

TEST REPORT

Test Report No. : UL-RPT-RP14880601-516A

Customer : Tedee Sp. z.o.o.
Model No. : TBV1.0
FCC ID : 2BCK5TBV10
Technology : *Bluetooth* – Low Energy
Test Standard(s) : FCC Parts 15.207, 15.209(a) & 15.247
Test Laboratory : UL International (UK) Ltd, Basingstoke, Hampshire, RG24 8AH, United Kingdom

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4. The test results in this report are traceable to the national or international standards.
5. Version 2.0 supersedes all previous versions.


Date of Issue: 27 October 2023

Checked by:



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Company Signatory:



Sarah Williams
RF Operations Leader, Radio Laboratory



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Report Revision History

Version Number	Issue Date	Revision Details	Revised By
1.0	23/10/2023	Initial Version	Ben Mercer
2.0	27/10/2023	TCB requested updates	Ben Mercer

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1 Attestation of Test Results








1.1 Description of EUT

The equipment under test was a smart lock wireless bridge incorporating *Bluetooth* LE and a 2.4 GHz / 5 GHz WLAN module (FCC ID: 2AHMR-BW16).

1.2 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
Site Registration:	FCC: 685609
FCC Lab. Designation No.:	UK2011
Location of Testing:	Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, G24 8AH, United Kingdom
Test Dates:	26 September 2023 to 19 October 2023

1.3 Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.247(a)(2)	Transmitter Minimum 6 dB Bandwidth	
Part 15.247(b)(3)	Transmitter Maximum Peak Output Power	
Part 15.247(e)	Transmitter Power Spectral Density	Note 1
Part 15.247(d) & 15.209(a)	Transmitter Radiated Emissions	
Part 15.247(d) & 15.209(a)	Transmitter Band Edge Radiated Emissions	
Part 15.207	Transmitter AC Conducted Emissions	
Key to Results  = Complied  = Did not comply		

Note(s):

1. In accordance with ANSI C63.10 Section 11.10.1, PSD measurements are 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 be equal to the measured output power.

1.4 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.

2 Summary of Testing

2.1 Facilities and Accreditation

The test site and measurement facilities used to collect data are located at Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom. The following table identifies which facilities were utilised for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

Site 1	X
Site 2	-
Site 17	X

UL International (UK) Ltd is accredited by the United Kingdom Accreditation Service (UKAS). UKAS is one of the signatories to the International Laboratory Accreditation Co-operation (ILAC) Arrangement for the mutual recognition of test reports. The tests reported herein have been performed in accordance with its terms of accreditation.

2.2 Methods and Procedures

Reference:	ANSI C63.10-2013
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
Reference:	KDB 558074 D01 15.247 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:	KDB 174176 D01 Line Conducted FAQ v01r01 June 3, 2015
Title:	AC Power-Line Conducted Emissions Frequently Asked Questions

2.3 Calibration and Uncertainty

Measuring Instrument Calibration

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

Measurement Uncertainty & Decision Rule

Overview

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

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

Decision Rule

Measurement system instrumentation shall be used with an accuracy specification meeting the accuracy specification limits according to IEC/IECEE OD-5014.

As applicable, unless specified otherwise in this report, the compliance "Decision Rule" is based on Simple Acceptance. 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 G8:09/2019.

Measurement Uncertainty

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	Range	Confidence Level (%)	Calculated Uncertainty
Duty Cycle	2.4 GHz to 2.4835 GHz	95%	±1.14 %
Minimum 6 dB Bandwidth	2.4 GHz to 2.4835 GHz	95%	±4.59 %
Conducted Maximum Peak Output Power	2.4 GHz to 2.4835 GHz	95%	±1.13 dB
Radiated Spurious Emissions	9 kHz to 30 MHz	95%	±5.32 dB
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±3.30 dB
Radiated Spurious Emissions	1 GHz to 25 GHz	95%	±3.16 dB
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±1.88 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.

2.4 Test and Measurement Equipment

Test Equipment Used for Transmitter Conducted Tests

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2042	Thermohygrometer	Testo	608-H1	45124926	09 Dec 2023	12
K240279	Phoenix-1	Anyload	Test 1	#1	Calibrated before use	-
M231906	Signal Analyser	Keysight Technologies Inc	N9020B	MY63430177	03 Dec 2023	12
A231990	Signal Distribution Box	Mini-Circuits	ZT-400	12211020009	Calibrated before use	-
M225506	Power Sensor	Boonton Electronics	RTP5008	12329	12 Oct 2023	12
A220131	Attenuator	Pasternack Enterprises	PE7013-10	#5	Calibrated before use	-

Test Measurement Software/Firmware Used for Transmitter Conducted Tests

Name	Version	Release Date
Phoenix	1.4.0	19 September 2023

Test and Measurement Equipment (continued)**Test Equipment Used for Transmitter Radiated Emissions Tests**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
K0017	3m RSE Chamber	MVG Industries UK Ltd.	N/A	N/A	08 Nov 2023	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	02 Nov 2023	12
A2863	Pre-Amplifier	Keysight Technologies Inc	8449B	3008A02100	07 Nov 2023	12
A2889	Horn Antenna	Schwarzbeck	BBHA 9120 B	00653	02 Nov 2023	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#2	25 Jan 2024	12
A2914	High Pass Filter	AtlanTecRF	AFH-03000	2155	25 Jan 2024	12
A2947	High Pass Filter	AtlanTecRF	AFH-07000	1601900001	25 Jan 2024	12
A2890	Horn Antenna	Schwarzbeck	HWRD 750	014	02 Nov 2023	12
A223628	Pre-Amplifier	Atlantic Microwave	A-LNAKX-380116-S5S5	210837001	03 Nov 2023	12
M2003	Thermohygrometer	Testo	608-H1	45046641	09 Dec 2023	12
A2892	Horn Antenna	Schwarzbeck	BBHA 9170	9170-727	31 Oct 2023	12
A3265	Pre-Amplifier	Schwarzbeck	BBV 9721	9721-069	31 Oct 2023	12
K0001	3m RSE Chamber	MVG Industries UK Ltd.	N/A	N/A	06 Sep 2024	12
M236226	Test Receiver	Rohde & Schwarz	ESW26	103134	21 Apr 2024	12
A3179	Pre-Amplifier	Hewlett Packard	8449B	3008A00934	21 Aug 2024	12
A3093	High Pass Filter	AtlanTecRF	AFH-03000	18051800077	26 Jan 2024	12
A2523	Attenuator	AtlanTecRF	AN18W5-10	832827#1	26 Jan 2024	12
A3138	Horn Antenna	Schwarzbeck	BBHA 9120 B	00702	23 Aug 2024	12
M2040	Thermohygrometer	Testo	608-H1	45124934	09 Dec 2023	12
A3095	High Pass Filter	AtlanTecRF	AFH-07000	18051600012	27 Jan 2024	12
A3139	Horn Antenna	Schwarzbeck	HWRD750	00027	23 Aug 2024	12
A3224	Pre-Amplifier	Schwarzbeck	BBV 9718 C	00071	09 Mar 2024	12
A3165	Magnetic Loop Antenna	ETS-Lindgren	6502	00224383	13 Apr 2024	12
A3010	Attenuator	AtlanTecRF	AN18-06	208801#5	27 Apr 2024	12
A231925	Bi-Log Antenna	Teseq, Inc	CBL6111D	63584	27 Apr 2024	12
A3154	Pre-Amplifier	Com-Power Corporation	PAM-103	18020012	21 Aug 2024	12

