TEST REPORT

Test Report No. : UL-RPT-RP14880601-2516B

Customer	:	Tedee Sp. z.o.o.
Model No.	:	TLV2.0
FCC ID	:	2BCK5TLV20
Test Standard(s)	:	Antenna Gain Measurement (Derived from FCC Part 15.247(b)(3))

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2. The results in this report apply only to the sample(s) tested.
3. The sample tested is in compliance with the above standard(s).
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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Lead Project Engineer, Radio Laboratory

Company Signatory:

Sarah Williams
RF Operations Leader, Radio Laboratory

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Customer Information

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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 for accessing doors.

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
Site Registration:	685609
Lab. Designation No.:	UK2011
Location of Testing:	Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, G24 8AH, United Kingdom
Test Dates:	19 September 2023 to 17 October 2023

1.3. Summary of Test Results

FCC Reference (47CFR)	Measurement
Part 15.247(b)(3) / ANSI C63.10 Annex G	Antenna Gain

Results:

Frequency (MHz)	Conducted Output Power (dBm)	Radiated Output Power (dBm)	Antenna Gain (dBi)
2402	7.39	0.98	-6.41
2440	7.38	1.84	-5.54
2480	7.38	1.58	-5.80

Notes:

1. Antenna gain in dBi was calculated in accordance with ANSI C63.10 G.3:

$$EIRP = P_T + G_T - L_C$$

Rearranged to: $G_T = EIRP + L_C - P_T$

LC is ignored since there is no cable connected between transmitter and antenna.

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	-

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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

2.3. 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
Maximum Peak Output Power (Conducted)	2.4 GHz to 2.4835 GHz	95%	±1.13 dB
Maximum Peak Output Power (Radiated)	2.4 GHz to 2.4835 GHz	95%	±3.16 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 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 (22U, 19 inch Rack)	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	USB Power sensor 50 MHz - 8 GHz	Boonton Electronics	RTP5008	12329	12 Oct 2023	12
A220131	10 dB Attenuator, SMA/M-S|MA/F, 5 W, 18 GHz	Pasternack Enterprises	PE7013-10	#5	Calibrated before use	-

Test Equipment Used for Transmitter Radiated Emissions Tests

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

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	Tedee
Model Name or Number / HVIN:	TLV2.0
PMN:	Lock GO
Test Sample Serial Number:	Not marked or stated *(Conducted sample #1, UL ID 6287460)*
Hardware Version:	TLV2.0
Software Version:	2.0
FCC ID:	2BCK5TLV20
Date Of Receipt:	01 September 2023

Brand Name:	Tedee
Model Name or Number / HVIN:	TLV2.0
PMN:	Lock GO
Test Sample Serial Number:	Not marked or stated *(Radiated sample #1, UL ID 6287459)*
Hardware Version:	TLV2.0
Firmware Version:	2.0
FCC ID:	2BCK5TLV20
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	9.0 VDC	
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 PCB antenna with the maximum measured gain stated below. The measured conducted peak output power was subtracted from the measured peak EIRP to obtain the antenna gain in dBi.

Frequency Range (MHz)	Antenna Gain (dBi)
2402	-6.41
2440	-5.54
2480	-5.80

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

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.

