 dB@2.4GHz from the EUT to Analyzer

   Therefore, total a reference level offset 0.9 dB was added to each of the at the tested frequencies conducted plots.

Transmitter Maximum (Peak) Output Power (continued)

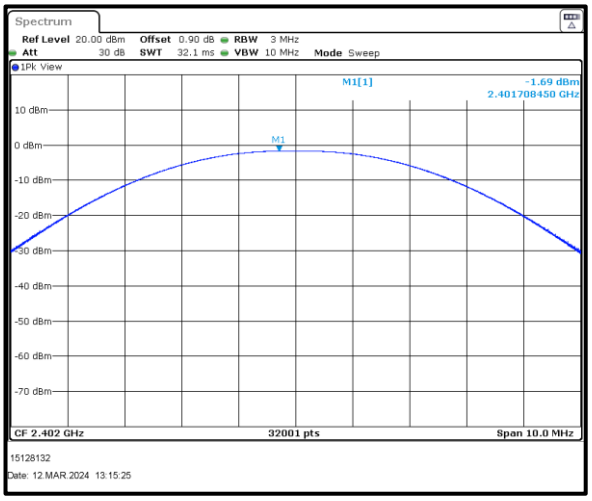
Results: BTLE

Conducted Power Limit Comparison

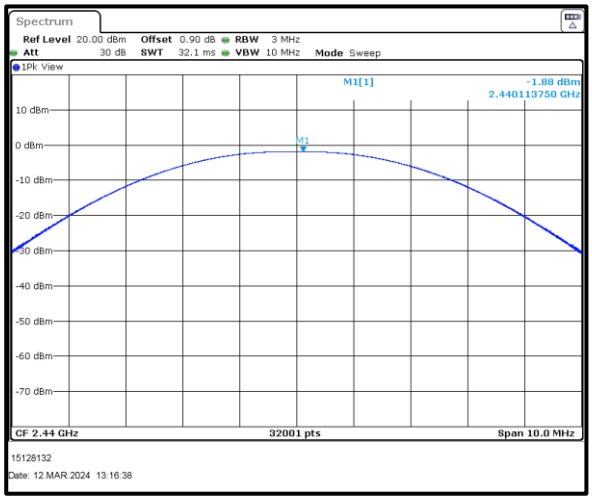
Channel	Conducted Peak Power (dBm)	Conducted Power Limit (dBm)	Margin (dB)	Result
Bottom	-1.69	30.0	31.69	Complied
Middle	-1.88	30.0	31.88	Complied
Top	-1.93	30.0	31.93	Complied

De Facto EIRP Limit Comparison

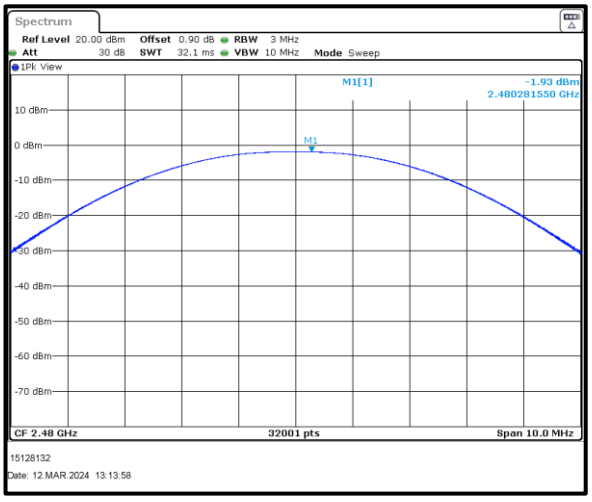
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	-1.69	0.29	-1.40	36.0	37.40	Complied
Middle	-1.88	0.29	-1.59	36.0	37.59	Complied
Top	-1.93	0.29	-1.64	36.0	37.64	Complied



Bottom Channel



Middle Channel



Top Channel

5.2.5. Transmitter Radiated Emissions

Test Summary:

Test Engineer:	Abbas Al-Hussainy	**Test Date:**	23 April 2024
Test Sample Serial Number:	eM6-0644 (Radiated Test Sample)		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.247(d) & 15.209(a)
ISED Canada Reference:	RSS-Gen 6.13 & 8.9 / RSS-247 5.5
Test Method Used:	FCC KDB 558074 Sections 8.5 & 8.6 referencing ANSI C63.10 Sections 11.11 and 11.12 ANSI C63.10:2013 Sections 6.3 and 6.4
Frequency Range	9 kHz to 30 MHz

Environmental Conditions:

Temperature (°C):	23.1
Relative Humidity (%):	38.6

Notes:

1. In accordance with FCC KDB 414788 D01 Radiated Test Site & ANSI C63.10 clause 5.2 an alternative test site that can demonstrate equivalence to an open area test site may be used. Therefore, the measurement was performed in a Semi Anechoic Chamber. (The OATS / SAC comparison data is available upon request).
2. FCC rule part 15.209(a) specifies limits at 300 m / 30 m in µV/m but RSS GEN specifies limits at 300 m / 30 m in µA/m. The relevant limits are the same after accounting for E-field to H-field correction. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table). According to Notice 2020-DRS0023 converting the magnetic field strength into electrical field strength using the following equation while considering free space impedance of 377 Ω results in a factor of 51.5 dBΩ.

   $$AF^{E}\,[dB(m^{-1})] = AF^{H}\,[dB(\Omega^{-1}m^{-1})] + Z_0[dB\Omega]$$

   For example, the measurement frequency X KHz resulted in a level of Y dBµV/m, which is equivalent to Y -51.5 = Z dBµA/m, which has the same margin, W dB, to the corresponding RSS-GEN Section 8.9, Table 6 limit as it has to the 15.209(a) limit.

3. The limits are specified at a test distances of 30 and 300 metres. However, as specified in FCC Section 15.31 (f)(2) & ANSI C63.10 clause 6.4.3, measurements may be performed at a closer distance and the measured level extrapolated to the specified measurement distance using the method described in clauses 6.4.4, specifically sub-clause 6.4.4.1 which specifies that the measured level shall be extrapolated to the specified distance by conservatively presuming that the field strength decays at 40 dB/decade.
   Therefore, measurements were performed at a measurement distance of 3 m.

4. The measured values at 3 m were extrapolated to the required measurement distances of 300 m and 30 m and compared the specified limits at those distances as follows:

   •9 kHz- 490 kHz: measured value extrapolated from 3 m to 300 m by subtracting 80 dB at 40 dB /decade.

   •490 kHz-30 MHz: measured value extrapolated from 3 m to 30 m by subtracting 40 dB at 40 dB /decade.

5. The results table shows both the measured levels at 3 m and the same measurement values extrapolated to the actual measurement distance for the limits specified at 30 and 300 metres.

6. Conversely, the limit line shown on the spectrum plot was extrapolated to 3 m from 300 m and 30 m using the 40 dB /decade rule.
7. Measurements below 30 MHz were performed in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) at a distance of 3 m. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. The measurement loop antenna height was 100 cm.
8. The radiated emissions measurements were performed with the EUT set to the following worst-case mode w.r.t output power.
    - BT LE | 1 Mbps | Bottom Channel | MAX PWR
9. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
10. Pre-scans were performed, and markers placed on the highest measured levels. The test receiver was set to:
    - Frequency range: 9 kHz-150 kHz: RBW: 300 Hz /VBW: 1 kHz
    - Frequency range: 150 kHz – 30 MHz: RBW: 10 kHz /VBW: 30 kHz
    - Detector: Peak detector
    - Trace Mode: Max Hold

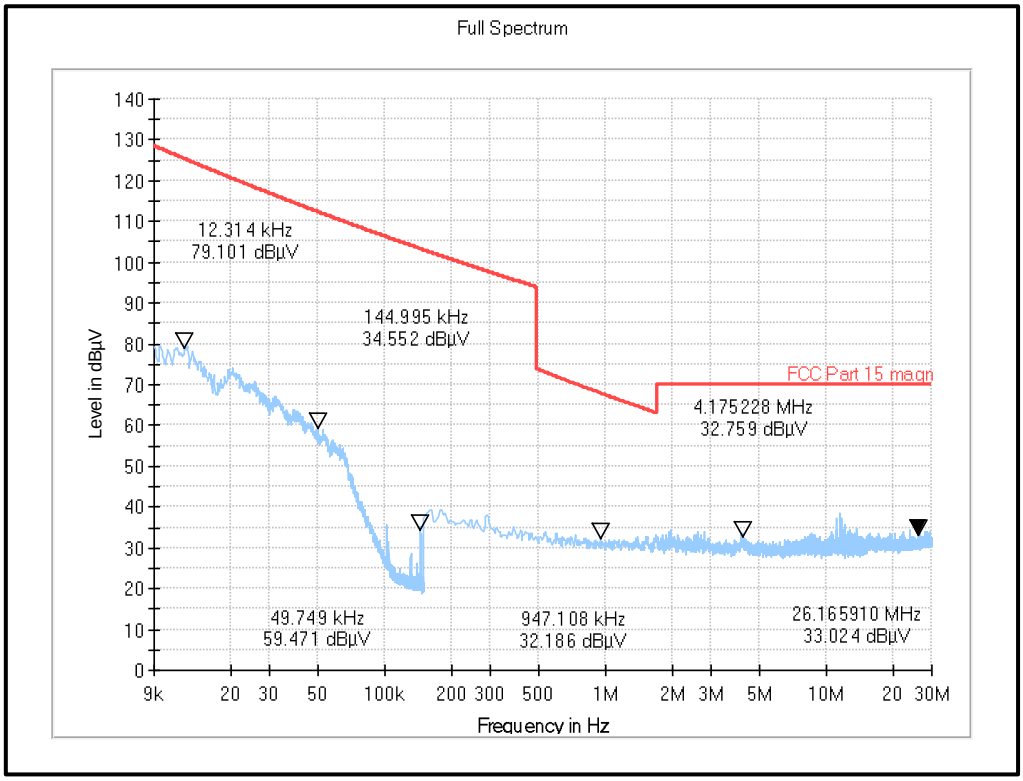
Final measurements performed with Quasi-peak detector as per CISPR requirements.