Test and Measurement Equipment (continued)**Test Equipment Used for Transmitter Band Edge Radiated Emissions Tests**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2040	Thermohygrometer	Testo	608-H1	45124934	09 Dec 2023	12
K0001	3m RSE Chamber	MVG Industries UK Ltd.	N/A	N/A	06 Sep 2024	12
M236226	Test Receiver	Rohde & Schwarz	ESW26	103134	21 Apr 2024	12
A3179	Pre-Amplifier	Hewlett Packard	8449B	3008A00934	21 Aug 2024	12
A2523	Attenuator	AtlanTecRF	AN18W5-10	832827#1	26 Jan 2024	12
A3138	Horn Antenna	Schwarzbeck	BBHA 9120 B	00702	23 Aug 2024	12

Test Equipment Used for Transmitter AC Conducted Spurious Emissions:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2037	Thermohygrometer	Testo	608-H1	45124925	08 Dec 2023	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	16 Dec 2023	12
A649	Single Phase LISN	Rohde & Schwarz	ESH3-Z5	825562/008	23 Aug 2024	36
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	01 Jun 2024	12

Test Measurement Software/Firmware Used:

Name	Version	Release Date
Rohde & Schwarz EMC32	6.30.0	2018

3 Equipment Under Test (EUT)

3.1 Identification of Equipment Under Test (EUT)

Brand Name:	Tedee
Model Name or Number:	TBV1.0
Test Sample Serial Number:	Not marked or stated (<i>Conducted sample #1, UL ID 6287455</i>)
Hardware Version:	TBV1.0
Firmware Version:	2.2 (build 12927)
FCC ID:	2BCK5TBV10
Date of Receipt:	01 September 2023

Brand Name:	Tedee
Model Name or Number:	TBV1.0
Test Sample Serial Number:	Not marked or stated (<i>Radiated sample #1, UL ID 6287454</i>)
Hardware Version:	TBV1.0
Firmware Version:	2.2 (build 12927)
FCC ID:	2BCK5TBV10
Date of Receipt:	01 September 2023

3.2 Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.3 Additional Information Related to Testing

Technology Tested:	Bluetooth Low Energy (Digital Transmission System)		
Type of Unit:	Transceiver		
Channel Spacing:	2 MHz		
Modulation:	GFSK		
Data Rate: LE	1 Mbps		
Data Rate: LE2M	2 Mbps		
Power Supply Requirement(s):	Nominal	5 VDC	
Maximum Conducted Output Power:	4.22 dBm		
Transmit Frequency Range:	2402 MHz to 2480 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	37	2402
	Middle	17	2440
	Top	39	2480

3.4 Description of Available Antennas

The radio utilizes an integrated antenna, with the following maximum gain:

Frequency Range (MHz)	Antenna Gain (dBi)
2400-2480	2.0

3.5 Description of Test Setup

Support Equipment

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

Description:	Laptop
Brand Name:	Lenovo
Model Name or Number:	ThinkPad L440
Serial Number:	R9-019E9Z

Description:	USB to UART Converter Board
Brand Name:	Tedee
Model Name or Number:	Not marked or stated
Serial Number:	6407243

Description:	USB A to USB Mini A Cable. Length 2m
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	Docking Station
Brand Name:	Lenovo
Model Name or Number:	ThinkPad USB-C Dock DK1633
Serial Number:	ZAD0LGYW

Description:	AC to DC Charger
Brand Name:	None
Model Name or Number:	KLT12-050100-BdUU
Serial Number:	None

Description:	Laptop
Brand Name:	Lenovo
Model Name or Number:	ThinkPad L470
Serial Number:	PF10T3HL

Operating Modes

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

- Transmitting at maximum power in *Bluetooth* LE mode with modulation, maximum possible data length available and Pseudorandom Bit Sequence 9.
- Transmitting at maximum power in *Bluetooth* LE2M mode with modulation, maximum possible data length available and Pseudorandom Bit Sequence 9.