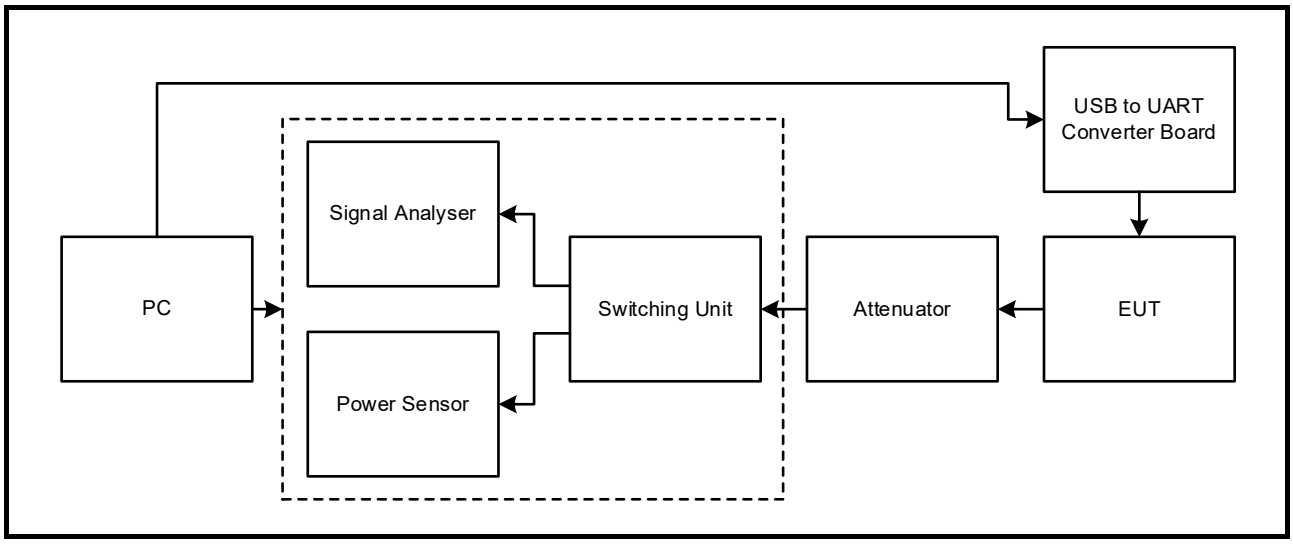
Configuration and Peripherals

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

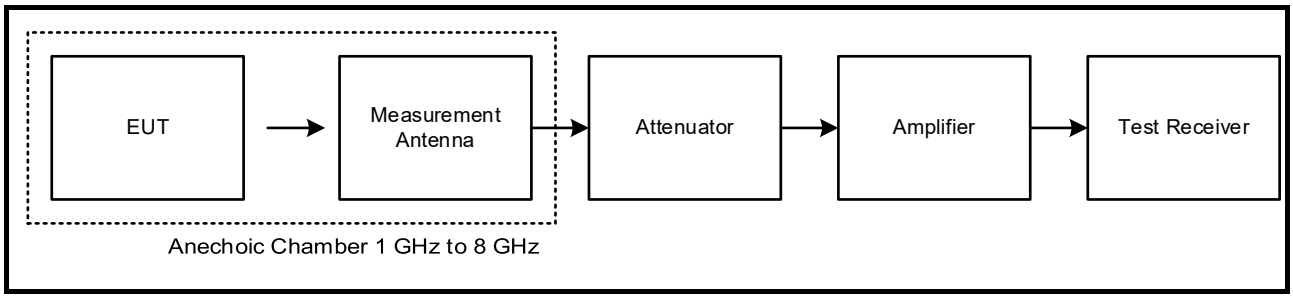
- Controlled in test mode using a set of commands entered into a terminal application on a test laptop. The commands were used to enable a continuous transmission and to select the test channels as required.
- Radiated peak output power tests were performed with the EUT in all 3 orientations.
- The EUT was powered by 3 fully charged CR123A batteries. The battery voltage was monitored throughout testing.
- The customer supplied U.FL test cables to facilitate conducted measurements. The resulting additional path loss was accounted for during conducted measurements.

Test Setup Diagrams

Conducted Tests:



Radiated Tests:



4. Test Results

4.1. Transmitter Maximum Peak Output Power (Conducted)

Test Summary:

Test Engineer:	Jerome Moyo & Max Passell	**Test Date:**	19 September 2023
Test Sample Serial Number:	UL ID 6287460		

Environmental Conditions:

Temperature (°C):	23.1
Relative Humidity (%):	50

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 signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the signal analyser to compensate for the loss of the attenuator and RF cable.

Results:

Frequency Range:	2400-2483.5 MHz	**Band:**	2.4 GHz
Limit Clause:	15.247 (b)(3) RSS-247 5.4 d)	**Test Method:**	ANSI C63.10 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): 4.260	Width (ms): 2.113

Test Frequency (MHz)	**Maximum Conducted Output Power (dBm)**					**Limit (dBm)**	**Margin (dB)**
	1	**2**	**3**	**4**	∑		
2402 (CH37)	7.39	-	-	-	-	30.00	22.61
2440 (CH17)	7.38	-	-	-	-	30.00	22.62
2480 (CH39)	7.38	-	-	-	-	30.00	22.62

4.2. Transmitter Maximum Peak Output Power (Radiated)

Test Summary:

Test Engineer:	John Ferdinand	**Test Date:**	17 October 2023
Test Sample Serial Number:	UL ID 6287459		

