

FCC 47 CFR MPE REPORT

DEI Sales, Inc., dba Polk Audio

HOME THEATE SYSTEM

Model Number: SIGNA S3 SOUND BAR

FCC ID: WLQSIGNAS3

Prepared for:	DEI Sales, Inc., dba Polk Audio
	1 Viper Way, Vista, California, United States
Prepared By:	EST Technology Co., Ltd.
	Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China
Tel: 86-769-83081888-808	

Report Number:	ESTE-R2001079
Date of Test:	Dec. 14, 2019~Feb. 22, 2020
Date of Report:	Feb. 24, 2020

Maximum Permissible Exposure

1. Applicable Standards

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2m normally can be maintained between the user and the device.

1.1. Limits for Maximum Permissible Exposure (MPE)

(a) Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Times E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-10000			5	6

(b) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Times E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-10000			1.0	30

Note: f=frequency in MHz; *Plane-wave equivalent power density

1.2. MPE Calculation Method

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \quad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

E = Electric Field (V/m)

P = Peak RF output Power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained

2. Applicable Standards

Antenna 1

Mode	Frequency (MHz)	Peak output power (dBm)	Peak output power (mW)	Target power (dBm)	Antenna gain	
					(dBi)	(Linear)
GFSK	2402	5.78	3.7844	5 ± 1	3.88	2.4434
	2441	6.41	4.3752	6 ± 1	3.88	2.4434
	2480	7.02	5.0350	7 ± 1	3.88	2.4434
8-DPSK	2402	5.82	3.8194	5 ± 1	3.88	2.4434
	2441	6.44	4.4055	6 ± 1	3.88	2.4434
	2480	7.05	5.0699	7 ± 1	3.88	2.4434
BLE GFSK	2402	1.82	1.5205	1 ± 1	3.88	2.4434
	2440	2.40	1.7378	2 ± 1	3.88	2.4434
	2480	2.97	1.9815	2 ± 1	3.88	2.4434
IEEE 802.11b	2412	19.70	93.3254	19 ± 1	3.88	2.4434
	2437	19.95	98.8553	19 ± 1	3.88	2.4434
	2462	19.36	86.2979	19 ± 1	3.88	2.4434
IEEE 802.11g	2412	24.88	307.6097	24 ± 1	3.88	2.4434
	2437	25.00	316.2278	25 ± 1	3.88	2.4434
	2462	24.49	281.1901	24 ± 1	3.88	2.4434
IEEE 802.11n 20 (2.4G)	2412	23.57	227.5097	23 ± 1	3.88	2.4434
	2437	23.69	233.8837	23 ± 1	3.88	2.4434
	2462	23.15	206.5380	23 ± 1	3.88	2.4434
IEEE 802.11n 40 (2.4G)	2422	22.86	193.1968	22 ± 1	3.88	2.4434
	2437	22.89	194.5360	22 ± 1	3.88	2.4434
	2452	22.88	194.0886	22 ± 1	3.88	2.4434
IEEE 802.11a (5G)	5180	14.13	25.8821	14 ± 1	3.81	2.4044
	5200	13.92	24.6604	13 ± 1	3.81	2.4044
	5240	14.10	25.7040	14 ± 1	3.81	2.4044
	5260	13.49	22.3357	13 ± 1	3.81	2.4044
	5300	12.74	18.7932	12 ± 1	3.81	2.4044
	5320	13.14	20.6063	13 ± 1	3.81	2.4044
	5500	13.83	24.1546	13 ± 1	3.81	2.4044
	5580	14.33	27.1019	14 ± 1	3.81	2.4044
	5700	12.10	16.2181	12 ± 1	3.81	2.4044
	5745	12.35	17.1791	12 ± 1	3.81	2.4044
	5785	11.94	15.6315	11 ± 1	3.81	2.4044
	5825	11.61	14.4877	11 ± 1	3.81	2.4044