Transmitter Radiated Emissions (continued)

Results: BTLE

Emission Frequency (MHz)	Loop Antenna Orientation	MaxPeak Level at 3 m(dBµV/m)	MaxPeak Emission Level extrapolated (dBmV/m)	Limit (dBµV/m)	Margin (dB)	Result
All emissions were below the level of the measurement system noise floor.						

Plot: 9 kHz – 30 MHz: Results:



Transmitter Radiated Emissions (continued)

Test Summary:

Test Engineer:	Abbas Al-Hussainy	**Test Date:**	23 April 2024
Test Sample Serial Number:	eM6-0644 (Radiated Test Sample)		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.247(d) & 15.209(a)
ISED Canada Reference:	RSS-Gen 6.13 & 8.9 / RSS-247 5.5
Test Method Used:	FCC KDB 558074 Sections 8.5 & 8.6 referencing ANSI C63.10 Sections 11.11 and 11.12 ANSI C63.10:2013 Sections 6.3 and 6.5
Frequency Range:	30 MHz to 1000 MHz

Environmental Conditions:

Temperature (°C):	23.1
Relative Humidity (%):	38.6

Note(s):

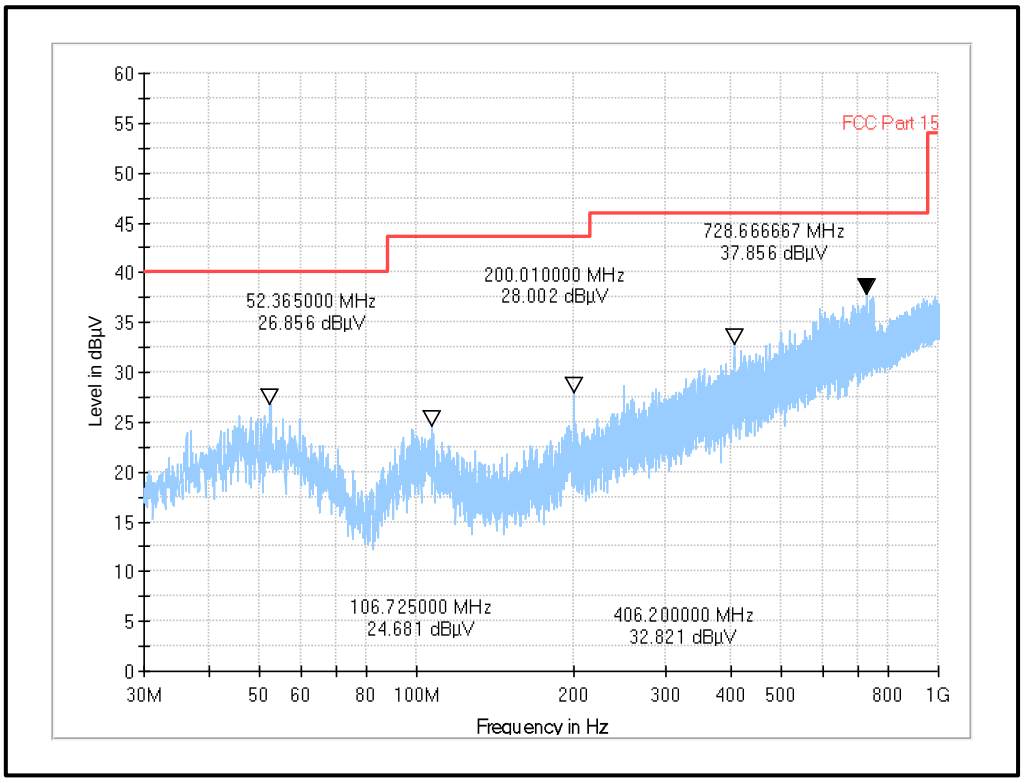
1. Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
2. The radiated measurements were performed with EUT set to the following worst-case mode w.r.t output power.
    - BT LE | 1 Mbps | Bottom Channel | MAX PWR
3. Pre-scans were performed, and markers placed on the highest measured levels. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.
4. Final measurements were performed on the marker frequencies. The results entered in the table below incorporates the calibrated antenna factor and cable loss. The test receiver resolution bandwidth was set to 120 kHz, using a CISPR quasi-peak detector and span big enough to see the whole emission.
5. All other emissions shown on the pre-scan plot were investigated and found to be below the measurement system noise floor.