FCC Reference:	Part 15.247(b)(3)
Test Method Used:	FCC KDB 558074 Section 8.3.1.1 referencing ANSI C63.10 Section 6.5 & 11.9.1.1

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	45

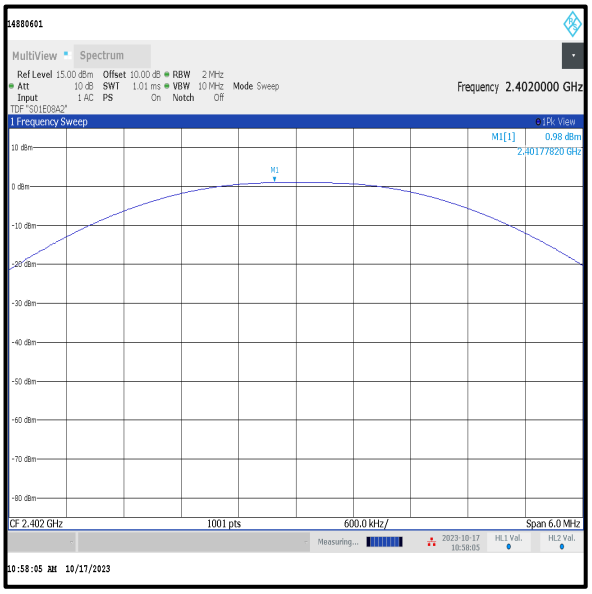
Note(s):

1. Radiated power tests were performed using a signal analyser in accordance with ANSI C63.10 Section 11.9.1.1 with the RBW ≥ DTS bandwidth procedure.
2. The signal analyser resolution bandwidth was set to 2 MHz and video bandwidth of 10 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 6 MHz. A marker was placed at the peak of the signal and the results recorded in the tables below.

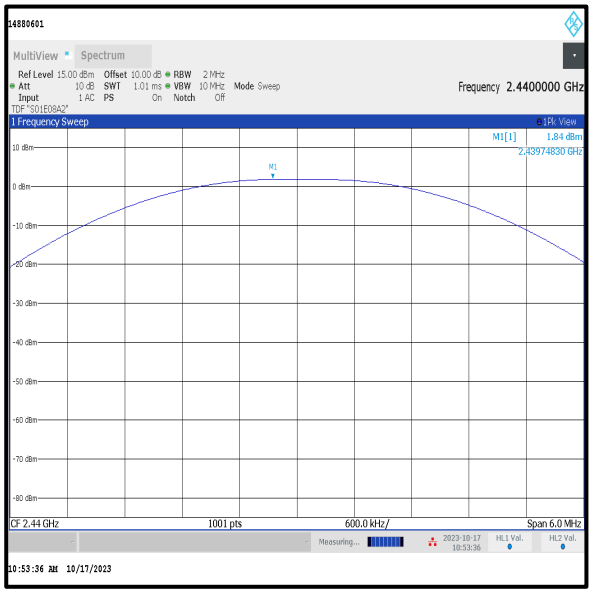
Transmitter Maximum Peak Output Power (Radiated) (continued)

Results: LE1M

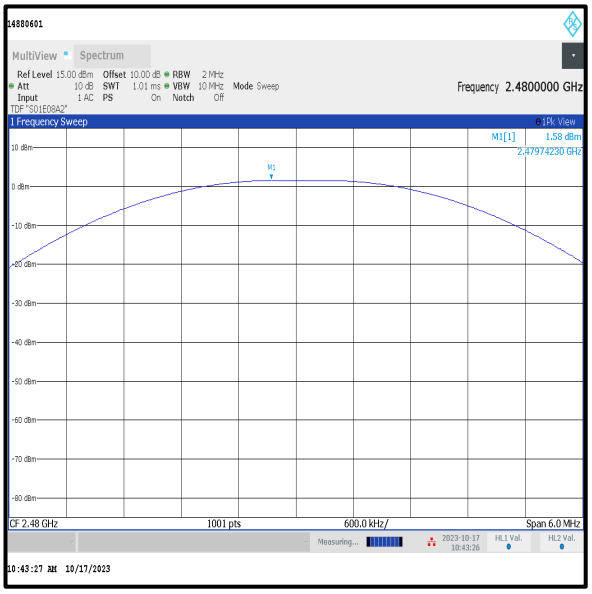
Channel	Radiated Peak Power (dBm)
Bottom	0.98
Middle	1.84
Top	1.58



Bottom Channel



Middle Channel



Top Channel

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