Mode	Frequency (MHz)	Peak output power (dBm)	Peak output power (mW)	Target power (dBm)	Antenna gain	
					(dBi)	(Linear)
IEEE802.11nHT20 (5G)	5180	13.01	19.9986	13 ± 1	3.81	2.4044
	5200	13.06	20.2302	13 ± 1	3.81	2.4044
	5240	12.86	19.3197	12 ± 1	3.81	2.4044
	5260	12.20	16.5959	12 ± 1	3.81	2.4044
	5300	11.60	14.4544	11 ± 1	3.81	2.4044
	5320	11.86	15.3462	11 ± 1	3.81	2.4044
	5500	12.58	18.1134	12 ± 1	3.81	2.4044
	5580	13.18	20.7970	13 ± 1	3.81	2.4044
	5700	11.31	13.5207	11 ± 1	3.81	2.4044
	5745	11.34	13.6144	11 ± 1	3.81	2.4044
	5785	10.96	12.4738	10 ± 1	3.81	2.4044
	5825	10.46	11.1173	10 ± 1	3.81	2.4044
IEEE802.11ac20 (5G)	5180	13.05	20.1837	13 ± 1	3.81	2.4044
	5200	12.82	19.1426	12 ± 1	3.81	2.4044
	5240	12.88	19.4089	12 ± 1	3.81	2.4044
	5260	12.21	16.6341	12 ± 1	3.81	2.4044
	5300	11.61	14.4877	11 ± 1	3.81	2.4044
	5320	11.88	15.4170	11 ± 1	3.81	2.4044
	5500	12.59	18.1552	12 ± 1	3.81	2.4044
	5580	13.19	20.8449	13 ± 1	3.81	2.4044
	5700	11.11	12.9122	11 ± 1	3.81	2.4044
	5745	11.30	13.4896	11 ± 1	3.81	2.4044
	5785	10.97	12.5026	10 ± 1	3.81	2.4044
	5825	10.38	10.9144	10 ± 1	3.81	2.4044

Mode	Frequency (MHz)	Peak output power (dBm)	Peak output power (mW)	Target power (dBm)	Antenna gain	
					(dBi)	(Linear)
IEEE802.11nHT40 (5G)	5190	12.24	16.7494	12 ± 1	3.81	2.4044
	5230	12.20	16.5959	12 ± 1	3.81	2.4044
	5270	11.24	13.3045	11 ± 1	3.81	2.4044
	5310	10.93	12.3880	10 ± 1	3.81	2.4044
	5510	11.96	15.7036	11 ± 1	3.81	2.4044
	5670	12.39	17.3380	12 ± 1	3.81	2.4044
	5755	10.73	11.8304	10 ± 1	3.81	2.4044
	5795	9.92	9.8175	9 ± 1	3.81	2.4044
IEEE802.11ac40 (5G)	5190	12.27	16.8655	12 ± 1	3.81	2.4044
	5230	12.23	16.7109	12 ± 1	3.81	2.4044
	5270	11.27	13.3968	11 ± 1	3.81	2.4044
	5310	10.79	11.9950	10 ± 1	3.81	2.4044
	5510	11.98	15.7761	11 ± 1	3.81	2.4044
	5670	12.41	17.4181	12 ± 1	3.81	2.4044
	5755	10.69	11.7220	10 ± 1	3.81	2.4044
	5795	9.93	9.8401	9 ± 1	3.81	2.4044
IEEE802.11ac80 (5G)	5210	12.15	16.4059	12 ± 1	3.81	2.4044
	5290	11.17	13.0918	11 ± 1	3.81	2.4044
	5530	12.36	17.2187	12 ± 1	3.81	2.4044
	5610	11.91	15.5239	11 ± 1	3.81	2.4044
	5775	10.38	10.9144	10 ± 1	3.81	2.4044

Antenna 2

Mode	Frequency (MHz)	Peak output power (dBm)	Peak output power (mW)	Target power (dBm)	Antenna gain	
					(dBi)	(Linear)
IEEE802.11b	2412	19.00	79.4328	19 ± 1	3.91	2.4604
	2437	18.96	78.7046	18 ± 1	3.91	2.4604
	2462	19.37	86.4968	19 ± 1	3.91	2.4604
IEEE802.11g	2412	24.19	262.4219	24 ± 1	3.91	2.4604
	2437	24.35	272.2701	24 ± 1	3.91	2.4604
	2462	24.05	254.0973	24 ± 1	3.91	2.4604
IEEE802.11nHT20 (2.4G)	2412	22.97	198.1527	22 ± 1	3.91	2.4604
	2437	23.08	203.2357	23 ± 1	3.91	2.4604
	2462	23.24	210.8628	23 ± 1	3.91	2.4604
IEEE802.11nHT40 (2.4G)	2422	22.30	169.8244	22 ± 1	3.91	2.4604
	2437	22.29	169.4338	22 ± 1	3.91	2.4604
	2452	22.30	169.8244	22 ± 1	3.91	2.4604
IEEE 802.11a (5G)	5180	14.16	26.0615	14 ± 1	3.37	2.1727
	5200	14.05	25.4097	14 ± 1	3.37	2.1727
	5240	13.90	24.5471	13 ± 1	3.37	2.1727
	5260	13.40	21.8776	13 ± 1	3.37	2.1727
	5300	12.56	18.0302	12 ± 1	3.37	2.1727
	5320	12.86	19.3197	12 ± 1	3.37	2.1727
	5500	13.37	21.7270	13 ± 1	3.37	2.1727
	5580	14.32	27.0396	14 ± 1	3.37	2.1727
	5700	12.15	16.4059	12 ± 1	3.37	2.1727
	5745	12.35	17.1791	12 ± 1	3.37	2.1727
	5785	11.97	15.7398	11 ± 1	3.37	2.1727
	5825	11.46	13.9959	11 ± 1	3.37	2.1727