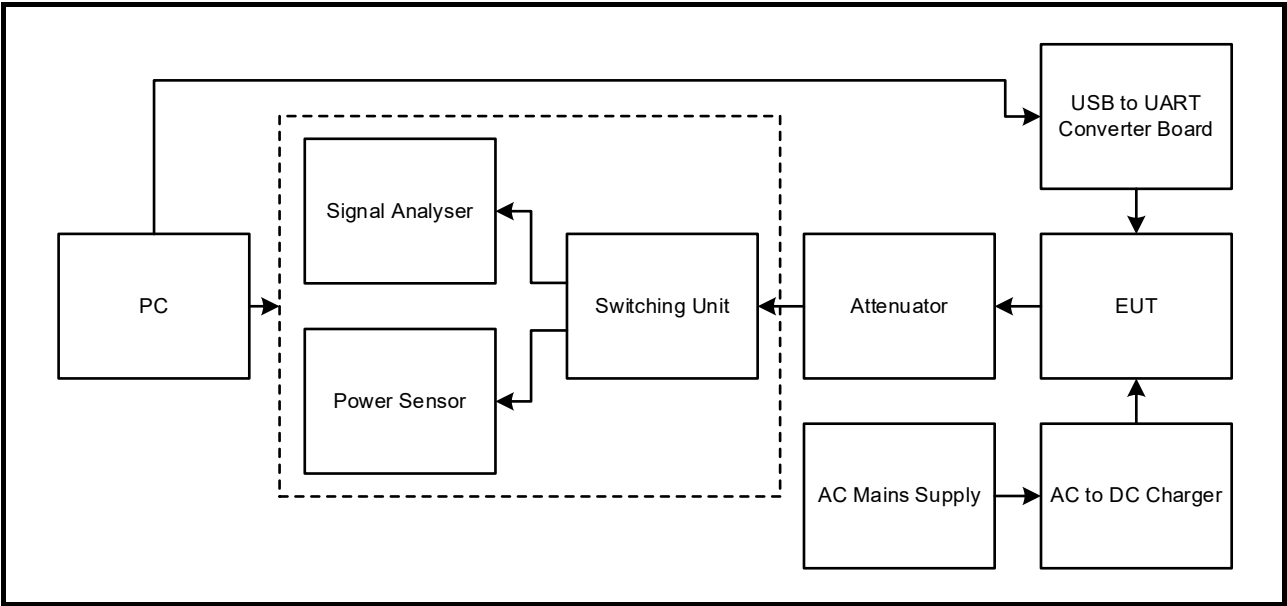
Configuration and Peripherals

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

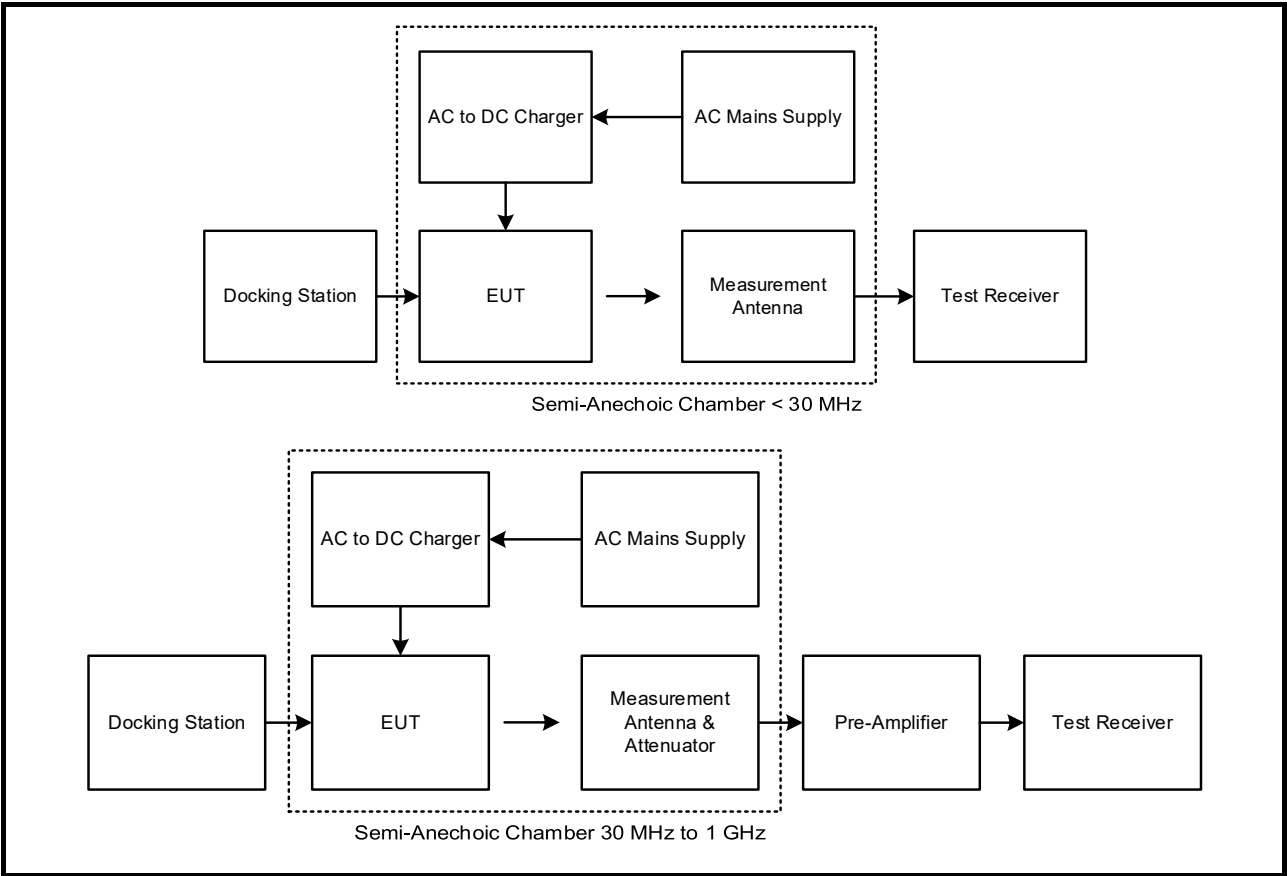
- Controlled in test mode using a set of commands entered into a terminal application on a test laptop. The commands were used to enable a continuous transmission and to select the test channels as required. The laptop and converter board were disconnected once the EUT was configured.
- The EUT was powered from a 120 VAC 60 Hz single phase mains supply.
- Transmitter radiated spurious emissions tests were performed with the EUT transmitting in LE2M mode as this was found to transmit the highest power.
- Transmitter radiated spurious emissions tests were performed with the EUT in the worst-case orientation. The USB port was terminated into an unpowered docking station.
- The customer supplied U.FL test cables to facilitate conducted measurements. The resulting additional path loss was accounted for during conducted measurements.
- For AC Conducted Emissions tests, the device was powered by its AC to DC charger.

Test Setup Diagrams

Conducted Tests:

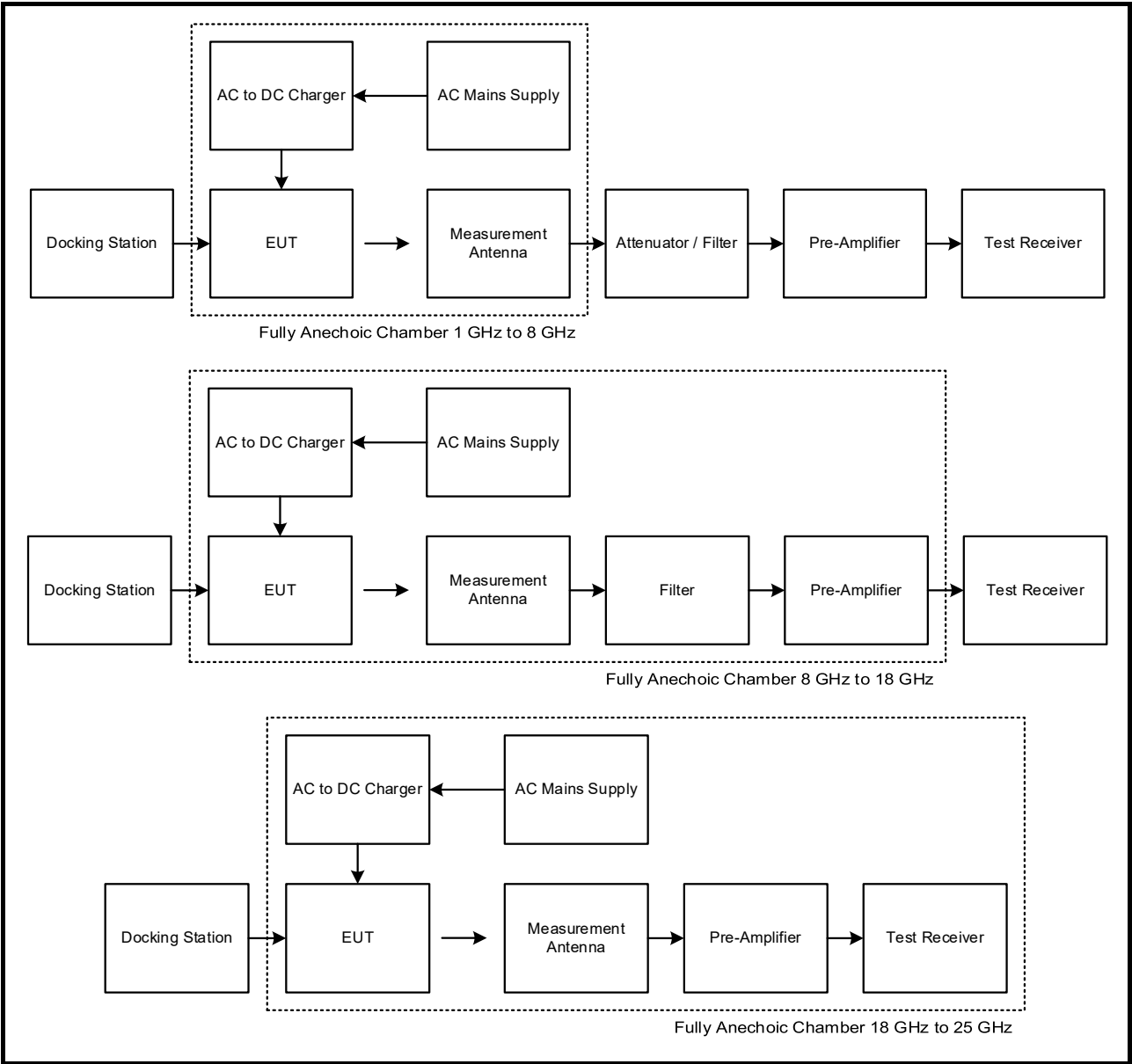


Radiated Tests:



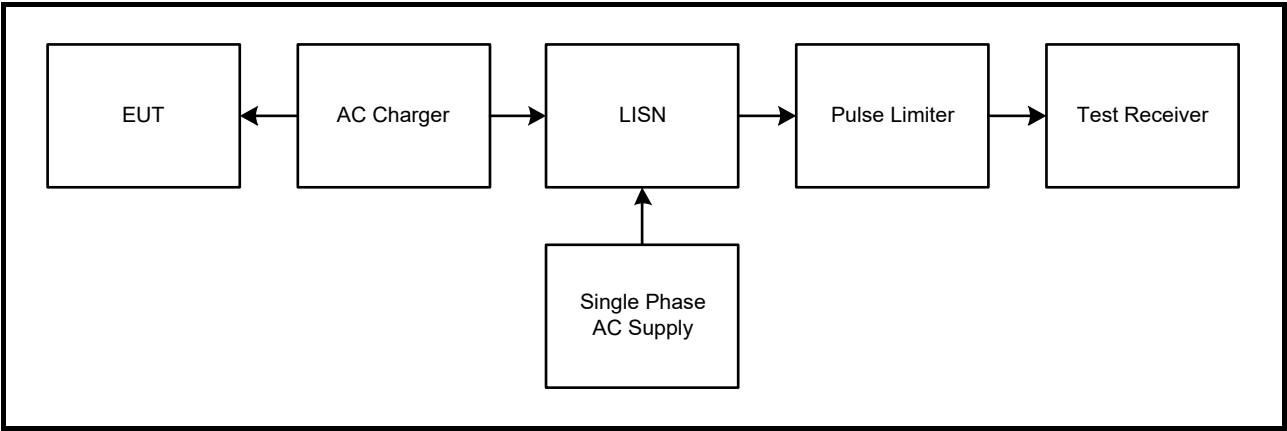
Test Setup Diagrams (continued)

Radiated Tests:



Test Setup Diagrams (continued)

Test Setup for Transmitter AC Conducted Spurious Emissions



4 Antenna Port Test Results

4.1 Transmitter Minimum 6 dB Bandwidth

Test Summary:

Test Engineers:	Jerome Moyo & Max Passell	Test Date:	29 September 2023
Test Sample Serial Number:	UL ID 6287455		

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	58

Note(s):

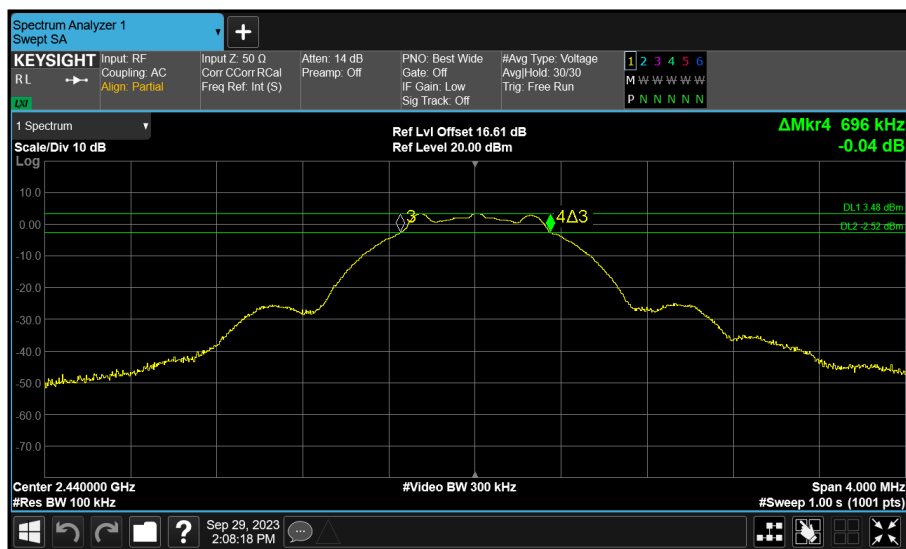
1. 6 dB DTS bandwidth tests were performed using a signal analyser in accordance with ANSI C63.10 Section 11.8.1 Option 1 measurement procedure. The signal analyser resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The DTS bandwidth was measured at 6 dB down from the peak of the signal.
2. The signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.
3. Example plots are provided for middle channel. Plots for all channels are stored on the UL server and available for inspection upon request.

Transmitter Minimum 6 dB Bandwidth (continued)**Results:**

Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause:	15.247 (a)(2)	Test Method:	ANSI C63.10 11.8.1

Antenna Configuration:	SISO	Mode:	LE
Test Port:	1	Rate/Modulation:	LE 1M (GFSK)

Test Frequency (MHz)	6 dB Bandwidth (MHz)				Limit (kHz)
	1	2	3	4	
2402 (CH37)	0.720	-	-	-	≥500
2440 (CH17)	0.696	-	-	-	≥500
2480 (CH39)	0.724	-	-	-	≥500

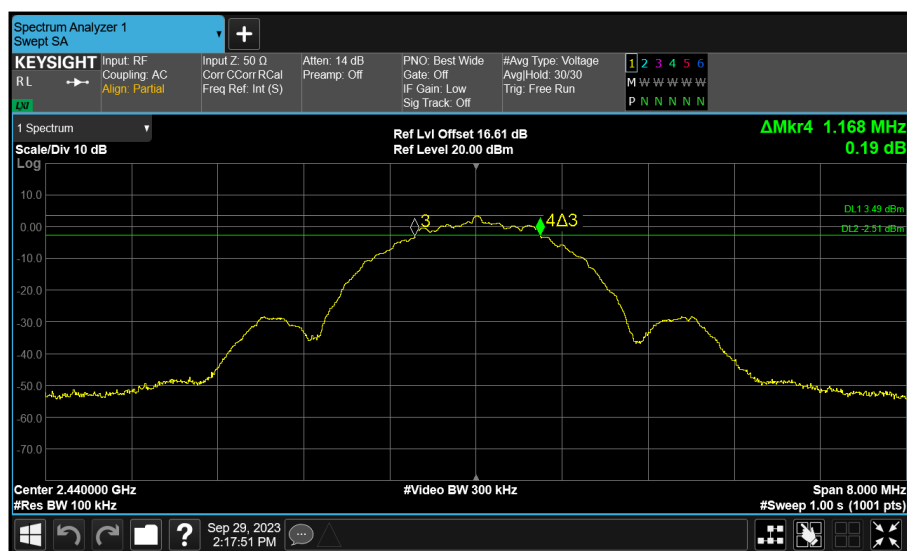
**Channel 17**

Transmitter Minimum 6 dB Bandwidth (continued)

Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause:	15.247 (a)(2)	Test Method:	ANSI C63.10 11.8.1

Antenna Configuration:	SISO	Mode:	LE
Test Port:	1	Rate/Modulation:	LE 2M (GFSK)

Test Frequency (MHz)	6 dB Bandwidth (MHz)				Limit (kHz)
	1	2	3	4	
2402 (CH37)	1.216	-	-	-	≥500
2440 (CH17)	1.168	-	-	-	≥500
2480 (CH39)	1.136	-	-	-	≥500

**Channel 17**

4.2 Transmitter Maximum Peak Output Power

Test Summary:

Test Engineers:	Jerome Moyo & Max Passell	Test Date:	29 September 2023
Test Sample Serial Number:	UL ID 6287455		

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	58

Note(s):

1. Conducted power tests were performed using a peak power meter in accordance with ANSI C63.10 Section 11.9.1.3 with the PKPM1 peak power meter method.
2. The test system was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the test system to compensate for the loss of the attenuator and RF cable.
3. The conducted power was added to the declared antenna gain to obtain the EIRP.

