SAR EVALUATION REPORT

FCC 47 CFR § 2.1093
IEEE Std 1528-2013

For
Alarm Control KeyFob

FCC ID: SWX-USLF
Model Name: USL-FOB

Report Number: 4791648924-US-S0-V0
Issue Date: 2025/12/9

Prepared for
Ubiquiti Inc.
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3398

REVISION HISTORY

Rev.	Date	Revisions	Revised By
V0	2025/12/9	Initial Issue	Sally Lu

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1. Attestation of Test Results

Applicant Name	Ubiquiti Inc.
FCC ID	SWX-USLF
Model Name	USL-FOB
Exposure Category	Uncontrolled Exposure
Exposure Category	SAR Limits (W/Kg) Peak spatial-average(1g of tissue)
General population/Uncontrolled exposure	1.6
RF Exposure Conditions	Equipment Class - Highest Reported SAR (W/kg)
Body-worn	0.116
Date Tested	2025/9/10
Test Results	Pass

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of any government. This report is written to support regulatory compliance of the applicable standards stated above.

For statement of conformity, simple acceptance (Section 8.2.1 of ISO/IEC Guide 98-4) was applied as decision rule for measurement in this test report.

- Pass - the measured value is below the acceptance limit, AL = TL.
- Fail - the measured value is above the acceptance limit, AL = TL.
- AL: Acceptance Limit.
- TL: Tolerance Limit (Specification Limit).
- Level of risk: PFA (Probability of False Accept) less than 50 %

Approved and Authorized By:	Prepared By:
	
Kent Liu Senior Laboratory Engineer Underwriters Laboratories Taiwan Co., Ltd.	Sally Lu Project Handler Underwriters Laboratories Taiwan Co., Ltd.

2. Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093, IEEE STD 1528- 2013, the following FCC Published RF exposure KDB procedures:

- FCC 47 CFR § 2.1093
- EEE Std 1528-2013
- 447498 D01 General RF Exposure Guidance v06
- 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04
- 865664 D02 RF Exposure Reporting v01r02

3. Facilities and Accreditation

The test sites and measurement facilities used to collect data are located at:

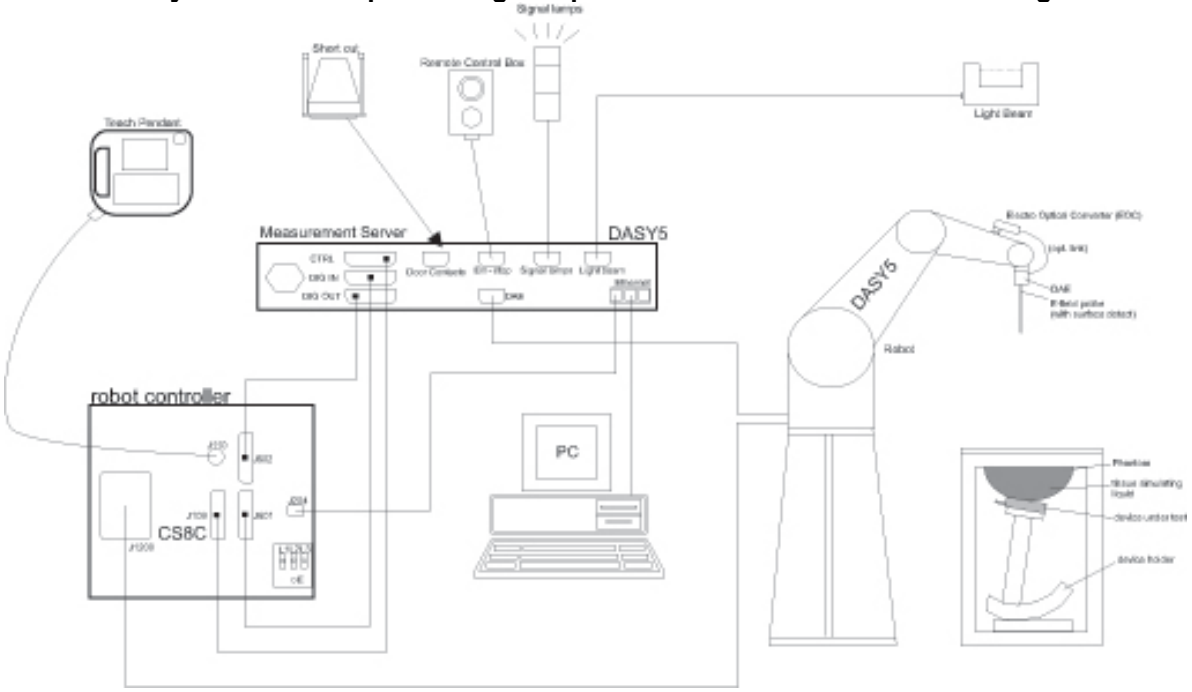
Underwriters Laboratories Taiwan Co., Ltd.,
SAR Room

Underwriters Laboratories Taiwan Co., Ltd. is accredited by TAF, Laboratory Code 3398.

