



Solutions

TEST REPORT

Test Report No.: UL-RPT-RP-14067528-316-2-FCC

Applicant * : EVBox North America Inc
Model No. * : L24871NAC00
FCC ID * : Contains FCC ID: 2A3C7-WIFIG5P
Technology * : Bluetooth 4.0 – Low Energy
Test Standard(s) : **FCC Parts 15.207, 15.209(a) & 15.247**

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 1.1 supersede Version 1.0 with immediate effect**
Test Report No. UL-RPT-RP-14067528-316-2-FCC Version 1.1, Issue Date 03 April 2023 replaces
Test Report No. UL-RPT-RP-14067528-316-2-FCC Version 1.0, Issue Date 01 September 2022, which is no longer valid
5. Result of the tested sample: **PASS**
6. All information marked with a (*) were provided by customer / applicant or authorized representative

Prepared by: Muhammad Faiq Khan
Title: Project Engineer
Date: 03 April 2023

Approved by: Rachid Acharkaoui
Title: Operations Manager
Date: 03 April 2023



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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:	EVBox North America Inc
Company Address:	1930 Innovation Way, Suite 200, Illinois, Libertyville, USA
Contact Person:	Susan Eckman
Contact E-Mail Address:	susan.eckman@evbox.com
Contact Phone No.:	+1 630 209 9060

1.2.Manufacturer Information

Company Name:	EVBox BV
Company Address:	Kabelweg 47 1014 BA Amsterdam The Netherlands
Contact Person:	Marco Farina
Contact E-Mail Address:	marco.farina@evbox.com
Contact Phone No.:	+31620549130

2. Summary of Testing

2.1. General Information

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

Applied Standards

Location

Location of Testing:	UL International Germany GmbH Hedelfinger Str. 61 70327 Stuttgart Germany
Test Firm Registration:	399704

Date information

Order Date:	27 October 2022
EUT Arrived:	07 July 2022
Test Dates:	13 July 2022 to 22 July 2022
EUT Returned:	-/-

2.2. Summary of Test Results

Clause	Measurement	Complied	Did not comply	Not performed	Not applicable
Part 15.207	Transmitter AC Conducted Emissions	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Part 15.247(a)(2)	Transmitter Minimum 6 dB Bandwidth ⁽²⁾	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Part 15.35(c)	Transmitter Duty Cycle ⁽¹⁾	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Part 15.247(e)	Transmitter Power Spectral Density ⁽²⁾	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Part 15.247(b)(3)	Transmitter Maximum (Peak) Output Power ⁽²⁾	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Part 15.247(d) & 15.209(a)	Transmitter Radiated Emissions	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Part 15.247(d) & 15.209(a)	Transmitter Band Edge Radiated Emissions	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Decision rule:

If the decision rule is not included in the applied customer specification or testing standard, the binary statement for simple acceptance, as defined in ILAC G8: 2019 Section 4.2.1, is applied as the decision rule for a pass/ fail statement.

If the measured value is on the limit, the result is defined as a pass. In this case the risk of a false positive is 50%. For further information regarding risk assessment refer to ILAC G8: 2019.

Note(s):

1. The measurement was performed to assist the other average measurements.
2. As per applicant's declaration, the EUT is a host product integrating FCC pre-certified radio module (FCC ID: 2A3C7-WIFIG5P). Therefore, only partial testing is performed [refer to section 3.4].

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
Reference:	FCC KDB 996369 D04 Module Integration Guide v02 October 13, 2020
Title:	Modular Transmitter Integration Guide Guidance for Host Product Manufacturers

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:	EVBox
Model Name or Number:	L24871NAC00
Test Sample Serial Number:	FCC / AT&T Sample 1
Hardware Version Number:	Com board Rev. G, US Power board Rev. F, HMI board Rev. E
Firmware Version Number:	Com board diagnostic image FW V5.0.1, HMI V1.1.0, Power v1.4.0, Safety 1.1.3
FCC ID:	Contains FCC ID: 2A3C7-WIFIG5P

3.2. Description of EUT *

The equipment under test was a stationary Level 2 Electric Vehicle Supply Equipment with Model Number: L24871NAC00, Contains FCC ID: 2A3C7-WIFIG5P, FCC ID: 2A3C7-HMIG5P and FCC ID: N7NHL78 supporting NFC 13.56 MHz, Bluetooth, Bluetooth LE, WLAN 2.4 GHz, WLAN 5 GHz and Cellular technologies.

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 4.0 / Digital Transmission System		
Type of Unit:	Transceiver		
Power Supply Requirement(s):	Nominal	240V (V) L1-L2-PE US Splitted phase	
Channel Spacing:	2 MHz		
Data Rate and Modulation:	1 Mbps (Note 1) (Note 2)		GFSK
Maximum Conducted Output Power:	5.11 dBm		
Declared Antenna Gain:	Printed board antenna		
Antenna Type:	Custom printed board antenna, not removable		
Antenna Details:	2402-2480 MHz < 6.1dBi		
Transmit Frequency Range:	2402 MHz to 2480 MHz		
Transmit Channels Tested:	Channel ID	RF Channel	Channel Frequency (MHz)
	Bottom	37 (Note 1) (Note 2)	2402
	Top	39	2480
Highest internally generated clock and/ or oscillator frequency:	Wi-Fi ref. clock 37.4 MHz (internal to the module) Oscillator freq. of NFC module of HMI board: 27.120 MHz LTE module: 32.768 KHz, 26MHz (internal to the module) Different other oscillator clocks are included for internal functionality e.g. bus/ CPU clock are present in the circuits: 32.768 KHz, 16 MHz, 24 MHz, 25 MHz 26 MHz		
(Note 1) In accordance with FCC KDB 996369 D04 Section 3.4 (b) the Host Product testing has been performed on unwanted (spurious) radiated emissions on the worst-case modulation and channel per frequency range as shown in original filing (FCC ID: 2A3C7-WIFIG5P/ FCC ID: VPYLBEE5HY1MW)			
(Note 2) As per applicant's declaration, the EUT is a host product integrating FCC pre-certified radio module (FCC ID: 2A3C7-WIFIG5P/ FCC ID: VPYLBEE5HY1MW). Therefore, only partial testing is performed.			