Transmitter Maximum Peak Output Power (continued)**Results:**

Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause:	15.247 (b)(3)	Test Method:	ANSI C63.10 Section 11.9.1.3

Antenna Configuration:	SISO	Mode:	LE
Test Port:	1	Rate/Modulation:	LE 1M (GFSK)

Burst Tx	Stability: < ±2%	Duty Cycle (%): 50.41	Period (ms): 4.215	Width (ms): 2.113
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Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)	Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
	1	2	3	4	Σ						
2402 (CH37)	3.85	-	-	-	-	30.00	26.15	2.00	5.85	36.00	30.15
2440 (CH17)	4.05	-	-	-	-	30.00	25.95	2.00	6.05	36.00	29.95
2480 (CH39)	4.22	-	-	-	-	30.00	25.78	2.00	6.22	36.00	29.78

Frequency Range:	2400-2483.5 MHz	Band:	2.4 GHz
Limit Clause:	15.247 (b)(3)	Test Method:	ANSI C63.10 11.9.1.3

Antenna Configuration:	SISO	Mode:	LE
Test Port:	1	Rate/Modulation:	LE 2M (GFSK)

Burst Tx	Stability: < ±2%	Duty Cycle (%): 50.92	Period (ms): 2.154	Width (ms): 1.067
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Test Frequency (MHz)	Maximum Conducted Output Power (dBm)					Limit (dBm)	Margin (dB)	Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	EIRP Margin (dB)
	1	2	3	4	Σ						
2402 (CH37)	3.87	-	-	-	-	30.00	26.13	2.00	5.87	36.00	30.13
2440 (CH17)	4.09	-	-	-	-	30.00	25.91	2.00	6.09	36.00	29.91
2480 (CH39)	4.17	-	-	-	-	30.00	25.83	2.00	6.17	36.00	29.83

5 Radiated Test Results

5.1 Transmitter Radiated Emissions <1 GHz

Test Summary:

Test Engineer:	Nick Steele	Test Dates:	04 October 2023 & 05 October 2023
Test Sample Serial Number:	UL ID 6287454		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	ANSI C63.10 Sections 6.3, 6.4 and 6.5
Frequency Range	9 kHz to 1000 MHz

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	47

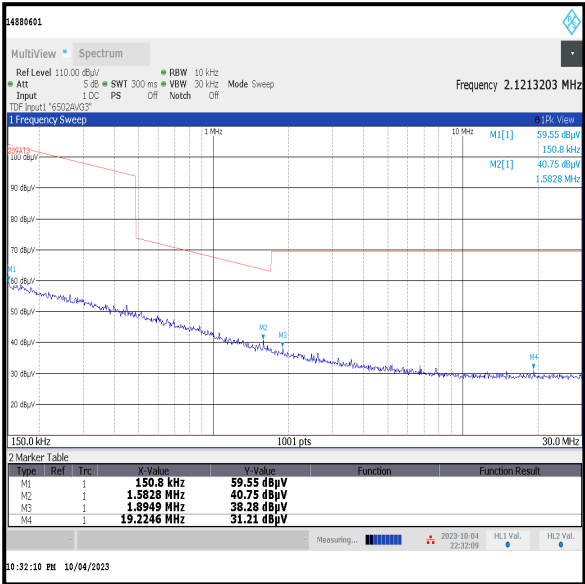
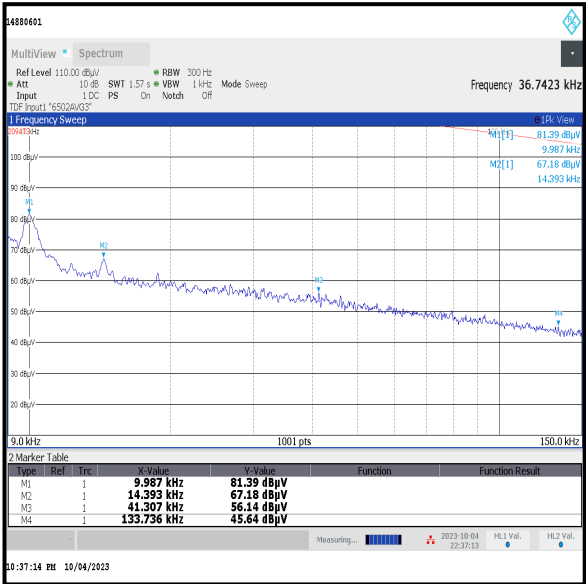
Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. No spurious emissions were detected above the noise floor of the measuring receiver, therefore the highest peak noise floor reading of the measuring receiver was recorded as shown in the table below.
3. 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.
4. Pre-scans were performed and markers placed on the highest measured levels. The test receiver was configured as follows: For 9 kHz to 150 kHz, the resolution bandwidth was set to 300 Hz and video bandwidth 1 kHz. A peak detector was used and trace mode was Max Hold. For 150 kHz to 30 MHz, the resolution bandwidth was set to 10 kHz and video bandwidth 30 kHz, trace mode was Max Hold. For 30 MHz to 1 GHz, the resolution bandwidth was set to 120 kHz and video bandwidth 500 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.

Transmitter Radiated Emissions (continued)

Results: Quasi-Peak / Middle Channel / LE2M

Frequency (MHz)	Antenna Polarity	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
965.552	Vertical	37.3	54.0	16.7	Complied



5.2 Transmitter Radiated Emissions >1 GHz

Test Summary:

Test Engineers:	John Ferdinand & Andrew Harding	Test Dates:	26 September 2023 & 28 September 2023
Test Sample Serial Number:	UL ID 6287454		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	FCC KDB 558074 Sections 8.1 c)3), 8.5 & 8.6 referencing ANSI C63.10 Sections 6.3, 6.6, 11.11 & 11.12
Frequency Range	1 GHz to 25 GHz

Environmental Conditions:

Temperature (°C):	23 to 24
Relative Humidity (%):	48 to 51

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. All other emissions shown on the pre-scans were investigated and found to be ambient, or > 20 dB below the appropriate limit or below the noise floor of the measurement system.
3. The emission shown on the 1 GHz to 3 GHz plot is the EUT fundamental.
4. Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number K0001/K0017) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT.
5. Final measurements above 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001/K0017) at a distance of 3 metres. 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 metre to 4 metres.