Mode	Frequency (MHz)	Peak output power (dBm)	Peak output power (mW)	Target power (dBm)	Antenna gain	
					(dBi)	(Linear)
IEEE802.11nHT20 (5G)	5180	13.00	19.9526	13 ± 1	3.37	2.1727
	5200	12.77	18.9234	12 ± 1	3.37	2.1727
	5240	12.88	19.4089	12 ± 1	3.37	2.1727
	5260	12.38	17.2982	12 ± 1	3.37	2.1727
	5300	11.32	13.5519	11 ± 1	3.37	2.1727
	5320	11.65	14.6218	11 ± 1	3.37	2.1727
	5500	12.23	16.7109	12 ± 1	3.37	2.1727
	5580	13.23	21.0378	13 ± 1	3.37	2.1727
	5700	11.10	12.8825	11 ± 1	3.37	2.1727
	5745	11.20	13.1826	11 ± 1	3.37	2.1727
	5785	10.96	12.4738	10 ± 1	3.37	2.1727
	5825	10.39	10.9396	10 ± 1	3.37	2.1727
IEEE802.11ac20	5180	13.04	20.1372	13 ± 1	3.37	2.1727
	5200	12.90	19.4984	12 ± 1	3.37	2.1727
	5240	12.87	19.3642	12 ± 1	3.37	2.1727
	5260	12.39	17.3380	12 ± 1	3.37	2.1727
	5300	11.31	13.5207	11 ± 1	3.37	2.1727
	5320	11.63	14.5546	11 ± 1	3.37	2.1727
	5500	12.23	16.7109	12 ± 1	3.37	2.1727
	5580	13.29	21.3304	13 ± 1	3.37	2.1727
	5700	11.15	13.0317	11 ± 1	3.37	2.1727
	5745	11.22	13.2434	11 ± 1	3.37	2.1727
	5785	10.96	12.4738	10 ± 1	3.37	2.1727
	5825	10.39	10.9396	10 ± 1	3.37	2.1727

Mode	Frequency (MHz)	Peak output power (dBm)	Peak output power (mW)	Target power (dBm)	Antenna gain	
					(dBi)	(Linear)
IEEE802.11n40 (5G)	5190	12.23	16.7109	12 ± 1	3.37	2.1727
	5230	12.10	16.2181	12 ± 1	3.37	2.1727
	5270	11.04	12.7057	11 ± 1	3.37	2.1727
	5310	10.77	11.9399	10 ± 1	3.37	2.1727
	5510	11.89	15.4525	11 ± 1	3.37	2.1727
	5670	12.17	16.4816	12 ± 1	3.37	2.1727
	5755	10.59	11.4551	10 ± 1	3.37	2.1727
	5795	9.69	9.3111	9 ± 1	3.37	2.1727
IEEE802.11ac40 (5G)	5190	12.28	16.9044	12 ± 1	3.37	2.1727
	5230	12.15	16.4059	12 ± 1	3.37	2.1727
	5270	11.07	12.7938	11 ± 1	3.37	2.1727
	5310	10.80	12.0226	10 ± 1	3.37	2.1727
	5510	11.91	15.5239	11 ± 1	3.37	2.1727
	5670	12.20	16.5959	12 ± 1	3.37	2.1727
	5755	10.61	11.5080	10 ± 1	3.37	2.1727
	5795	9.74	9.4189	9 ± 1	3.37	2.1727
IEEE802.11ac80 (5G)	5210	12.27	16.8655	12 ± 1	3.37	2.1727
	5290	11.02	12.6474	11 ± 1	3.37	2.1727
	5610	12.50	17.7828	12 ± 1	3.37	2.1727
	5530	11.79	15.1008	11 ± 1	3.37	2.1727
	5775	10.44	11.0662	10 ± 1	3.37	2.1727