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	Raspberry PI	N/A	N/A	W65
2	Ethernet Switch	D-Link	EES105E C2E	QS3P111000361
3	EVBox Certification team Windows Laptop	Dell	N/A	EVB17001260

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):

- ☒ Continuously transmitting modulated carrier with combination of
 - Bluetooth Low Energy (BLE) | PRBS9 | 1 Mbps | Maximum Power Settings | Bottom Channel

4.2. Configuration and Peripherals

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

- The applicant or manufacturer supplied test setup instructions "DUT and testing - Board configuration and setting Quickguide Rev1.pdf" issued on 30/06/2022 was used to configure the EUT.

EUT Power Supply:

- The EUT was powered with 240V AC / 60 Hz split phase.

Test Mode Activation:

- The EUT can be connected with the Test laptop via Ethernet switch and ethernet cables supplied by the customer. The cable was used only for configuration and was removed during the measurement.
- The test modes were activated by the terminal software "radio_cert_v12". The commands to setup the respective modes and power were defined by the customer in the setup instructions.
- NFC was also active all the time and we cannot de-activate it.

AC Conducted Emissions Measurements:

- The measurements were carried out with 240 VAC/60Hz.
- The Toyo EMI Software EP5/CE Ver 4.0.1. was used for these measurements.

Radiated Measurements:

- The EUT needs to use in standing position as a used case. Therefore, this report includes relevant results.
- The position of the Antenna was 90° vertical in the z-axis from the EUT.
- 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.
- 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.
- R&S® EMC32 V11.30 Software was used for the Radiated spurious emission measurements.

Duty Cycle Correction Details:

- As the continuous transmission of the EUT ($D \geq 98\%$) cannot be achieved and EUT was transmitting continuously at Duty Cycles of 62.30 % (duty cycle variations are less than $\pm 2\%$ at the respective data rate) for BLE. Therefore, Duty Cycle Correction Factor of 2.05 dB 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.

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 Spurious Emissions

Test Summary:

Test Engineer:	Tobias Koch	Test Date:	22 July 2022
Test Sample Serial Number:	FCC / AT&T Sample 1		
Test Site Identification	SR 7/8		

FCC Reference:	Part 15.207
Test Method Used:	ANSI C63.10 Section 6.2 / FCC KDB 174176 and notes below

Environmental Conditions:

Temperature (°C):	25.6
Relative Humidity (%):	48.7

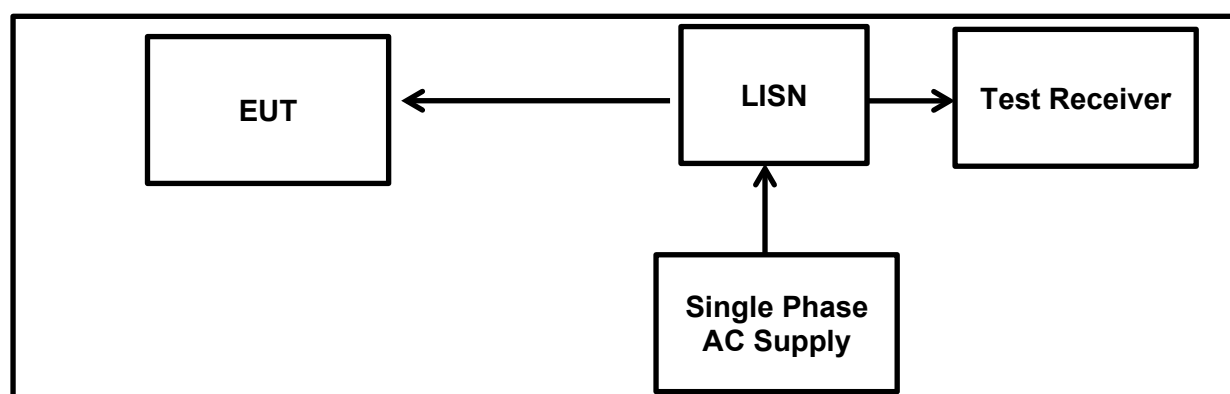
Settings of the Instrument

Detector	Quasi Peak/ Average
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Note(s):

1. The EUT was powered via AC/DC power supply which was connected with the LISN during the measurement.
2. EUT can only be powered via 240 VAC split phase.
3. The measurement was performed with following worst-case mode.
 - BT-LE Mode | Bottom channel | MAX PWR | 1 Mbps
4. Pre-scans were performed, and markers placed on the highest L1 and L2 measured levels. Final measurements were performed on the marker frequencies and the results entered into the tables below.
5. The final measured value, for the given emission, in the table below incorporates the cable loss.
6. 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.
7. 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.
8. Measurement software used: Toyo EMI Software; CE measurement software EP5/CE Ver 4.0.1.

Test Setup:



Transmitter AC Conducted Spurious Emissions (continued)**Results: BT-LE Mode / 1 Mbps/ Bottom Channel / MAX PWR****Results: L1 / Quasi Peak / 240 VAC 60 Hz**

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.153390	L1	47.40	65.80	18.40	Complied
0.181700	L1	42.10	64.40	22.30	Complied
0.190470	L1	40.40	64.00	23.60	Complied
0.204190	L1	38.40	63.40	25.00	Complied
0.212850	L1	37.90	63.10	25.20	Complied
0.245450	L1	31.70	61.90	30.20	Complied
3.138540	L1	30.90	56.00	25.10	Complied
13.560370	L1	43.80	60.00	16.20	Complied
23.127860	L1	46.10	60.00	13.90	Complied