Results: Bottom Channel / Peak / LE2M

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4805.099	Vertical	52.4	74.0	21.6	Complied

Results: Bottom Channel / Average / LE2M

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4804.899	Vertical	46.2	54.0	7.8	Complied

Results: Middle Channel / Peak / LE2M

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4880.959	Vertical	55.3	74.0	18.7	Complied
7321.419	Vertical	58.4	74.0	15.6	Complied

Results: Middle Channel / Average / LE2M

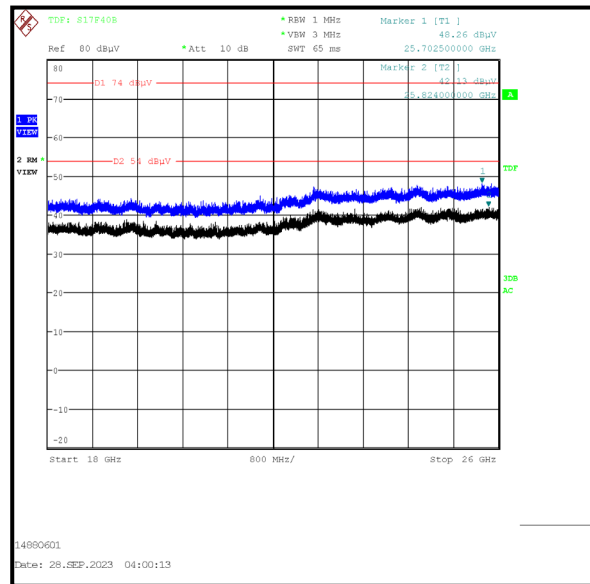
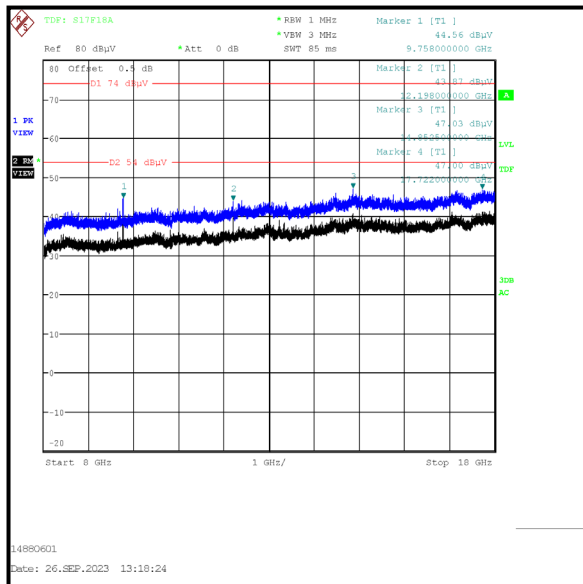
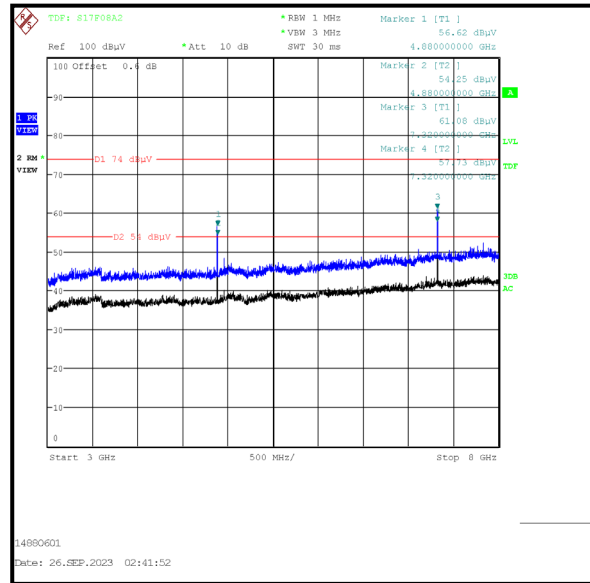
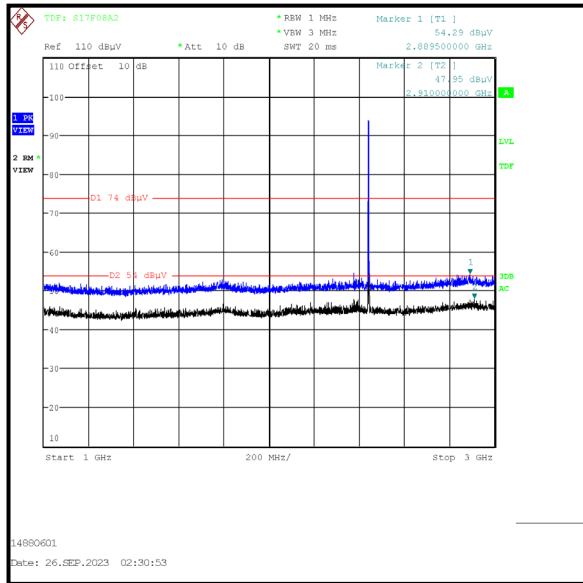
Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4879.24	Vertical	49.7	54.0	4.3	Complied
7321.499	Vertical	52.4	54.0	1.6	Complied

Results: Top Channel / Peak / LE2M

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4959.161	Vertical	56.9	74.0	17.1	Complied
7438.561	Vertical	58.7	74.0	15.3	Complied

Results: Top Channel / Average / LE2M

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4959.421	Vertical	51.5	54.0	2.5	Complied
7441.399	Vertical	53.1	54.0	0.9	Complied

Transmitter Radiated Emissions (continued)

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

5.3 Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineer:	John Ferdinand	Test Date:	02 October 2023
Test Sample Serial Number:	UL ID 6287454		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	KDB 558074 Section 8.7 referencing ANSI C63.10 Sections 11.11, 11.12 & 11.13

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	49

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. As the lower band edge is adjacent to a non-restricted band, only peak measurements are required. In accordance with ANSI C63.10 Section 11.11.1, the test method in Section 11.11.3 was followed: 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. As the maximum peak conducted output power was measured using an peak detector in accordance with ANSI C63.10 Section 11.9.1.1 an out-of-band limit line was placed 20 dB (ANSI C63.10 Section 11.11.1(a)) below the peak level. A marker was placed on the band edge spot frequencies. Marker frequency and levels were recorded.
3. As the upper band edge is adjacent to 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. An RMS detector was used, sweep time was set to auto and trace mode was trace averaging over 300 sweeps. 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.
4. 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 peak and RMS detectors respectively. Markers were placed on the highest point on each trace.
5. * -20 dBc limit.

Transmitter Band Edge Radiated Emissions (continued)**Results: Peak / LE**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2400.000	Vertical	46.1	76.7*	30.6	Complied
2483.500	Vertical	47.5	74.0	26.5	Complied
2484.149	Vertical	48.4	74.0	25.6	Complied.

Results: Average / LE

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.500	Vertical	37.0	54.0	17.0	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Peak / LE

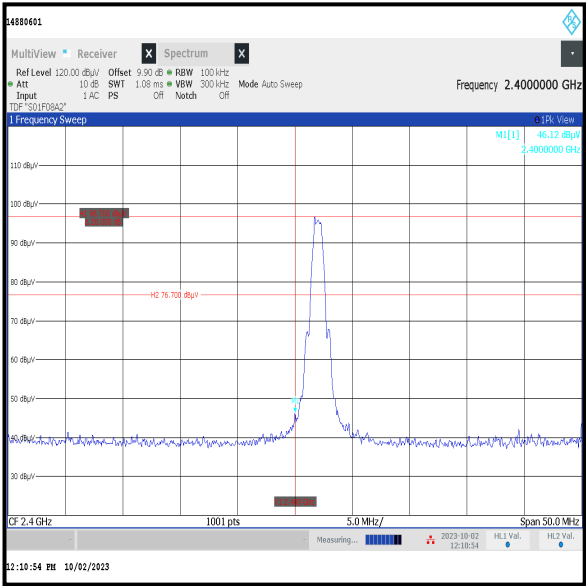
Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2347.762	Vertical	51.8	74.0	22.2	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Average / LE

