

SAR Evaluation Report

Application No.: SZEM1905014067CR
Applicant: ZAGG Inc.
Address of Applicant: 910 West Legacy Center Way, Midvale, Utah, 84047, United States.
Manufacturer: ZAGG Inc.
Address of Manufacturer: 910 West Legacy Center Way, Midvale, Utah, 84047, United States.
Factory: DONGGUAN MAE TAY ELECTRONIC CO., LTD.
Address of Factory: Bei Huan Rd Industrial Area Chang Ping Town Dongguan Guangdong 523560 P.R.C.

Equipment Under Test (EUT):
EUT Name: Keyboard
Model No.: ZKB79RBB18
Trade mark: ZAGG
FCC ID: QTG-ZKPIB
Standards: 47 CFR Part 1.1307
47 CFR Part 2.1093
KDB447498D01 General RF Exposure Guidance v06

Date of Receipt: 2019-05-17
Date of Test: 2019-05-21 to 2019-05-24
Date of Issue: 2019-05-28

Test Result :	PASS*
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* In the configuration tested, the EUT complied with the standards specified above.

Keny Xu
EMC Laboratory Manager



2 Version

<i>Revision Record</i>				
<i>Version</i>	<i>Chapter</i>	<i>Date</i>	<i>Modifier</i>	<i>Remark</i>
01		2019-05-28		Original

Authorized for issue by:				
				
		Leo Li /Project Engineer		
				
		Eric Fu /Reviewer		





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4 General Information

4.1 General Description of EUT

Power supply:	DC 5V Lithium Ion Battery: 3.7V 450mAh rechargeable battery which charged by USB port
Cable:	USB cable: 50cm shielded
Operation Frequency:	2402MHz to 2480MHz
Bluetooth Version:	V5.0 LE
Modulation Type:	GFSK
Number of Channels:	40
Channel Spacing:	2MHz
Antenna Type:	PCB Antenna
Antenna Gain:	0dBi



4.2 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch

No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China
518057

Telephone: +86 (0) 755 2601 2053 Fax: +86 (0) 755 2671 0594

No tests were sub-contracted.

4.3 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

• CNAS (No. CNAS L2929)

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

• A2LA (Certificate No. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• VCCI

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

• FCC –Designation Number: CN1178

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

• Innovation, Science and Economic Development Canada

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.





4.4 Deviation from Standards

None.

4.5 Abnormalities from Standard Conditions

None.

4.6 Other Information Requested by the Customer

None.



5 SAR Evaluation

5.1 RF Exposure Compliance Requirement

5.1.1 Standard Requirement

According to KDB447498D01 General RF Exposure Guidance v06

4.3.1. Standalone SAR test exclusion considerations

Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Exclusion Threshold condition, listed below, is satisfied.

5.1.2 Limits

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$$\left[\frac{\text{(max. power of channel, including tune-up tolerance, mW)}}{\text{(min. test separation distance, mm)}} \right] \cdot \sqrt{f(\text{GHz})} \leq 3.0$$
 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

f(GHz) is the RF channel transmit frequency in GHz

Power and distance are rounded to the nearest mW and mm before calculation¹⁷

The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion

5.1.3 EUT RF Exposure



1 Refer to the SAR test report of Ipad Mini 5(FCC ID:BCGA2133):

For WLAN 2.4GHz

- 1) the maximum average output power (including tune-up tolerance) is 15.0dBm(31.62mw) of WF1 antenna @2412MHz
- 2) the maximum average output power (including tune-up tolerance) is 16.0dBm(39.81mw) of WF6 antenna @2412MHz

For WLAN 5GHz

- 3) the maximum average output power (including tune-up tolerance) is 17.0dBm(50.12mw) of WF1 antenna @5230MHz
- 4) the maximum average output power (including tune-up tolerance) is 16.5dBm(44.67mw) of WF6 antenna @5230MHz

For BT

- 5) the maximum average output power (including tune-up tolerance) is 16.55dBm(45.19mw) of WF1 antenna @2402MHz
- 6) the maximum average output power (including tune-up tolerance) is 16.94dBm(49.43mw) of WF6 antenna @2402MHz