Results: L1 / Average / 240 VAC 60 Hz

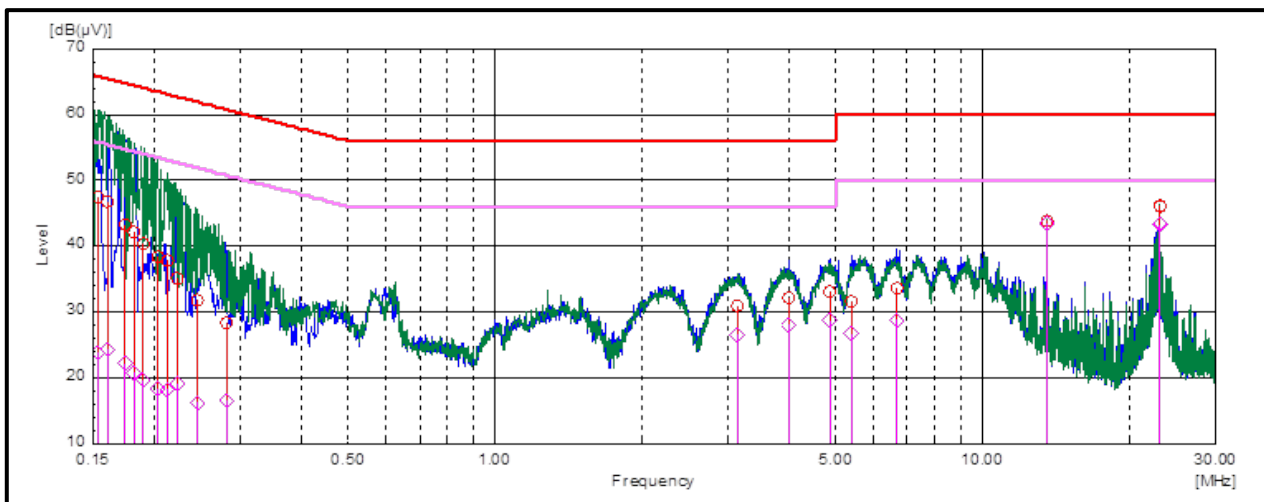
Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.153390	L1	20.70	54.40	33.70	Complied
0.181700	L1	19.70	54.00	34.30	Complied
0.190470	L1	18.30	53.40	35.10	Complied
0.204190	L1	18.10	53.10	35.00	Complied
0.212850	L1	16.20	51.90	35.70	Complied
0.245450	L1	26.60	46.00	19.40	Complied
3.138540	L1	43.50	50.00	6.50	Complied
13.560370	L1	43.30	50.00	6.70	Complied
23.127860	L1	23.90	55.80	31.90	Complied

Results: L2 / Quasi Peak / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.160950	L2	46.60	65.40	18.80	Complied
0.174910	L2	43.30	64.70	21.40	Complied
0.222760	L2	35.00	62.70	27.70	Complied
0.281330	L2	28.30	60.80	32.50	Complied
4.007030	L2	32.30	56.00	23.70	Complied
4.861850	L2	33.00	56.00	23.00	Complied
5.373100	L2	31.60	60.00	28.40	Complied
6.672870	L2	33.60	60.00	26.40	Complied
23.129270	L2	46.00	60.00	14.00	Complied

Transmitter AC Conducted Spurious Emissions (continued)**Results: BT-LE Mode / 1 Mbps/ Bottom Channel / MAX PWR****Results: L2 / Average / 240 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.160950	L2	24.30	55.40	31.10	Complied
0.174910	L2	22.20	54.70	32.50	Complied
0.222760	L2	19.10	52.70	33.60	Complied
0.281330	L2	16.60	50.80	34.20	Complied
4.007030	L2	28.00	46.00	18.00	Complied
4.861850	L2	28.70	46.00	17.30	Complied
5.373100	L2	26.70	50.00	23.30	Complied
6.672870	L2	28.80	50.00	21.20	Complied
23.129270	L2	43.40	50.00	6.60	Complied

Result: Pass**Plot: L1 and L2 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 Duty Cycle**Test Summary:**

Test Engineer:	Sercan Usta	Test Date:	21 July 2022
Test Sample Serial Number:	FCC / AT&T Sample 1		
Test Site Identification	SR 1/2		

FCC Reference:	Part 15.35(c)
Test Method Used:	FCC KDB 558074 Section 6.0 referencing ANSI C63.10 Section 11.6

Environmental Conditions:

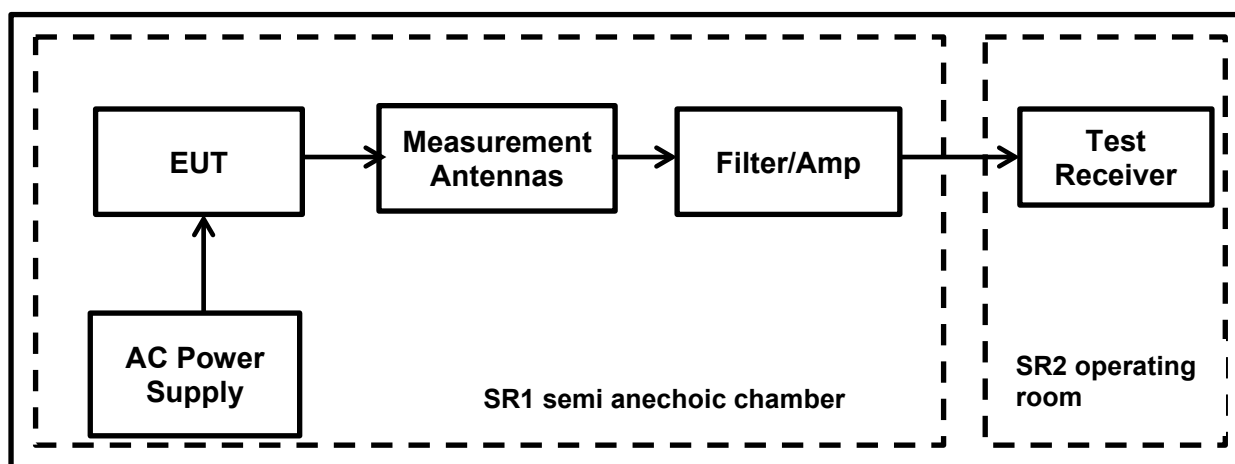
Temperature (°C):	23
Relative Humidity (%):	38

Notes:

- The transmitter duty cycle was measured using a spectrum analyser in the time domain and calculated by using the following calculation:

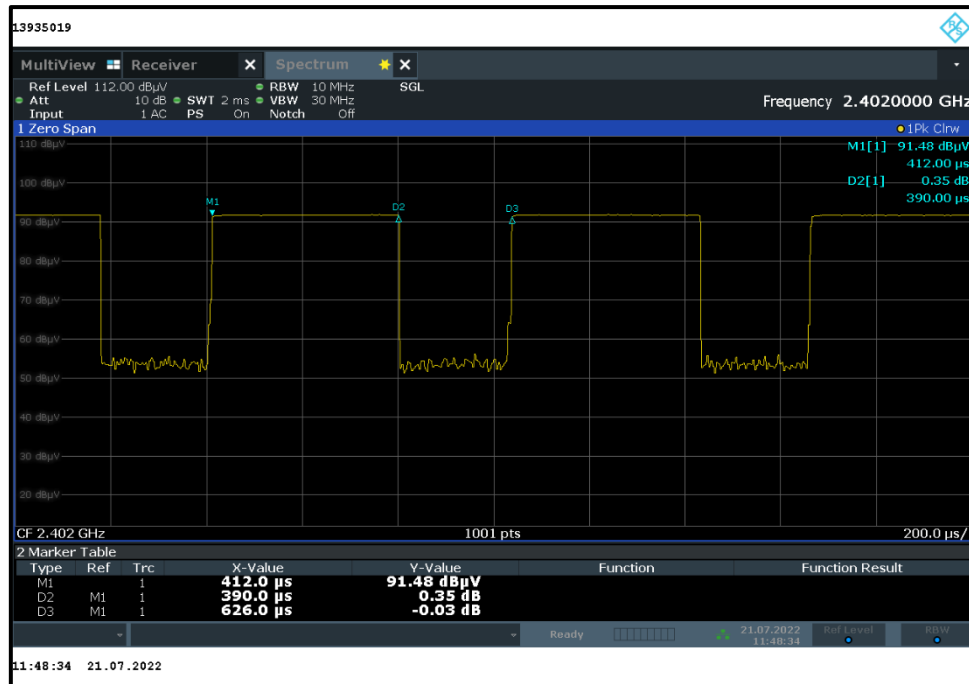
$$\text{Duty Cycle (\%)} = 100 \times [\text{On Time (T}_{\text{ON}})] / [\text{Period(T}_{\text{ON}} + \text{T}_{\text{OFF}}) \text{ or } 100\text{ms whichever is the lesser}]$$