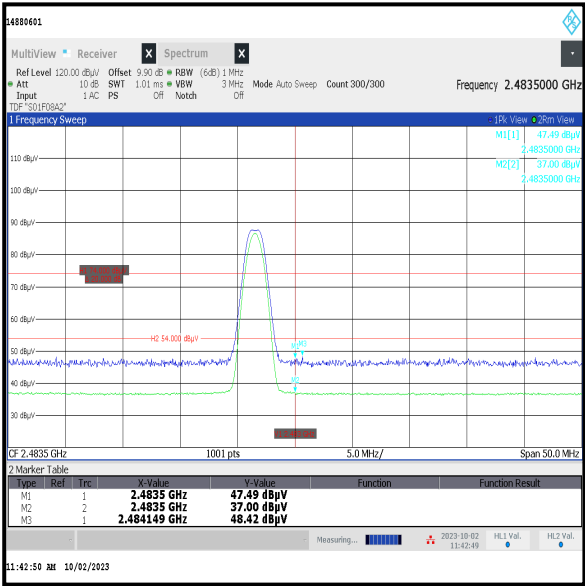
Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2389.321	Vertical	39.6	54.0	14.4	Complied

Transmitter Band Edge Radiated Emissions (continued)

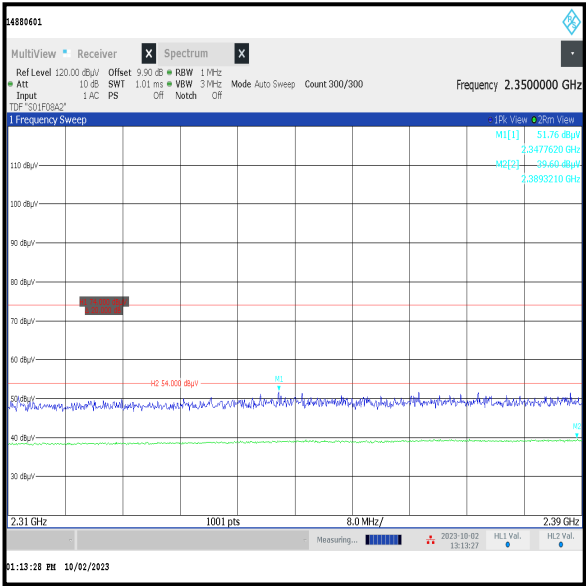
Results: LE



Lower Band Edge



Upper Band Edge



2310 MHz to 2390 MHz Restricted Band

Transmitter Band Edge Radiated Emissions (continued)**Results: Peak / LE2M**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2400.000	Vertical	64.9	75.7*	10.8	Complied
2483.500	Vertical	49.3	74.0	24.7	Complied

Results: Average / LE2M

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.500	Vertical	38.1	54.0	15.9	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Peak / LE2M

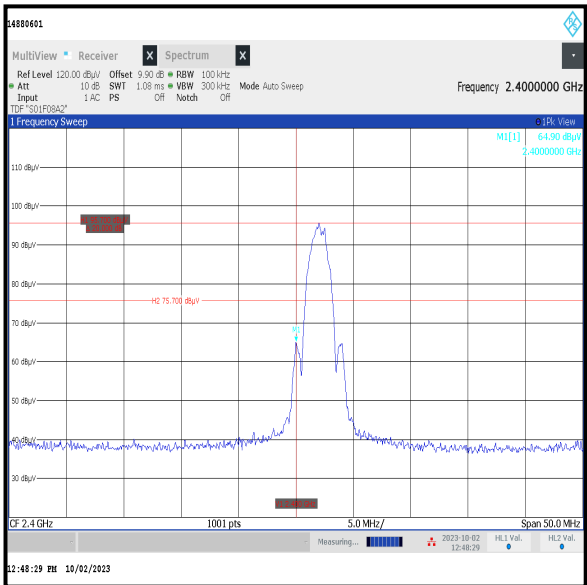
Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2350.879	Vertical	52.2	74.0	21.8	Complied

Results: 2310 MHz to 2390 MHz Restricted Band / Average / LE2M

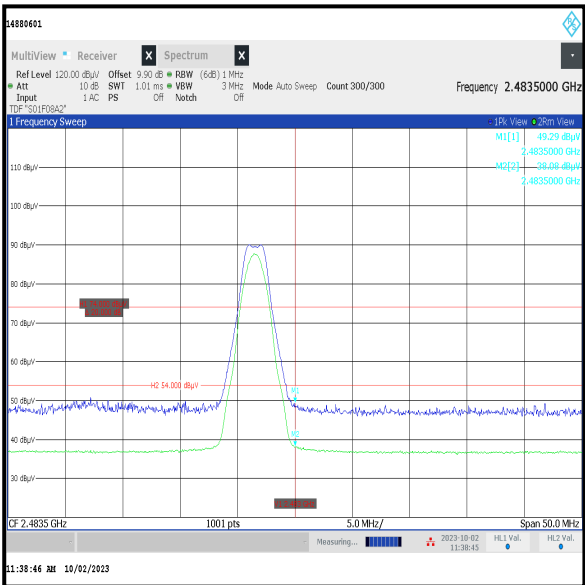
Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2387.642	Vertical	39.5	54.0	14.5	Complied

Transmitter Band Edge Radiated Emissions (continued)

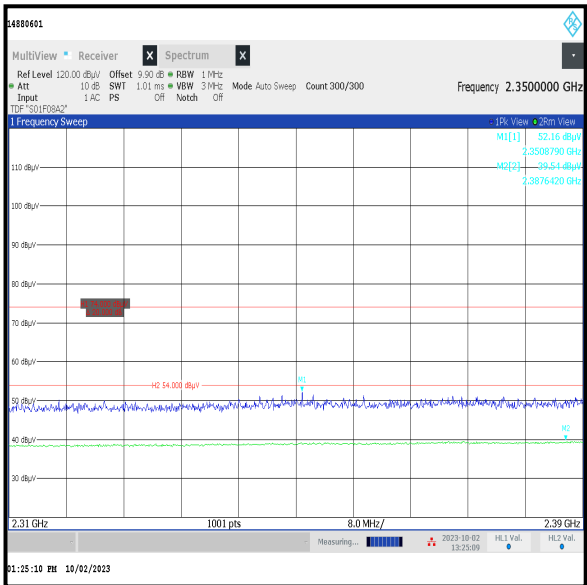
Results: LE2M



Lower Band Edge



Upper Band Edge



2310 MHz to 2390 MHz Restricted Band

6 AC Power Line Conducted Emissions Test Results

6.1 Transmitter AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Alison Johnston	Test Date:	19 October 2023
Test Sample Serial Number:	UL ID 6287454		

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

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	54

Note(s):

1. The EUT was plugged directly into its AC to DC charger. The AC to DC charger was connected to a 120 VAC 60 Hz single phase supply via a LISN.
2. In accordance with FCC KDB 174176 Q4, tests were performed with a 240 VAC 60 Hz single phase supply as this was within the voltage range marked on the KLT12-050100-BdUU power supply.
3. A pulse limiter was fitted between the LISN and the test receiver.