Transmitter Radiated Emissions (continued)

Results: BTLE

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
All emissions were below the level of the measurement system noise floor.					

Plot: 30 MHz – 1GHz:



Transmitter Radiated Emissions (continued)

Test Summary:

Test Engineer:	Abbas Al-Hussainy	**Test Date:**	22 April 2024 to 29 April 2024
Test Sample Serial Number:	eM6-0644 (Radiated Test Sample)		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.247(d) & 15.209(a)
ISED Canada Reference:	RSS-Gen 6.13 & 8.9 / RSS-247 5.5
Test Method Used:	FCC KDB 558074 Sections 8.5 & 8.6 referencing ANSI C63.10 Sections 11.11 and 11.12 ANSI C63.10:2013 Sections 6.3 and 6.6
Frequency Range:	1 GHz to 26.5 GHz

Environmental Conditions:

Temperature (°C):	22.0 to 23.0
Relative Humidity (%):	38.9 to 41.8

Notes:

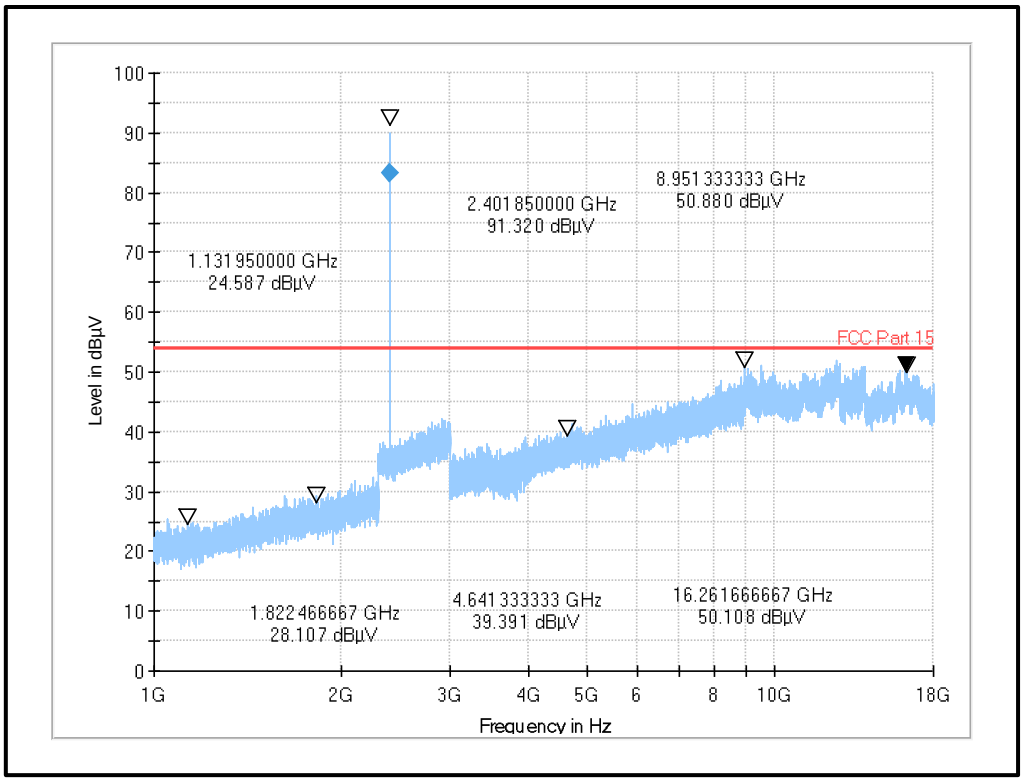
1. Pre-scans above 1 GHz were performed in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) with RF absorbers on the floor at a distance of 3 m. The EUT was placed at a height of 1.5 m above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 m above the test chamber floor, in line with the EUT. Final measurements above 1 GHz were performed in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) with absorber on the floor at a distance of 3 m. The EUT was placed at a height of 1.5 m above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 m to 4 m.
2. The radiated measurements were performed with the EUT set to the following worst-case mode w.r.t output power.
    - BT LE | 1 Mbps | Bottom Channel | MAX PWR
3. Pre-scans were performed, and a marker placed on the highest measured level of the appropriate plot. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz the sweep time was set to auto.
4. The emissions shown at frequencies approximately 2.4 GHz to 2.4835 GHz on the 1 GHz to 18 GHz plots are the EUT fundamental for the tested channel.
5. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
6. In accordance with ANSI C63.10-2013 Section 5.3.3 & 6.5.3 measurements above 18 GHz were performed at closer distance (1 m); because at specified measurement distance (3m) for compliance the instrumentation noise floor was typically close to the radiated emission limit.
7. For frequency range between 18 GHz and 26.5 GHz, no critical emissions were found. All emissions shown on the pre-scans were investigated and found to be below the noise floor of the measurement system