$$\text{Duty Cycle Correction Factor} = 10 \log 1 / [\text{On Time (T}_{\text{ON}})] / [\text{Period(T}_{\text{ON}} + \text{T}_{\text{OFF}}) \text{ or } 100\text{ms whichever is the lesser}]$$

Test Setup:

Transmitter Duty Cycle (continued)**Results: BLE / 1 Mbps**

Pulse On Time (T _{ON}) (μ s)	Pulse Period (T _{ON} + T _{OFF}) (μ s)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
390.0	626.0	62.30	2.05

**Result: Pass**

5.2.3. Transmitter Radiated Emissions**Test Summary:**

Test Engineer:	Sercan Usta	Test Date:	13 July 2022
Test Sample Serial Number:	FCC / AT&T Sample 1		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.247(d) & 15.209(a)
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:

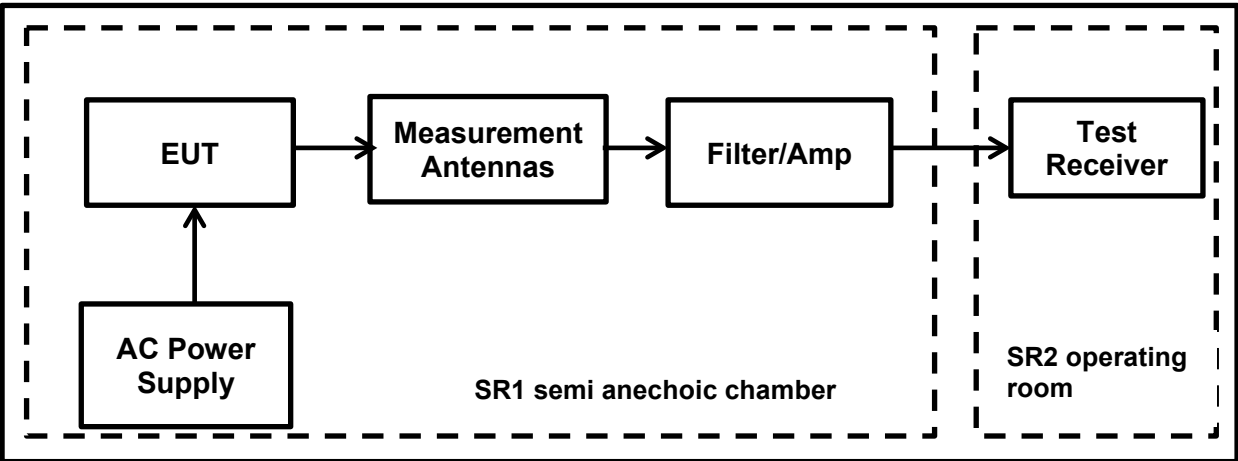
Temperature (°C):	22.3
Relative Humidity (%):	46.4

Note(s):

- 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 a 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).
- 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.
- Therefore, the limit values are extrapolated to a measurement distance of 3 m.
 - 9 kHz- 490 kHz: limits extrapolated from 300 m to 3 m by adding 80 dB at 40 dB /decade.
 - 490 kHz-1705 kHz: limits extrapolated from 30 m to 3 m by adding 40 dB at 40 dB /decade.
- 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.
- In accordance with FCC KDB 996369 D04 Section 3.4 (b) the Host Product testing has been performed on unwanted (spurious) radiated emissions on the worst-case modulation and channel per frequency range as shown in original filing (FCC ID: 2A3C7-WIFIG5P / FCC ID: VPYLBEE5HY1MW).
- The radiated emissions measurements were performed with the EUT set to the following worst-case mode.
 - BT-LE Mode | Bottom channel | MAX PWR | 1 Mbps
- All other emissions shown on the pre-scan plot were investigated and found to be below the measurement system noise floor.
- 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: 1 kHz /VBW: 3 kHz
 - Frequency range: 150 kHz – 30 MHz: RBW: 10 kHz /VBW: 30 kHz
 - Detector: Max-Peak detector
 - Trace Mode: Max Hold

Transmitter Radiated Emissions (continued)

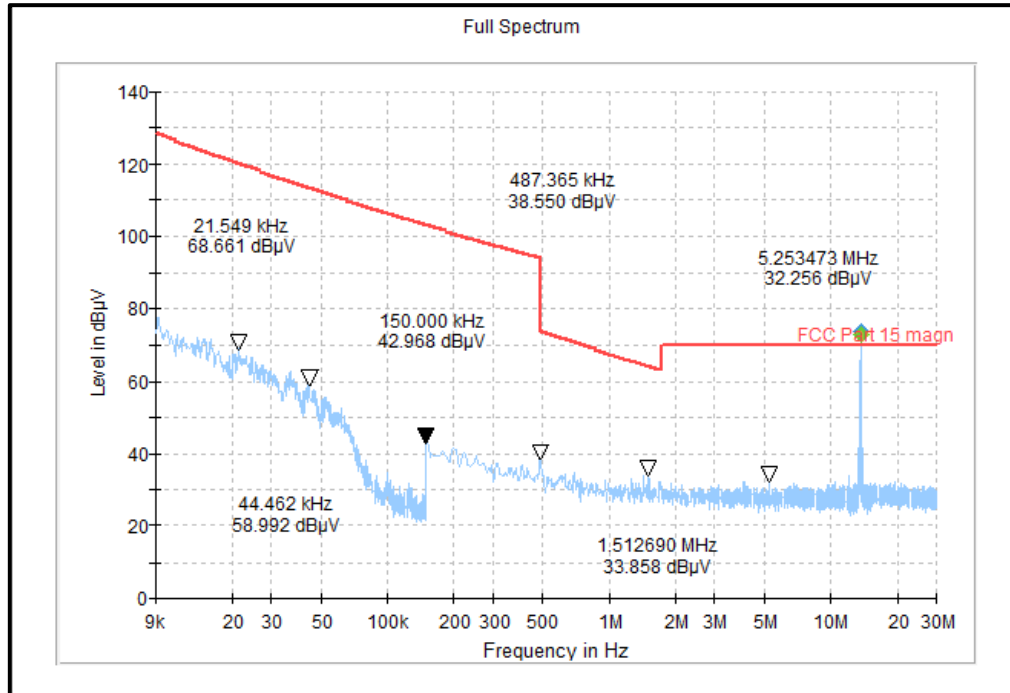
Test Setup:



Transmitter Radiated Emissions (continued)**Results: BLE / 1 Mbps / Bottom Channel / Max Power**

Frequency (MHz)	Loop Antenna Orientation	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
No critical spurious emissions were found					

Plot: Radiated Transmitter spurious emission from 9 kHz – 30 MHz



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.
The emission at 13.56 MHz is from NFC and we cannot de-activate it during the measurement

Result: Pass

Transmitter Radiated Emissions (continued)**Test Summary:**

Test Engineer:	Sercan Usta	Test Date:	13 July 2022
Test Sample Serial Number:	FCC / AT&T Sample 1		
Test Site Identification	SR 1/2		

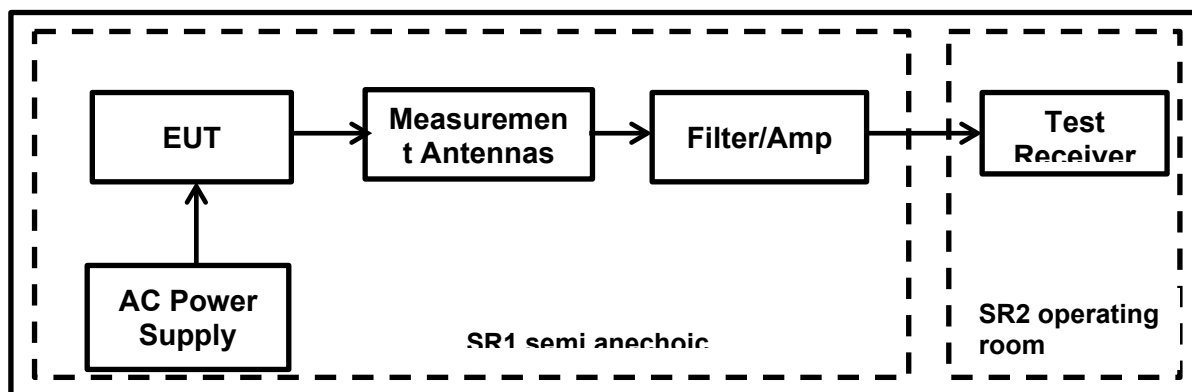
FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	FCC KDB 558074 Sections 8.5 & 8.6 referencing ANSI C63.10 Sections 11.11 and 11.12 ANSI C63.10:2013 Sections 6.3 and 6.5
Frequency Range	30 MHz to 1000 MHz

Environmental Conditions:

Temperature (°C):	22.3
Relative Humidity (%):	46.4

Note(s):

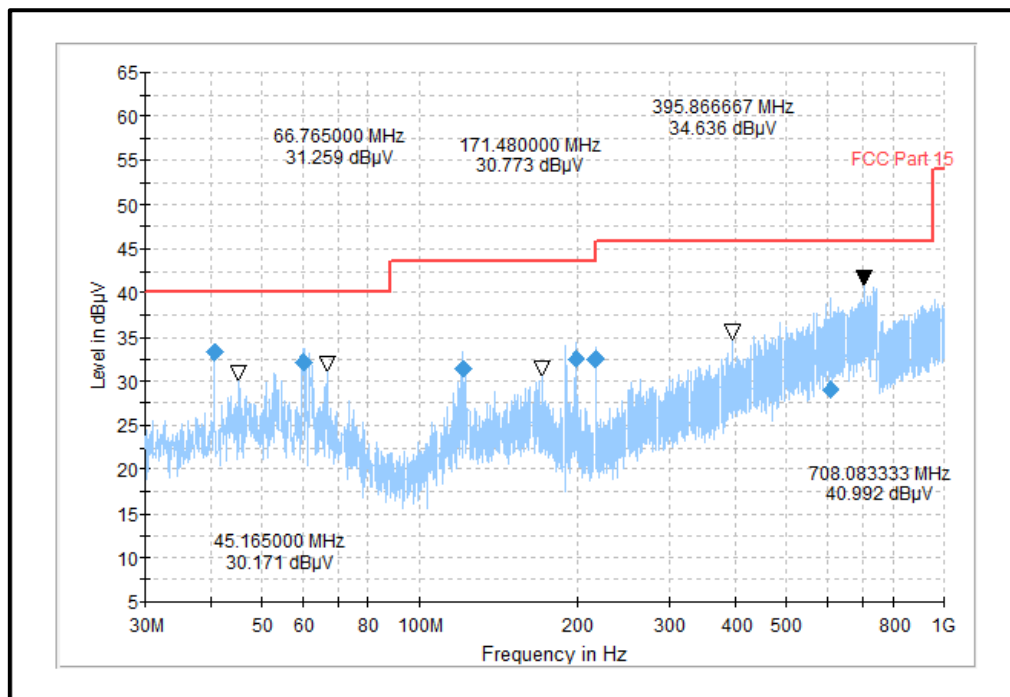
- Measurements below 1 GHz were performed in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) at a distance of 3 m. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 m to 4 m.
- 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.
- In accordance with FCC KDB 996369 D04 Section 3.4 (b) the Host Product testing has been performed on unwanted (spurious) radiated emissions on the worst-case modulation and channel per frequency range as shown in original filing (FCC ID: 2A3C7-WIFIG5P / FCC ID: VPYLBEE5HY1MW).
- The radiated emissions measurements were performed with the EUT set to the following worst-case mode.
 - BT-LE Mode | Bottom channel | MAX PWR | 1 Mbps
- All emissions shown on the pre-scan plots were investigated and found to be below system noise floor.
- The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.

