TEST REPORT

Report Number : 15126863-E10V1

Applicant	:	Sonos Inc. 301 Coromar Dr. Goleta, CA 93117 USA
Model	:	S55
Brand	:	Sonos
FCC ID	:	SBVRM055
IC	:	5373A-RM055
EUT Description	:	Wireless Smart Speaker
Test Standard(s)	:	FCC Part 1 Subpart I FCC Part 2 Subpart J RSS 102 ISSUE 6

Date Of Issue:
2024-06-03

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ACCREDITED
CERT #0751.05

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2024-06-03	Initial Issue	---

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Sonos Inc.
301 Coromar Dr.
Goleta, CA 93117 USA

EUT DESCRIPTION: Wireless Smart Speaker

MODEL: S55

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 1 SUBPART I & PART 2 SUBPART J	Complies
RSS 102 ISSUE 6	Complies

UL Verification Services Inc. 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 Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document.

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2. TEST METHODOLOGY

All calculations were made in accordance with;

- FCC Parts 1.1310, 2.1091, 2.1093
- KDB 447498 D01
- KDB 447498 D03
- IEEE Std C95.1-2005, IEEE Std C95.3-2002
- IC Safety Code 6 and RSS 102 Issue 6.

3. REFERENCES

Maximum Declared Output power, Duty cycle and Antenna gain data is excerpted from product documentation provided by the applicant.
Note: Output Power is the declared maximum power across production units.

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47658 Kato Road, Fremont, California, USA.

UL Verification Services Inc. is accredited by A2LA, Certificate Number #0751.05, for all testing performed within the scope of this report.

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/cm^2)	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/f^2	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/f^2	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

Notes:

(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. ISED RULES

For the purpose of this standard, Innovation, Science and Economic Development (ISED) has adopted the SAR and RF field strength limits established in Health Canada's RF exposure guideline, Safety Code 6.

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Dentisty (W/m^2)	Reference Period (minutes)
0.003-10[21]	83	90	-	Instantaneous*
0.1-10	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
10-20	27.46	0.0728	-2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142f^{0.3417}$	$0.008335f^{0.3417}$	$0.02619f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000/f^{1.2}$

Note: f is frequency in MHz.

* Based on nerve stimulation (NS).

** Based on specific absorption rate (SAR).

5.3. 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 Verification Services Inc. is only responsible for correctly integrating customer-provided data with measurements performed by UL Verification Services Inc.

Below is a list of the data provided by the customer:

1) Antenna gain and type

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.

FCC

Single Chain and non-colocated transmitters											
Band	**Mode**	**Chain for MIMO**	**Separ. Distance (cm)**	**Output AVG Power (dBm)**	**Ant. Gain (dBi)**	**EIRP (dBm)**	**Duty Cycle (%)**	**EIRP (mW)**	**FCC Power Density (mW/cm^2)**	**FCC MPE Limit (mW/cm^2)**	**Exposure ratio (PD / Limit)**
2.4 GHz	BLE	N/A	20	9.00	3.6	12.60	100.0	18.20	0.01	1.00	**0.01**
2.4 GHz_Non ax	802.11b/g/n	2Tx	20	25.27	5.2	30.47	100.0	1114.29	0.44	1.00	**0.44**
2.4 GHz_ax	802.11ax	2Tx	20	21.51	5.2	26.71	100.0	468.81	0.19	1.00	0.19
5 GHz_Non ax	5.8GHz 802.11a/n	2Tx	20	25.54	5.8	31.34	100.0	1361.14	0.54	1.00	**0.54**
5 GHz_ax	5.8GHz 802.11ax	2Tx	20	26.04	5.8	31.84	100.0	1527.57	0.61	1.00	0.61
6 GHz_Non ax	UNII-5 802.11a	2Tx	20	-	-	7.60	100.0	5.75	0.00	1.00	0.00
6 GHz_ax	UNII-5 802.11ax HE80	2Tx	20	-	-	12.50	100.0	17.78	0.01	1.00	**0.01**