Transmitter Radiated Emissions (continued)

Results: BTLE

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
All emissions were below the level of the measurement system noise floor.					

Plot: 1 GHz – 18 GHz

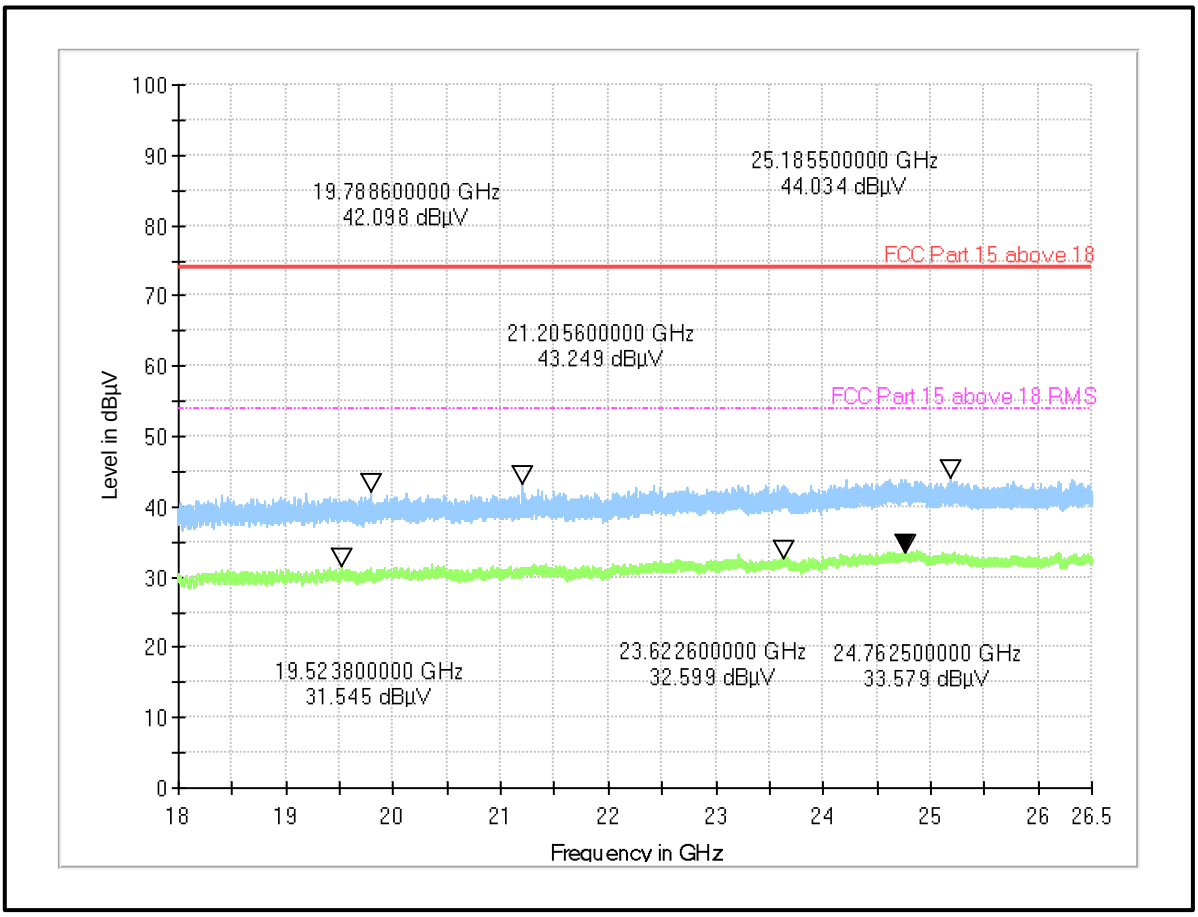


Transmitter Radiated Emissions (continued)