Test Setup:

Transmitter Radiated Emissions (continued)**Results: BLE / 1 Mbps / Bottom Channel / Max Power**

Frequency (MHz)	Antenna Polarization	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
40.66	Vertical	33.20	40.00	6.80	Complied
60.11	Vertical	32.07	40.00	7.93	Complied
121.44	Vertical	31.38	43.50	12.12	Complied
198.35	Horizontal	32.55	43.50	10.95	Complied
216.98	Vertical	32.48	46.00	13.52	Complied
609.17	Vertical	28.95	46.00	17.05	Complied

Plot: Radiated Transmitter spurious emission from 30 MHz – 1 GHz



*Note: This plot is a pre-scan and for indication purposes only.
For final measurements, see accompanying table.*

Result: Pass

Transmitter Radiated Emissions (continued)**Test Summary:**

Test Engineer:	Sercan Usta	Test Date:	15 July 2022
Test Sample Serial Number:	FCC / AT&T Sample 1		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.247(d), 15.209(a) & 15.205(a)
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 25 GHz

Environmental Conditions:

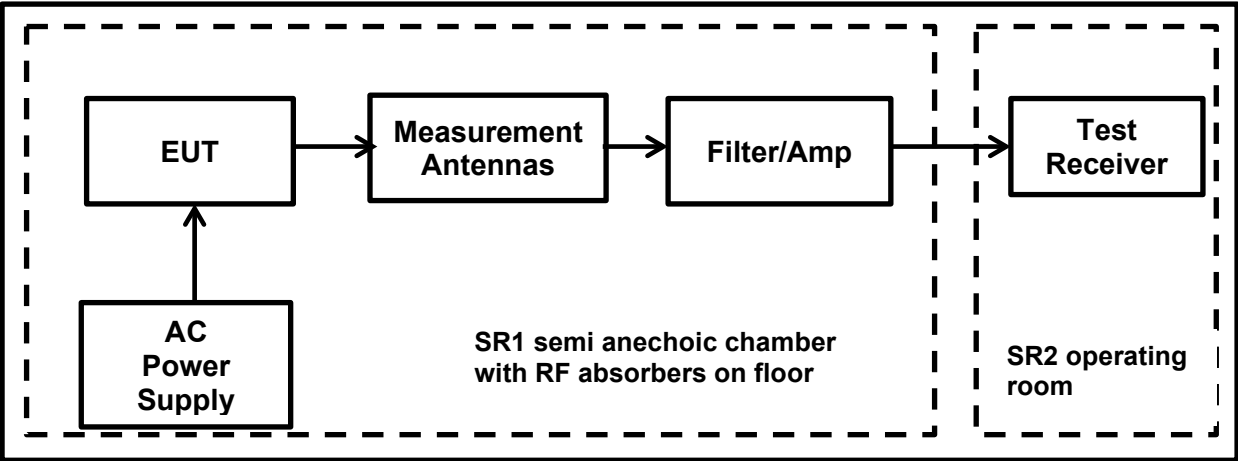
Temperature (°C):	22.4
Relative Humidity (%):	46.4

Note(s):

- 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.
- 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 channels.
- 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.
- In accordance with FCC KDB 996369 D04 Section 3.4 (b) the Host Product testing has been performed on unwanted (spurious) radiated emissions on the worst-case modulation and channel per frequency range as shown in original filing (FCC ID: 2A3C7-WIFIG5P / FCC ID: VPYLBEE5HY1MW).
- The radiated emissions measurements were performed with the EUT set to the following worst-case mode.
 - BT-LE Mode | Bottom channel | MAX PWR | 1 Mbps
- For frequency range 1 GHz to 18 GHz, all other emissions shown on the pre-scan plots were investigated and found to be below system noise floor.
- 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.
- 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)

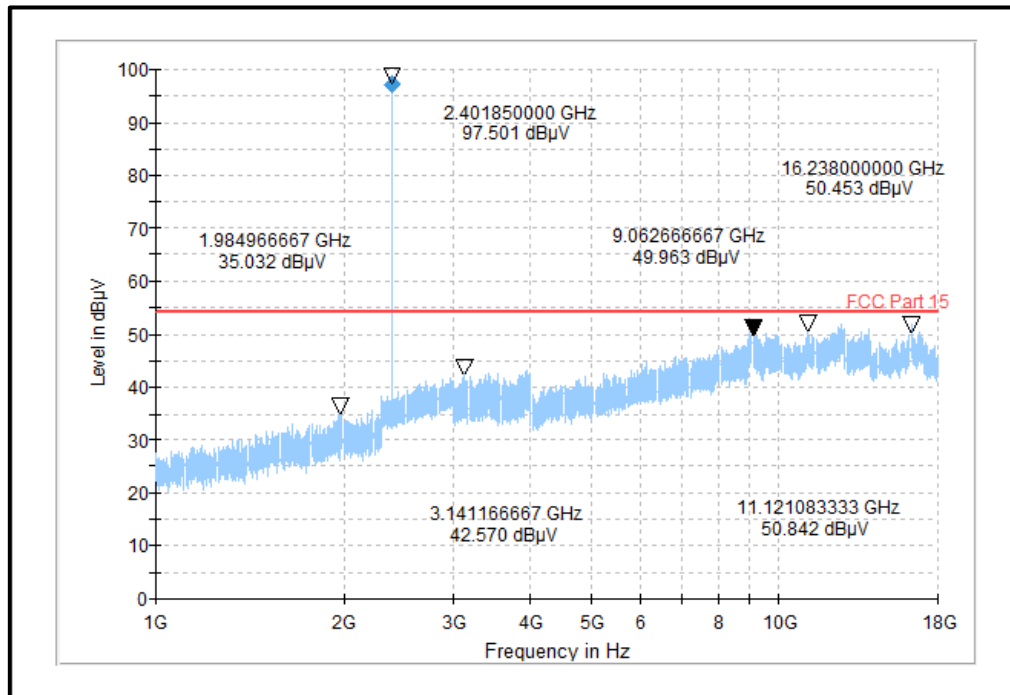
Test Setup:



Transmitter Radiated Emissions (continued)**Results: BLE / 1 Mbps / Bottom Channel / Max Power**

Frequency (MHz)	Antenna Polarization	MaxPeak Level (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)	Result
No critical spurious emissions were found					