4. SAR Measurement System & Test Equipment

4.1. SAR Measurement System

The DASY5 system used for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running Win7 or Win10 and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

4.2. SAR Scan Procedures

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEC/IEEE 62209-1528, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Area Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

Step 3: Zoom Scan

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

Zoom Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

			≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ 1.5·$\Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.

* When zoom scan is required and the *reported* SAR from the *area scan based 1-g SAR estimation* procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

Step 4: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

4.3. Test Equipment

The measuring equipment used to perform the tests documented in this report has been calibrated in accordance with the manufacturers' recommendations, and is traceable to recognized national standards.

Dielectric Property Measurements

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Date
Network Analyzer	Anritsu	MS46322B	1740002	2025/2/7
Dielectric Assessment Kit	SPEAG	DAK-3.5	1101	2025/6/17
Humidity/Temp meter	TECPEL	DTM-20	17020736	2025/4/28

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Date
EXG-B RF Vector Signal Generator	Keysight Technologies	N5172B	MY56200320	2025/4/7
Power Meter	Keysight Technologies	N1914A	MY56360007	2024/12/17
Power Sensor	Keysight Technologies	N8481H	MY56350009	2024/12/17
Power Meter	Anritsu	ML2495A	1645002	2024/11/25
Power Sensor	Anritsu	MA2411B	1531202	2024/11/25
Dosimetric E-Field Probe	SPEAG	EX3DV4	7515	2025/1/7
Data Acquisition Electronice	SPEAG	DAE4	1305	2025/4/22
System Validation Dipole	SPEAG	D835V2	4d216	2024/10/1
Humidity/Temp meter	TECPEL	DTM-20	17020735	2025/2/26

UL Software

Software Version
DASY NEO52 D10.4 S14.6.14
SEMCAD-X-PostPro

5. Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be ≤ 30%, for a confidence interval of k = 2. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval.

Therefore, the measurement uncertainty is not required.

6. Device Under Test (DUT) Information

6.1. DUT Description

Product	Alarm Control KeyFob
Brand Name	UBIQUITI
Model Name	USL-FOB
Operating Frequency	Lora : 915 to 928MHz
Modulation	GFSK
S/N	2449AZ 8478482C8D98
Sample ID	8858704
Software Version	Tera Term
Received Date	2025/09/05

Notes:

1. Disclaimer: The EUT information is declared by manufacturer and for more detailed features description, please refer the manufacturer's or user's manual.

2. The laboratory is not responsible when the information is supplied by the customer and can affect the validity of results.

3. Disclaimer: The antenna gain specification is supplied by the customer.

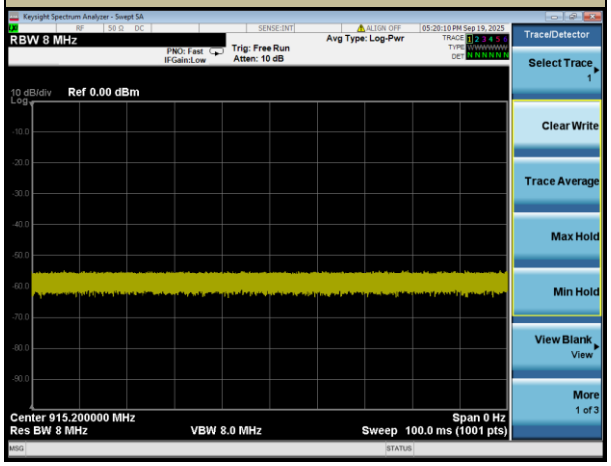
4. The antennas provided to the EUT, we select the highest gain on each frequency band for calculation and testing, please refer to the following table:

Ant. No.	Transmitter Circuit	Brand Name	Model Name	Ant. Type	Maximum Gain (dBi)
1	Chain 0	Ubiquiti Inc.	117-06151	Helix	902MHz-928MHz: -1

6.2. Wireless Technologies

Wireless technologies	Frequency bands	Operating mode	Duty Cycle used for SAR testing
Lora	900MHz	915 to 928MHz	100%

Lora



7. RF Exposure Conditions (Test Configurations)

Refer to Appendix B for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

7.1. Standalone SAR Test Exclusion Considerations

Since the *Dedicated Host Approach* is applied, the standalone SAR test exclusion procedure in KDB 447498 § 4.3.1 is applied to determine the minimum test separation distance:

- When the separation distance from the antenna to an adjacent edge is ≤ 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.
- When the separation distance from the antenna to an adjacent edge is > 5 mm, the actual antenna-to-edge separation distance is applied to determine SAR test exclusion.

SAR Test Exclusion Calculations

Band	Test Position	separation distance(mm)	Max. ERP power(dBm)	Max. ERP power(mW)	Test Require
Lora	Front	5	12.85	19.3	Yes
	Back	5			Yes
	Edge 1	2			Yes
	Edge 2	2			Yes
	Edge 3	490			Yes
	Edge 4	2			Yes

Note(s):

1. ERP=EIRP-2.15

8. Dielectric Property Measurements & System Check

8.1. Dielectric Property Measurements

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized.
The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.
Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.
The dielectric constant (εr) and conductivity (σ) of typical tissue-equivalent media recipes are expected to
be within ± 5% of the required target values; but for SAR measurement systems that have implemented the SAR error compensation algorithms documented in IEEE Std 1528-2013, to automatically compensate the measured SAR results for deviations between the measured and required tissue dielectric parameters, the tolerance for εr and σ may be relaxed to ± 10%. This is limited to frequencies ≤ 3 GHz.