Transmitter AC Conducted Spurious Emissions (continued)**Results: Live / Quasi Peak / 120 VAC 60 Hz**

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.496500	Live	48.9	56.1	7.2	Complied
0.852000	Live	38.4	56.0	17.6	Complied
1.320000	Live	34.5	56.0	21.5	Complied
4.492500	Live	41.0	56.0	15.0	Complied
20.719500	Live	46.1	60.0	13.9	Complied
21.880500	Live	47.5	60.0	12.5	Complied

Results: Live / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.492000	Live	39.4	46.1	6.7	Complied
0.856500	Live	28.9	46.0	17.1	Complied
4.488000	Live	31.5	46.0	14.5	Complied
14.401500	Live	30.7	50.0	19.3	Complied
20.719500	Live	39.2	50.0	10.8	Complied
21.840000	Live	40.7	50.0	9.3	Complied

Results: Neutral / Quasi Peak / 120 VAC 60 Hz

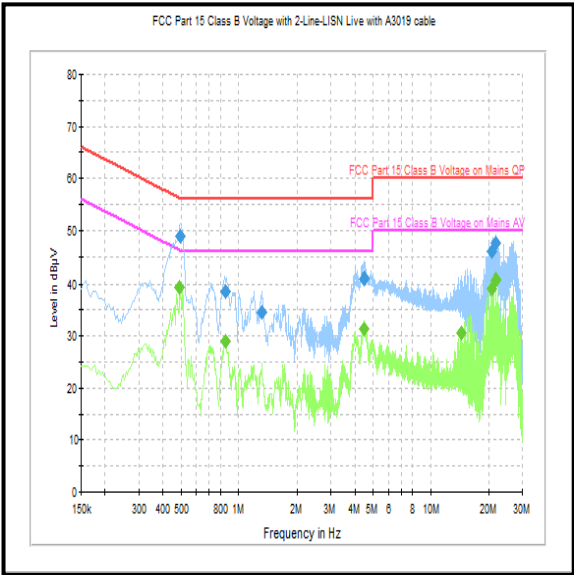
Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.496500	Neutral	44.4	56.1	11.7	Complied
0.726000	Neutral	33.5	56.0	22.5	Complied
0.856500	Neutral	33.8	56.0	22.2	Complied
4.515000	Neutral	37.2	56.0	18.8	Complied
20.719500	Neutral	49.2	60.0	10.8	Complied
21.880500	Neutral	51.6	60.0	8.4	Complied

Results: Neutral / Average / 120 VAC 60 Hz

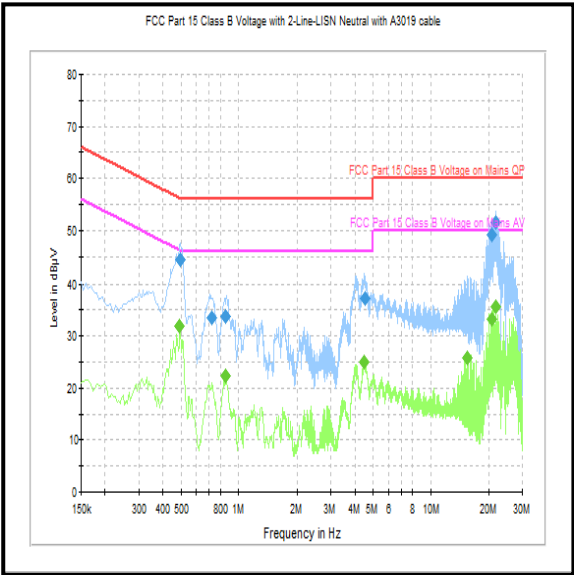
Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.492000	Neutral	31.8	46.1	14.3	Complied
0.856500	Neutral	22.2	46.0	23.8	Complied
4.492500	Neutral	24.9	46.0	21.1	Complied
15.481500	Neutral	25.9	50.0	24.1	Complied
20.719500	Neutral	33.3	50.0	16.7	Complied
21.840000	Neutral	35.6	50.0	14.4	Complied

Transmitter AC Conducted Spurious Emissions (continued)

Results: 120 VAC 60 Hz



Live



Neutral

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

Transmitter AC Conducted Spurious Emissions (continued)**Results: Live / Quasi Peak / 240 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.496500	Live	48.7	56.1	7.4	Complied
0.649500	Live	39.6	56.0	16.4	Complied
4.173000	Live	43.0	56.0	13.0	Complied
15.522000	Live	41.3	60.0	18.7	Complied
20.760000	Live	46.7	60.0	13.3	Complied
21.880500	Live	47.7	60.0	12.3	Complied

Results: Live / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.478500	Live	40.7	46.4	5.7	Complied
0.658500	Live	31.0	46.0	15.0	Complied
4.173000	Live	34.8	46.0	11.2	Complied
15.481500	Live	34.1	50.0	15.9	Complied
20.040000	Live	39.5	50.0	10.5	Complied
21.840000	Live	40.8	50.0	9.2	Complied

Results: Neutral / Quasi Peak / 240 VAC 60 Hz

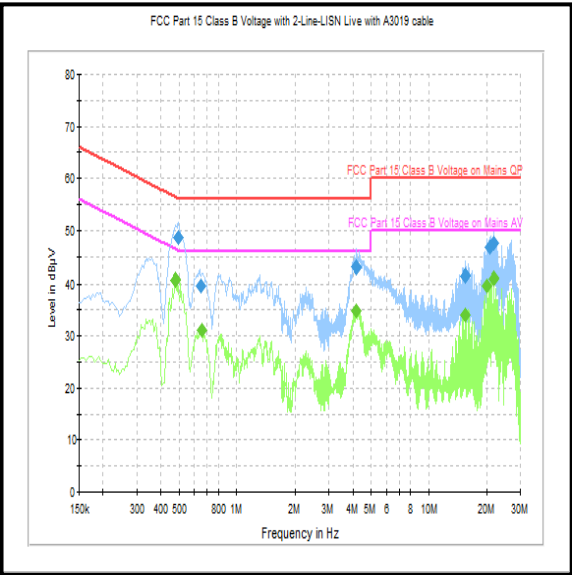
Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.478500	Neutral	45.0	56.4	11.4	Complied
0.658500	Neutral	35.4	56.0	20.6	Complied
4.182000	Neutral	40.8	56.0	15.2	Complied
16.120500	Neutral	39.3	60.0	20.7	Complied
20.800500	Neutral	48.3	60.0	11.7	Complied
21.880500	Neutral	50.9	60.0	9.1	Complied

Results: Neutral / Average / 240 VAC 60 Hz

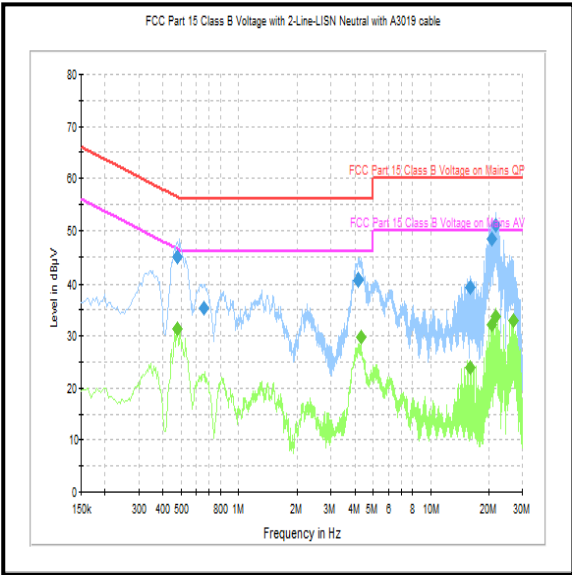
Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.478500	Neutral	31.3	46.4	15.1	Complied
4.326000	Neutral	29.8	46.0	16.2	Complied
16.080000	Neutral	24.0	50.0	26.0	Complied
20.719500	Neutral	32.3	50.0	17.7	Complied
21.799500	Neutral	33.7	50.0	16.3	Complied
26.839500	Neutral	32.9	50.0	17.1	Complied

Transmitter AC Conducted Spurious Emissions (continued)

Results: 240 VAC 60 Hz



Live



Neutral

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

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