Plot: Radiated Transmitter spurious emission from 1 GHz – 18 GHz



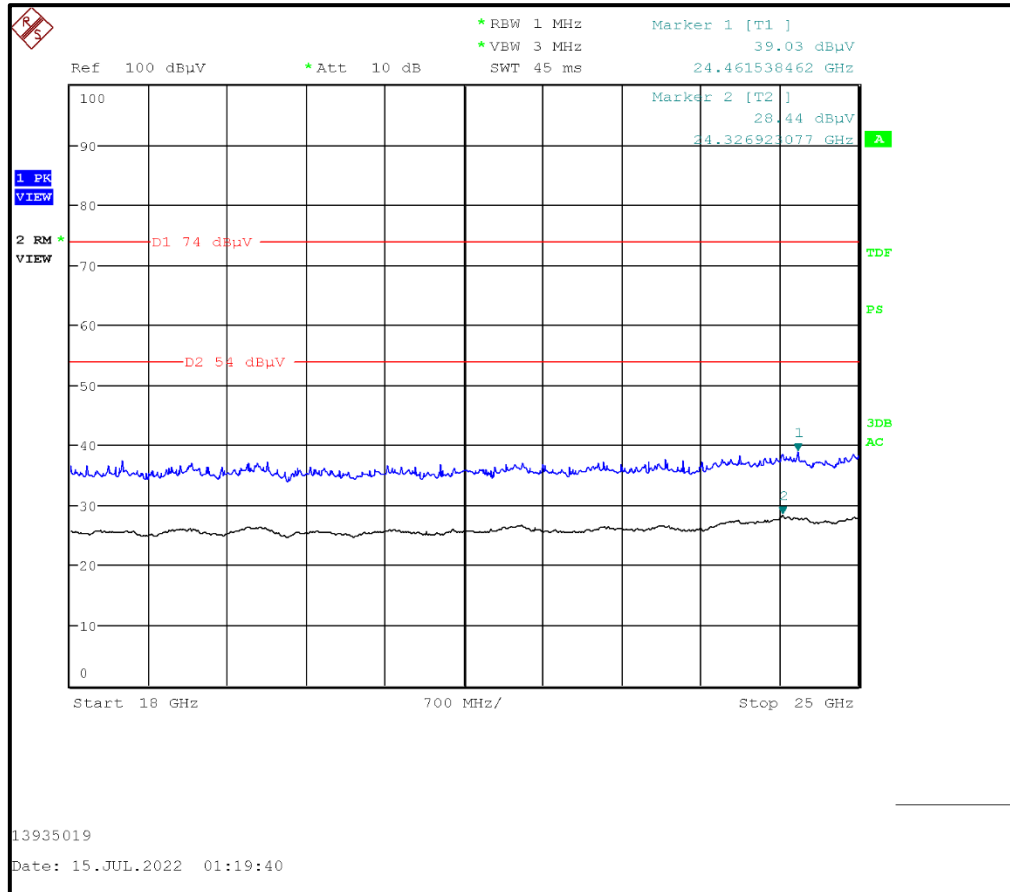
Note: This plot is a pre-scan and for indication purposes only.
For final measurements, see accompanying table.

Result: **Pass**

Transmitter Radiated Emissions (continued)**Results: BLE / 1 Mbps / Bottom Channel / Max Power**

Frequency (MHz)	Antenna Polarization	MaxPeak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
No critical spurious emissions were found					

Plot: Radiated Transmitter spurious emission from 18 GHz – 25 GHz



Note: This plot is a pre-scan and for indication purposes only.
For final measurements, see accompanying table.

Result: **Pass**

5.2.4. Transmitter Band Edge Radiated Emissions**Test Summary:**

Test Engineer:	Sercan Usta	Test Date:	18 July 2022
Test Sample Serial Number:	FCC / AT&T Sample 1		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.247(d), 15.209(a) & 15.205(a)
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:

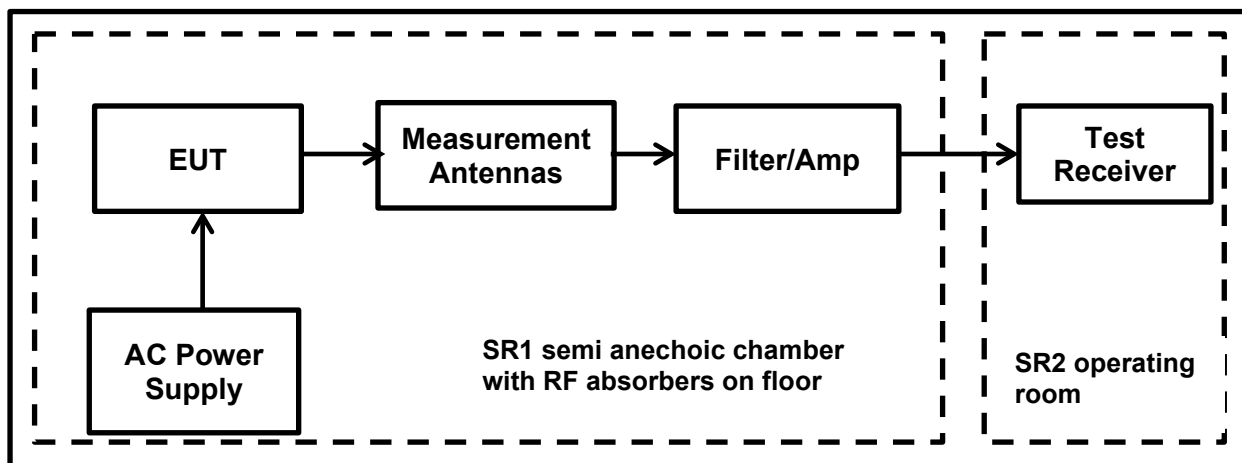
Temperature (°C):	21.6
Relative Humidity (%):	48.3

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 a sufficient length of time 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 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 300 sweeps 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.
6. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.

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 radiated emissions measurements were performed with the EUT set to the following worst-case mode with highest output power and on the mode with the widest bandwidth.
 - BT-LE Mode | Bottom channel | MAX PWR
9. As the continuous transmission of the EUT ($D \geq 98\%$) cannot be achieved and EUT was transmitting continuously at Duty Cycles of 62.30 % (duty cycle variations are less than $\pm 2\%$ at the respective data rate). Therefore, Duty Cycle Correction Factor of 2.05 dB 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.