Tissue Dielectric Parameters

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

Target Frequency (MHz)	Head	
	ε_r	σ (S/m)
150	52.3	0.76
300	45.3	0.87
450	43.5	0.87
835	41.5	0.90
900	41.5	0.97
915	41.5	0.98
1450	40.5	1.20
1610	40.3	1.29
1800 – 2000	40.0	1.40
2450	39.2	1.80
3000	38.5	2.40
5000	36.2	4.45
5100	36.1	4.55
5200	36.0	4.66
5300	35.9	4.76
5400	35.8	4.86
5500	35.6	4.96
5600	35.5	5.07
5700	35.4	5.17
5800	35.3	5.27

IEEE Std 1528-2013

Refer to Table 3 within the IEEE Std 1528-2013

Dielectric Property Measurements Results:

Date	Tissue Type	Frequency (MHz)	Relative Permittivity (εr)			Conductivity (σ)		
			Measured	Target	Delta (%)	Measured	Target	Delta (%)
2025/9/10	Head	835	42.44	41.50	2.27	0.93	0.90	3.23
		915.2	41.29	41.50	-0.51	1.00	0.98	1.62
		921.4	41.20	41.50	-0.72	1.01	0.98	2.68
		927.8	41.08	41.50	-1.02	1.02	0.99	3.12

8.2. System Check

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are re-measured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

System Check Results

The 1-g and 10-g SAR measured with a reference dipole, using the required tissue-equivalent medium at the test frequency, must be within 10% of the manufacturer calibrated dipole SAR target.

Date	Tissue Type	Dipole S/N	Input Power (mW)	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Delta 1g ±10 (%)	Measured 10g SAR (W/kg)	Targeted 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Delta 10g ±10 (%)	Plot No.
2025/9/10	Head	D835V2-4d216	250	2.60	9.76	10.4	6.56	1.72	6.40	6.88	7.50	1

9. Conducted Output Power Measurements

9.1. Lora

Band	Modulation	Bandwidth	Ch #	Freq. (MHz)	Meas. Avg Pwr (dBm)	Tune-up Limit (dBm)	SAR Test (Yes/No)
Lora	GFSK	125kHz	0	915.2	14.88	15.0	Yes
			31	921.4	14.85	15.0	
			63	927.8	14.86	15.0	

Note(s):

10. Measured and Reported (Scaled) SAR Results

SAR Test Reduction criteria are as follows:

KDB 447498 D01 General RF Exposure Guidance:
Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

- ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
- ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
- ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

To determine the *initial test position*, Area Scans were performed to determine the position with the *Maximum Value of SAR (measured)*. The position that produced the highest *Maximum Value of SAR* is considered the worst case position; thus used as the *initial test position*.

10.1. Test Condition

Test Item	Test Site No.	Test Date	Tested by
SAR	SAR1	2025/9/10	Edison Hu

10.2. Lora

Band	Modulation	Bandwidth	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		Power Drift	Plot No.
								Tune-up Limit	Meas.	Meas.	Scaled		
Lora	GFSK	125kHz	0	Front	0	915.2	100.0%	15.0	14.88	0.102	0.105	-0.12	
Lora	GFSK	125kHz	0	Back	0	915.2	100.0%	15.0	14.88	0.099	0.102	-0.20	
Lora	GFSK	125kHz	0	Edge 1	0	915.2	100.0%	15.0	14.88	0.068	0.070	-0.16	
Lora	GFSK	125kHz	0	Edge 2	0	915.2	100.0%	15.0	14.88	0.113	**0.116**	-0.17	1
Lora	GFSK	125kHz	0	Edge 2	31	921.4	100.0%	15.0	14.85	0.109	0.113	-0.10	
Lora	GFSK	125kHz	0	Edge 2	63	927.8	100.0%	15.0	14.86	0.086	0.088	-0.18	
Lora	GFSK	125kHz	0	Edge 3	0	915.2	100.0%	15.0	14.88	0.027	0.028	-0.20	
Lora	GFSK	125kHz	0	Edge 4	0	915.2	100.0%	15.0	14.88	0.105	0.108	-0.13	

Appendixes

Refer to separated files for the following appendixes.

4791648924-US-S0-V0_Appendix A: SAR Setup Photos

4791648924-US-S0-V0_Appendix B: Antenna Dimensions and Separation Distances

4791648924-US-S0-V0_Appendix C: SAR System Check Plots

4791648924-US-S0-V0_Appendix D: Highest SAR Test Plots

4791648924-US-S0-V0_Appendix E: SAR Probe and Dipole Calibration Certificates

END OF REPORT