Results: BTLE

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
All emissions were below the level of the measurement system noise floor.					

Plot: 18 GHz – 26.5 GHz:



5.2.6. Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineer:	Abbas Al-Hussainy	**Test Date:**	24 April 2024 to 29 April 2024
Test Sample Serial Number:	eM6-0644 (Radiated Test Sample)		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.247(d), 15.209(a) & 15.205(a)
ISED Canada Reference:	RSS-Gen 6.13 / RSS-247 5.5
Test Method Used:	DTS emissions in non-restricted frequency bands: FCC KDB 558074 Section 8.5 referencing ANSI C63.10:2013 Sections 11.11
	DTS emissions in restricted frequency bands: FCC KDB 558074 Section 8.6 referencing ANSI C63.10:2013 Sections 11.12
	ANSI C63.10:2013 Sections 6.10.4, 6.10.5

Environmental Conditions:

Temperature (°C):	22.2 to 23.0
Relative Humidity (%):	39.0 to 41.8

Note(s):

1. The measurements were in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) with RF absorbers on the floor at a distance of 3 m. The EUT was placed at a height of 1.5 m above the test chamber floor in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 m to 4 m
2. As the lower band edge falls within a non-restricted band, measurements were performed in accordance with FCC KDB 558074 Section 8.5 referencing ANSI C63.10 Section 11.11. Since maximum conducted (Peak) output power was previously measured in accordance with ANSI C63.10 Section 11.11.1(a) lower band edge measurement was performed with a peak detector and the -20 dBc limit applied.
3. As the lower band edge falls within a non-restricted band, only peak measurements are required. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The test receiver was left to sweep for 300 sweeps in order to maximise the carrier level and out-of-band emissions. A marker and corresponding reference level line were placed on the peak of the carrier. Marker frequencies and levels were recorded.
4. The restricted band peak measurements were performed in accordance with ANSI C63.10 Section 11.12.2.4.
5. As the EUT continuous transmission of the EUT ($D \geq 98\%$) cannot be achieved and the duty cycle is constant (duty cycle variations are less than ±2%), the restricted band average measurements were performed in accordance with ANSI C63.10 Section 11.12.2.5.2.
6. As the upper band edge falls within a restricted band both peak and average measurements were recorded by placing a marker at the edge of the band. For peak measurements the test receiver resolution bandwidth was set to 1 MHz and the video bandwidth 3 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. For average measurements the test receiver resolution bandwidth was set to 1 MHz and the video bandwidth 3 MHz. A RMS detector in power averaging mode was used. The test receiver was left to sweep for a sufficient length of time in order to maximise the carrier level and out-of-band emissions. A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent restricted band of operation (where a higher level emission was present). Marker frequencies and levels were recorded.

Transmitter Band Edge Radiated Emissions (continued)

Note(s): (continued)

7. There is a restricted band 10 MHz below the lower band edge. The test receiver was set up as follows: the RBW set to 1 MHz, the VBW set to 3 MHz, with the sweep time set to auto couple. Peak and average measurements were performed with their respective detectors. Markers were placed on the highest point on each trace.
8. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
9. As the EUT continuous transmission of the EUT (D $\geqslant$ 98%) can be achieved and EUT was transmitting continuously with a constant Duty Cycle of 100% (duty cycle variations are less than $\pm$ 2%). Therefore, no Duty Cycle Correction Factors was added to all average measurements to compute the corrected average values of the emissions that would have been measured had the test been performed at 100% Duty Cycle.

