FCC Part 1 Subpart I
FCC Part 2 Subpart J

RF EXPOSURE REPORT

FOR

WIRELESS SMART SPEAKER

MODEL NUMBER: S36

FCC ID: SBVRM036

REPORT NUMBER: R13687586-E15

ISSUE DATE: 2022-02-08

Prepared for
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REVISION HISTORY

Ver.	Issue Date	Revisions	Revised By
1	2021-07-28	Initial Issue	Brian T. Kiewra
2	2022-01-26	Revised power based on manufacturer's declaration	Brian T. Kiewra
3	2022-01-27	Revised power and removed ISED	Niklas Haydon
4	2022-02-02	Revised declared power values	Niklas Haydon
5	2022-02-07	Added simultaneous transmission	Niklas Haydon

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Sonos, Inc.
                          614 Chapala Street
                          Santa Barbara, CA 93101, USA

EUT DESCRIPTION: Wireless Smart Speaker

MODEL: S36

SAMPLE RECEIPT DATE: 2021-05-10

TEST DATE: 2021-07-21

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 1 SUBPART I & PART 2 SUBPART J	Complies

UL LLC. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL LLC. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC. will constitute fraud and shall nullify the document.

Approved & Released   Prepared By:
For UL LLC By:

Mike Antola   Brian T. Kiewra
Staff Engineer   Project Engineer
Consumer Technology Division   Consumer Technology Division
UL LLC   UL LLC

2. TEST METHODOLOGY

All calculations were made in accordance with FCC Parts 1.1310, 2.1091, 2.1093, KDB 447498 D01 v06, KDB 447498 D03 V01, IEEE Std C95.1-2005, and IEEE Std C95.3-2002.

3. REFERENCES

This report contains data provided by the customer which can impact the validity of results. UL LLC is only responsible for the validity of results after the integration of the data provided by the customer.

Output power, Duty cycle and Antenna gain data is excerpted from product documentation provided by the applicant.

4. FACILITIES AND ACCREDITATION

UL LLC is accredited by A2LA, Certificate #0751.06, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
☐	Building: 12 Laboratory Dr RTP, NC 27709, U.S.A	US0067	2180C	703469
☒	Building: 2800 Perimeter Park Dr. Suite B Morrisville, NC 27560		27265	

5. MAXIMUM PERMISSIBLE EXPOSURE (LIMITS AND EQUATIONS)

5.1.   FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/f	*900/f²	6
30-300	61.4	0.163	1.0	6
300-1,500			f/300	6
1,500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*100	30
1.34-30	824/f	2.19/f	*180/f²	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

<u>Notes:</u>

(1) Occupational/controlled exposure limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when a person is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

(2) General population/uncontrolled exposure limits apply in situations in which the general public may be exposed, or in which persons who are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure

5.2.   EQUATIONS

POWER DENSITY

Power density is given by:

S = EIRP / (4 * Pi * D^2)

Where

S = Power density in mW/cm^2
EIRP = Equivalent Isotropic Radiated Power in mW
D = Separation distance in cm

Power density in units of mW/cm^2 is converted to units of W/m^2 by multiplying by 10.

DISTANCE

Distance is given by:

D = SQRT (EIRP / (4 * Pi * S))

Where

D = Separation distance in cm
EIRP = Equivalent Isotropic Radiated Power in mW
S = Power density in mW/cm^2

SOURCE-BASED DUTY CYCLE

Where applicable (for example, multi-slot cell phone applications) a duty cycle factor may be applied.

Source-based time-averaged EIRP = (DC / 100) * EIRP

Where

DC = Duty Cycle in %, as applicable
EIRP = Equivalent Isotropic Radiated Power in mW

MIMO AND COLOCATED TRANSMITTERS (IDENTICAL LIMIT FOR ALL TRANSMITTERS)

For multiple chain devices, and colocated transmitters operating simultaneously in frequency bands where the limit is identical, the total power density is calculated using the total EIRP obtained by summing the EIRP (in linear units) of each transmitter.

Total EIRP = (EIRP1) + (EIRP2) + ... + (EIRPn)

where

EIRPx = Source-based time-averaged EIRP of chain x or transmitter x

The total EIRP is then used to calculate the Power Density or the Distance as applicable.

MIMO AND COLOCATED TRANSMITTERS (NON-IDENTICAL LIMIT FOR ALL TRANSMITTERS)

For multiple colocated transmitters operating simultaneously in frequency bands where different limits apply:

The Power Density at the specified separation distance is calculated for each transmitter chain or transmitter.

The fraction of the exposure limit is calculated for each chain or transmitter as
(Power Density of chain or transmitter) / (Limit applicable to that chain or transmitter).

The fractions are summed.

Compliance is established if the sum of the fractions is less than or equal to one.

6.   RF EXPOSURE RESULTS

This report contains data provided by the customer which can impact the validity of results. UL LLC is only responsible for the validity of results after the integration of the data provided by the customer.

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

Single Chain transmitters

Band	Mode	Separ. Distance (cm)	Output AVG Power (dBm)	Ant. Gain (dBi)	EIRP (mW)	FCC PD (mW/cm^2)	FCC PD Limit (mW/cm^2)
2.4 GHz	BLE	20	0.00	3.40	2.19	0.00	1.00

Colocated transmitters

Band	Mode	Chain for MIMO	Separ. Dist. (cm)	Output AVG Power (dBm)	Ant. Gain (dBi)	EIRP (mW)	FCC PD (mW/cm^2)	FCC PD Limit (mW/cm^2)
2.4 GHz	WLAN	0		19.50	3.20	186.21		
2.4 GHz	WLAN	1		19.50	4.80	269.15		
5.2 GHz	WLAN	0		12.50	4.30	47.86		
5.2 GHz	WLAN	1		12.00	4.50	44.67		
5.3 GHz	WLAN	0		19.00	4.70	234.42		
5.3 GHz	WLAN	1		18.50	4.80	213.80		
5.6 GHz	WLAN	0		17.50	5.10	181.97		
5.6 GHz	WLAN	1		18.00	4.50	177.83		
5.8 GHz	WLAN	0		21.00	5.20	416.87		
5.8 GHz	WLAN	1		19.50	4.50	251.19		
Combined			20			2023.97	0.40	1.00

Notes:

1) For MPE the new KDB 447498 requires the calculations to use the maximum rated power; that power should be declared by the manufacturer and should not be lower than the measured power. Manufacturer has stated declared power equal to measured power.

2) The manufacturer configures output power so that the maximum power, after accounting for manufacturing tolerances, will never exceed the maximum power level declared.

3) The output power in the tables above is the maximum power per chain among various channels and various modes within the specific band.

4) The antenna gain in the tables above is the maximum antenna gain among various channels within the specified band.

5) No simultaneous transmissions

END OF TEST REPORT