3. Calculated Result and Limit

Antenna 1

Mode	Target power (dBm)	Antenna gain		Power Density (S) (mW/cm ²)	Limited of Power Density (S) (mW/cm ²)	Test Result
		(dBi)	(Linear)			
2.4G Band						
GFSK	8	3.88	2.4434	0.00307	1	Compiles
8-DPSK	8	3.88	2.4434	0.00307	1	Compiles
BLE GFSK	3	3.88	2.4434	0.00097	1	Compiles
IEEE 802.11b	20	3.88	2.4434	0.04861	1	Compiles
IEEE 802.11g	26	3.88	2.4434	0.19352	1	Compiles
IEEE 802.11n HT20	24	3.88	2.4434	0.12210	1	Compiles
IEEE 802.11n HT40	23	3.88	2.4434	0.09699	1	Compiles
5G Band						
IEEE 802.11a	15	3.81	2.4044	0.01513	1	Compiles
IEEE 802.11n HT20	14	3.81	2.4044	0.01202	1	Compiles
IEEE 802.11ac VHT20	14	3.81	2.4044	0.01202	1	Compiles
IEEE 802.11n HT40	13	3.81	2.4044	0.00954	1	Compiles
IEEE 802.11ac VHT40	13	3.81	2.4044	0.00954	1	Compiles
IEEE 802.11ac VHT80	13	3.81	2.4044	0.00954	1	Compiles

For 2.4G SRD

Ant gain=3.88dBi

Ant numeric gain=2.443

Field strength = 94.29dBuV/m@3m

$P = \{ [10^{(94.29/20)} / 10^6 * 3]^2 / (30 * 2.443) \} * 1000 \text{mW} = 0.330 \text{mW}$

$Pd = (30 * 0.330 * 2.443) / (377 * 20^2) = 0.00016 < 1$

Antenna 2

Mode	Target power (dBm)	Antenna gain		Power Density (S) (mW/cm ²)	Limited of Power Density (S) (mW/cm ²)	Test Result
		(dBi)	(Linear)			
2.4G Band						
IEEE 802.11b	20	3.91	2.4604	0.04895	1	Compiles
IEEE 802.11g	25	3.91	2.4604	0.15479	1	Compiles
IEEE 802.11n HT20	24	3.91	2.4604	0.12295	1	Compiles
IEEE 802.11n HT40	23	3.91	2.4604	0.09766	1	Compiles
5G Band						
IEEE 802.11a	15	3.37	2.1727	0.01367	1	Compiles
IEEE 802.11n HT20	14	3.37	2.1727	0.01086	1	Compiles
IEEE 802.11ac VHT20	14	3.37	2.1727	0.01086	1	Compiles
IEEE 802.11n HT40	13	3.37	2.1727	0.00862	1	Compiles
IEEE 802.11ac VHT40	13	3.37	2.1727	0.00862	1	Compiles
IEEE 802.11ac VHT80	13	3.37	2.1727	0.00862	1	Compiles

Antenna 1+2

Mode	Directional Antenna Gain (Numeric)	Peak Output Power (mW)	Power Density (S) (mW/cm ²) Total	Limited of Power Density (S) (mW/cm ²)	Test Result
2.4G Band					
IEEE 802.11n HT20	4.909 (6.91dBi)	437.1	0.42688	1	Compiles
IEEE 802.11n HT40	4.909 (6.91dBi)	364.0	0.35549	1	Compiles
5G Band					
IEEE 802.11n HT20	4.571 (6.60dBi)	41.8	0.03801	1	Compiles
IEEE 802.11ac VHT20	4.571 (6.60dBi)	42.2	0.03837	1	Compiles
IEEE 802.11n HT40	4.571 (6.60dBi)	33.8	0.03074	1	Compiles
IEEE 802.11ac VHT40	4.571 (6.60dBi)	34.0	0.03092	1	Compiles
IEEE 802.11ac VHT80	4.571 (6.60dBi)	35.0	0.03183	1	Compiles

Total

Mode	BT (mW)	2.4G Wi-Fi (mW)	5G Wi-Fi (mW)	2.4G SRD wireless (mW)	Power Density (S) (mW/cm ²) Total	Limited of Power Density (S) (mW/cm ²)	Test Result
MIMO Configuration 1	0.00307			0.00016	0.00323	1	Compiles
MIMO Configuration 2		0.42688		0.00016	0.42704	1	Compiles
MIMO Configuration 3			0.03837	0.00016	0.03853	1	Compiles

Note: 2.4 and 5GHz bands are share an antenna, Cann't both the 2.4 and 5 GHz bands operate simultaneously.

End of Test Report