Transmitter Band Edge Radiated Emissions (Continued)

Results: BTLE

Results: Lower Band Edge / Peak

Frequency (MHz)	Peak Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
2399.95	38.52	70.83	32.31	Complied
2400.00	38.21	70.83	32.62	Complied

Results: Lower Band Edge / *2310 to 2390 MHz Restricted Band* / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2323.39	44.17	74.00	29.83	Complied

Results: Lower Band Edge / *2310 to 2390 MHz Restricted Band* / Average

Frequency (MHz)	Average Level (dBµV/m)	Duty Cycle Correction Factor (dB)	Corrected Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2388.12	32.37	0	32.37	54.00	21.63	Complied

Results: Upper Band Edge / Peak

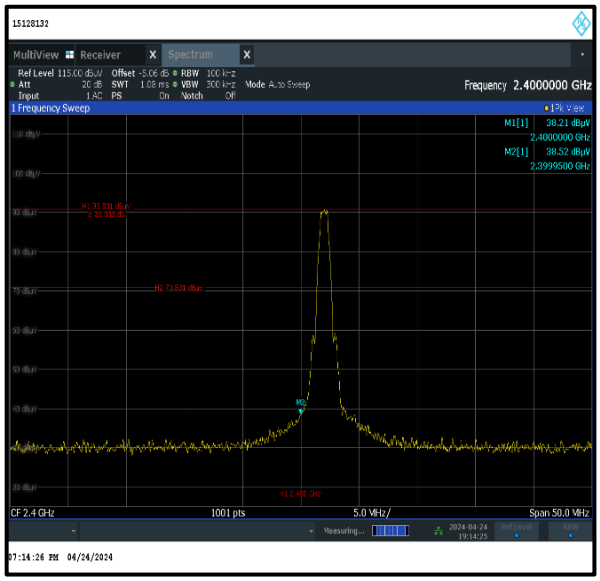
Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2483.50	50.48	74.00	23.52	Complied
2483.58	50.27	74.00	23.63	Complied

Results: Upper Band Edge / Average

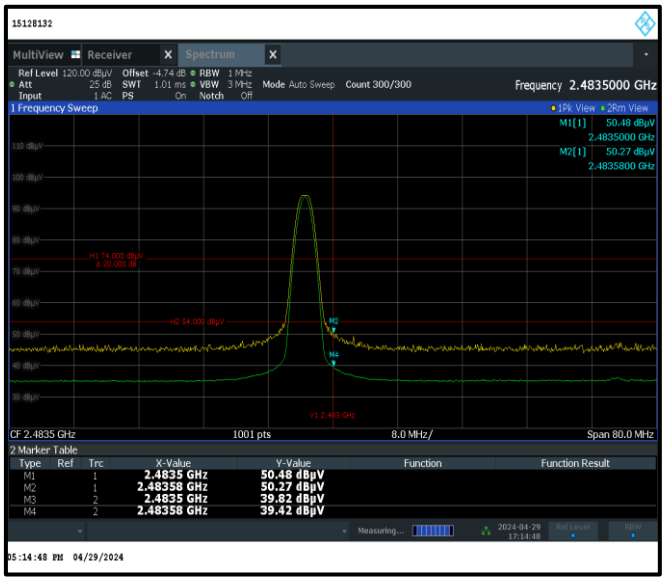
Frequency (MHz)	Average Level (dBµV/m)	Duty Cycle Correction Factor (dB)	Corrected Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2483.50	39.82	0	39.82	54.00	14.18	Complied
2485.14	39.42	0	39.42	54.00	14.58	Complied

Transmitter Band Edge Radiated Emissions (Continued)

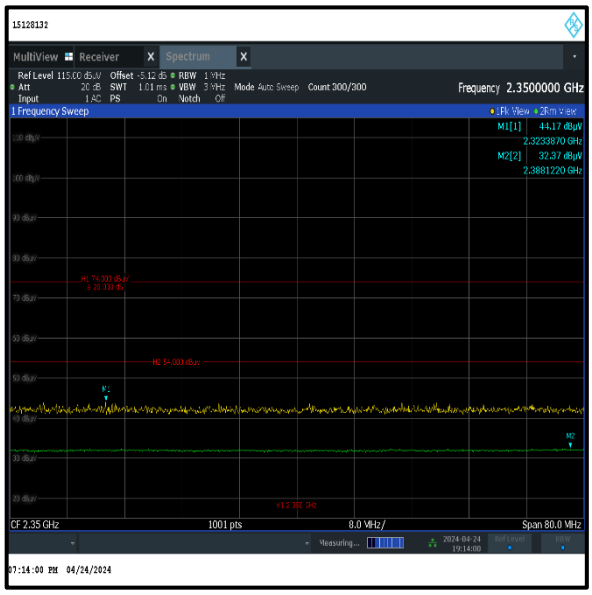
Results: BTLE



Lower Band Edge Peak Measurement



Upper Band Edge Measurement



Restricted Band Edge Measurement

6. Measurement Uncertainty

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	95%	±2.49 dB
Conducted Maximum Peak Output Power	95%	±0.59 dB
Radiated Spurious Emissions	95%	±3.10 dB
Band Edge Radiated Emissions	95%	±3.10 dB
Minimum 6 dB Bandwidth	95%	±0.87 %