Test Setup:

Transmitter Band Edge Radiated Emissions (Continued)**Results: BLE / 1 Mbps / PRBS9 / Max Power****Results: Lower Band Edge / Peak**

Frequency (MHz)	Peak Level (dB μ V/m)	-20 dBc Limit (dB μ V/m)	Margin (dB)	Result
2399.90	43.59	81.39	37.80	Complied
2400.00	44.49	81.39	36.90	Complied

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

Frequency (MHz)	Peak Level (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)	Result
2317.07	49.98	74.00	24.02	Complied

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

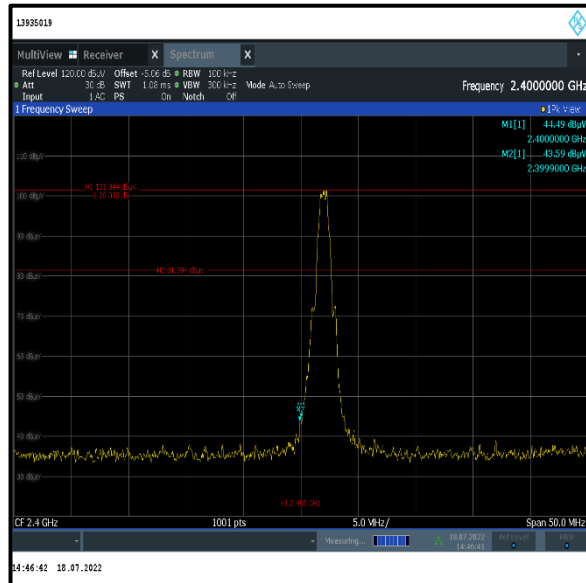
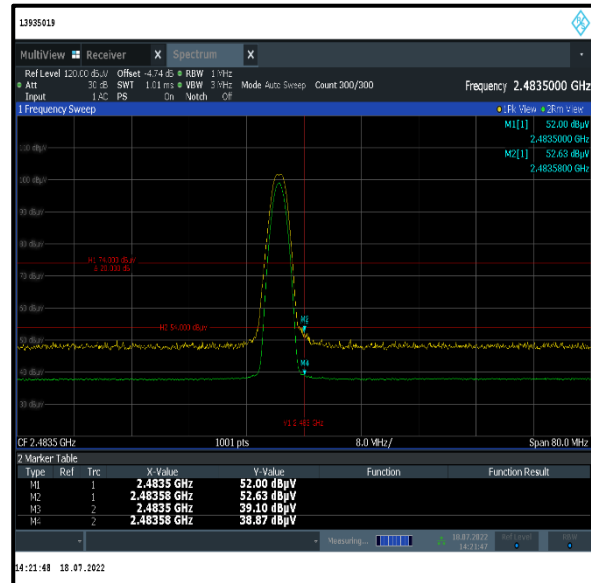
Frequency (MHz)	Average Level (dB μ V/m)	Duty Cycle Correction Factor (dB)	Corrected Average Level (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)	Result
2385.08	37.70	2.05	39.75**	54.00	14.25	Complied

Results: Upper Band Edge / Peak

Frequency (MHz)	Peak Level (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)	Result
2483.50	52.00	74.00	22.00	Complied
2483.58	52.63	74.00	21.37	Complied

Results: Upper Band Edge / Average

Frequency (MHz)	Average Level (dB μ V/m)	Duty Cycle Correction Factor (dB)	Corrected Average Level (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)	Result
2483.50	39.10	2.05	41.15**	54.00	12.85	Complied
2483.58	38.87	2.05	40.92**	54.00	13.08	Complied

Transmitter Band Edge Radiated Emissions (Continued)**Results: BLE / PRBS9 / 1 Mbps / PWR 8****Lower Band Edge Peak Measurement****Upper Band Edge Measurement****Restricted Band Edge Measurement****Result: Pass**

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
Transmitter Duty Cycle	95%	$\pm 3.4\%$
Radiated Spurious Emissions	95%	± 3.10 dB
Band Edge Radiated Emissions	95%	± 3.10 dB

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	10/07/2020	36
377	BONN Elektronik	Amplifier, Low Noise Pre	BLMA 0118-1A	025294B	13/07/2022	12
423	Bonn Elektronik	Amplifier, Low Noise Pre	BLMA 1840-1A	55929	13/07/2022	12
460	Deisel	Turntable	DT 4250 S	n/a	n/a	n/a
452	Schwarzbeck	Antenna, Trilog Broadband	VULB 9168	9168-240	02/09/2020	36
495	Rohde & Schwarz	Antenna, log. - periodical	HL050	100296	06/08/2021	24
496	Rohde & Schwarz	Antenna, log. - periodical	HL050	100297	22/08/2022	24
587	Maturo	antenna mast, tilting	TAM 4.0-E	011/7180311	n/a	n/a
588	Maturo	Controller	NCD	029/7180311	n/a	n/a
591	Rohde & Schwarz	Receiver	ESU 40	100244/040	13/07/2022	12
669	Rohde & Schwarz	EMI Test Receiver	ESW 44	103087	03/02/2022	18
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

Test site: SR 7/8

ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
23	Rohde & Schwarz	Artificial Mains	ESH3-Z5	831767/013	11/07/2022	12
28	Rohde & Schwarz	Passive Probe	ESH2-Z3	none	12/07/2022	36
349	Rohde & Schwarz	Receiver, EMI Test	ESIB7	836697/009	12/07/2022	12
351	Rohde & Schwarz	network, Artificial Mains	ESH3-Z5	862770/018	11/07/2022	12
564	Teseq	Impedance stabilisation network (ISN)	ISN T800	26076	14/07/2021	24
616	Rohde & Schwarz	ISN	ENY81-CA6	101656	07/07/2020	36
-/-	Testo	Thermo-Hygrometer	608-H1	08	lab verification	n/a
327	SPS	AC/DC power distribution system	PAS 5000	A2464 00/1 0200	lab verification	n/a

8. Report Revision History

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	32	-	Initial Version
Test Report Version 1.1 supersede Version 1.0 with immediate effect Test Report No. UL-RPT-RP-14067528-316-2-FCC Version 1.1, Issue Date 03 April 2023 replaces Test Report No. UL-RPT-RP-14067528-316-2-FCC Version 1.0, Issue Date 01 September 2022, which is no longer valid.			
1.1	as below	as below	Current Version
	-	-	Report template updated
	1	-	Model no.and FCC ID updated
	4	1.2	Applicant and Manufacturer info updated
	6	2.2	Notes updated
	7	3.1	Identification of EUT updated
	7	3.2	Description of EUT updated
	8	3.4	Notes updated
	9	3.5	Support equipment table updated
	13 & 14	5.2.1	Tables updated
	17	-	Notes updated
	20	-	Notes updated
	22	-	Notes updated
	35	7	Used equipment list updated

--- END OF REPORT ---