IC

Single Chain and non-colocated transmitters											
Band	**Mode**	**Chain for MIMO**	**Separ. Distance (cm)**	**Output AVG Power (dBm)**	**Ant. Gain (dBi)**	**EIRP (dBm)**	**Duty Cycle (%)**	**EIRP (mW)**	**IC Power Density (W/m^2)**	**IC MPE Limit (W/m^2)**	**Exposure ratio (PD / Limit)**
2.4 GHz	BLE	N/A	20	9.00	3.6	12.60	100.0	18.20	0.07	5.35	**0.01**
2.4 GHz_Non ax	802.11b/g/n	2Tx	20	25.27	5.2	30.47	100.0	1114.29	4.43	5.37	**0.83**
2.4 GHz_ax	802.11ax	2Tx	20	21.51	5.2	26.71	100.0	468.81	1.87	5.37	**0.35**
5 GHz_Non ax	5.8GHz 802.11a/n	2Tx	20	25.54	5.8	31.34	100.0	1361.14	5.42	9.05	**0.60**
5 GHz_ax	5.8GHz 802.11ax	2Tx	20	26.04	5.8	31.84	100.0	1527.57	6.08	9.05	**0.67**
6 GHz_Non ax	UNII-5 802.11a	2Tx	20	-	-	7.60	100.0	5.75	0.02	9.95	**0.00**
6 GHz_ax	UNII-5 802.11ax HE80	2Tx	20	-	-	12.50	100.0	17.78	0.07	9.95	**0.01**

(MIMO and/or Colocated transmitters all with same Power Density limit, 20 cm MPE distance)

Multiple chain or colocated transmitters									
Band	**Mode**	**Chain for MIMO**	**Separ. Dist. (cm)**	**Output AVG Power (dBm)**	**Ant. Gain (dBi)**	**Duty Cycle (%)**	**EIRP (mW)**	**FCC PD (mW/cm^2)**	**FCC PD Limit (mW/cm^2)**
2.4 GHz	BLE	N/A		9.00	3.60	100.0	18.20		
2.4 GHz	WLAN	2Tx		25.27	5.20	100.0	1114.29		
Combined			20				1132.49	0.23	1.00

Multiple chain or colocated transmitters									
Band	**Mode**	**Chain for MIMO**	**Separ. Dist. (cm)**	**Output AVG Power (dBm)**	**Ant. Gain (dBi)**	**Duty Cycle (%)**	**EIRP (mW)**	**FCC PD (mW/cm^2)**	**FCC PD Limit (mW/cm^2)**
2.4 GHz	BLE	N/A		9.00	3.60	100.0	18.20		
5 GHz	WLAN	2Tx		26.04	5.80	100.0	1527.57		
Combined			20				1545.76	0.31	1.00

Multiple chain or colocated transmitters									
Band	**Mode**	**Chain for MIMO**	**Separ. Dist. (cm)**	**Output AVG Power (dBm)**	**Ant. Gain (dBi)**	**Duty Cycle (%)**	**EIRP (mW)**	**FCC PD (mW/cm^2)**	**FCC PD Limit (mW/cm^2)**
2.4 GHz	BLE	N/A		9.00	3.60	100.0	18.20		
6 GHz	WLAN	2				100.0	12.50		
Combined			20				30.70	0.01	1.00

(MIMO and/or Colocated transmitters with different Power Density limits among bands)

Multiple chain or colocated transmitters

Band	(GHz)	2.4	2.4
Mode		BLE	802.11 b/g/n
Transmitter		1Tx	2Tx
Separation Distance	(cm)	20	20
Output Power	(dBm)	9.00	25.27
Antenna Gain	(dBi)	3.6	5.2
Duty Cycle	(%)	100	100
Source Based EIRP	(mW)	18.2	1114.3
ISED Power Density	(W/m^2)	0.036	2.218
ISED Power Density Limit	(W/m^2)	5.35	5.37
ISED Fraction of Limit	(%)	0.7	41.3
ISED Sum of Fractions (%)	42.0		

Multiple chain or colocated transmitters

Band	(GHz)	2.4	5
Mode		BLE	802.11 ax
Transmitter		1Tx	2Tx
Separation Distance	(cm)	20	20
Output Power	(dBm)	9.00	26.04
Antenna Gain	(dBi)	3.6	5.8
Duty Cycle	(%)	100	100
Source Based EIRP	(mW)	18.2	1527.6
ISED Power Density	(W/m^2)	0.036	3.041
ISED Power Density Limit	(W/m^2)	5.35	9.05
ISED Fraction of Limit	(%)	0.7	33.6
ISED Sum of Fractions (%)	34.3		

Multiple chain or colocated transmitters

Band	(GHz)	2.4	6
Mode		BLE	802.11ax
Transmitter		1Tx	2Tx
Separation Distance	(cm)	20	20
Output Power	(dBm)	9.00	
Antenna Gain	(dBi)	3.6	
Duty Cycle	(%)	100	100
Source Based EIRP	(mW)	18.2	12.5
ISED Power Density	(W/m^2)	0.036	0.025
ISED Power Density Limit	(W/m^2)	5.35	9.95
ISED Fraction of Limit	(%)	0.7	0.3
ISED Sum of Fractions (%)	0.9		

Notes:

1) For MPE the KDB 447498 D01 v6 and RSS-102 the calculations use the maximum rated power.

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

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.

END OF REPORT