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

7. Used equipment

Test site: SR 1/2

ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
1	Rohde & Schwarz	Antenna, Loop	HFH2-Z2	831247/012	18/07/2023	36
377	BONN Elektronik	Amplifier, Low Noise Pre	BLMA 0118-1A	025294B	18/07/2023	12
460	Deisel	Turntable	DT 4250 S	n/a	n/a	n/a
465	Schwarzbeck	Antenna, Trilog Broadband	VULB 9163	01691	30/11/2023	36
496	Rohde & Schwarz	Antenna, log. - periodical	HL050	100297	22/08/2022	24
588	Maturo	Controller	NCD	029/7180311	n/a	n/a
669	Rohde & Schwarz	EMI Test Receiver	ESW 44	103087	13/07/2023	18
694	Rohde & Schwarz	Signal Analyzer	FSW 50	101847	09/05/2023	12
608	Rohde & Schwarz	Switch Matrix	OSP 120	101227	lab verification	n/a
628	Maturo	Antenna mast	CAM 4.0-P	224/19590716	n/a	n/a
629	Maturo	Kippeinrichtung	KE 2.5-R-M	MAT002	n/a	n/a
-/-	Testo	Thermo-Hygrometer	608-H1	01	lab verification	n/a
328	SPS	AC/DC power distribution system	PAS 5000	A2464 00/2 0200	lab verification	n/a
1603665	Siemens Matsushita Components	semi-anechoic chamber SR1/ 2	-/-	B83117-A1421-T161	n/a	n/a
681	Maturo	Antenna mast, tilting	BAM4.5-P	402/0718.1	n/a	n/a
207571*	Schwarzbeck Mess-Elektronik OHG	Antenna broadband horn antenna	BBHA 9170	9170-561	13-May-2024	48

*Remark: The equipment was calibrated during the tests of this report.

Test Measurement Software/Firmware Used:

Name	Version	Release Date
EMC32	Rohde & Schwarz	11.30.00

Test site: SR 9

ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
637	Rohde & Schwarz	Spectrum Analyser	FSV40	101587	12/07/2023	12
-/-	Testo	Thermo-Hygrometer	608-H1	07	lab verification	n/a
-/-	Huber+Suhner	RF Cable -OSP120-DUT1	ST18/SMAm/SMAm/72	605505	lab verification	n/a
1603668	Siemens Matsushita Components	Shield room	--	B83117-B1422-T161	n/a	n/a

Test Measurement Software/Firmware Used:

Name	Manufacturer	Version
--	--	--

Test site: SR 7/8

ID	Manufacturer	Type	Model	Serial No.	Calibration Date	Cal. Cycle
22	Rohde & Schwarz	Artificial Mains	ESH3-Z5	831767/014	18.07.2023	12
23	Rohde & Schwarz	Artificial Mains	ESH3-Z5	831767/013	18.07.2023	12
215	Rohde & Schwarz	Artificial Mains Network	ESH2-Z5	879675/002	18.07.2023	24
349	Rohde & Schwarz	Receiver, EMI Test	ESIB7	836697/009	18.07.2023	12
351	Rohde & Schwarz	network, Artificial Mains	ESH3-Z5	862770/018	18.07.2023	12

Test Measurement Software/Firmware Used:

Name	Manufacturer	Version
EMI Software; CE measurement software	Toyo	EP5/CE Ver 4.0.1.

8. Report Revision History

Version Number	Revision Details		
	Page No(s)	**Clause**	**Details**
1.0	-	-	Initial Version
1.1	5,6,8,9	-	Editorial changes
	Cover, 7	-	PMN added
	18	5.2.2	Note added
	22	5.2.4	Correction of test method used
	23	5.2.4	Antenna gain corrected
	34	5.2.6	Result table header corrected
	37	7	Used equipment corrected
Test Report Version 1.2 supersede Version 1.1 with immediate effect Test Report No. UL-RPT-RP-15128132-116 Version 1.2, Issue Date 14 November 2024 replaces Test Report No. UL-RPT-RP-15128132-116 Version 1.1, Issue Date 11 November 2024, which is no longer valid.			
	Page No(s)	**Clause**	**Details**
1.2	8	3.4	Correction of channel number
	38	7	Used equipment corrected

--- END OF REPORT ---