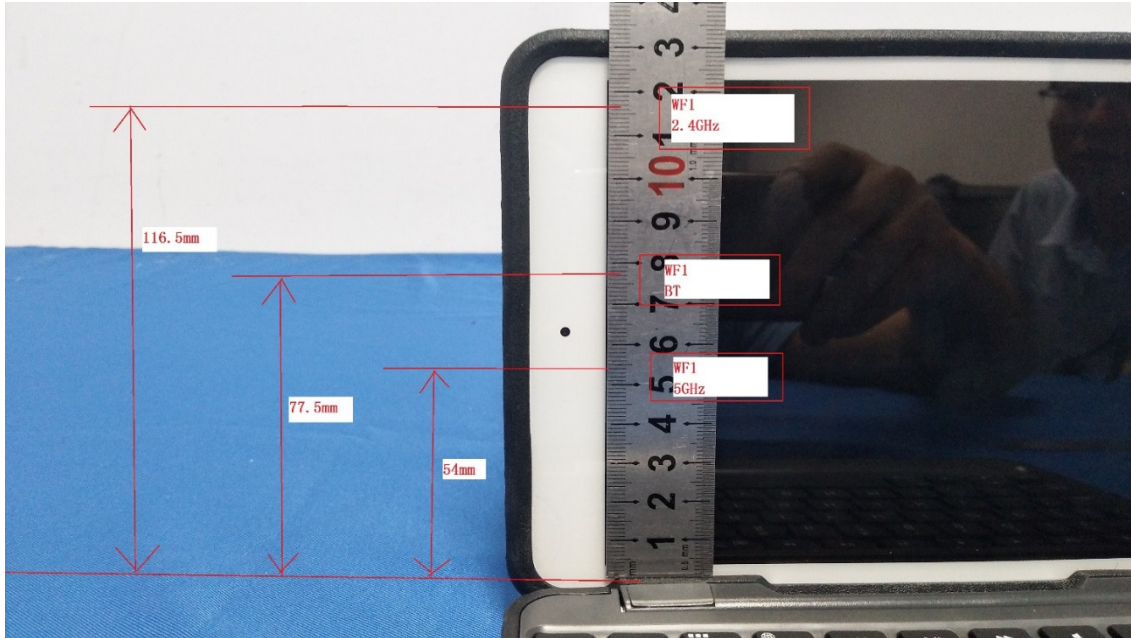


2 The separation distances between the Ipad mini 5's antennas to the upper edge of the EUT is illustrated bellow

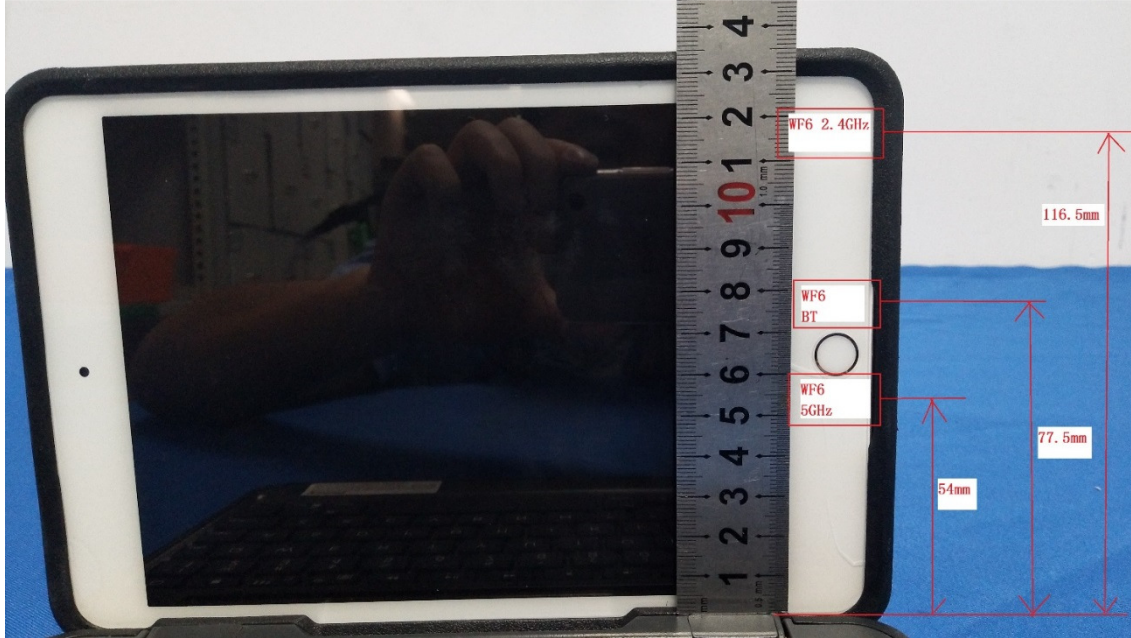
Front view:



The separation distances between the Ipad mini 5's WF1 antennas to the upper edge of the EUT



The separation distances between the Ipad Mini 5's WF6 antennas to the upper edge of the EUT



3 According to KDB 447498 section 4.3.1 a), For 100 MHz to 6 GHz and test separation distances ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR, where $f(\text{GHz})$ is the RF channel transmit frequency in GHz

For BT of the EUT

the max. average power of channel, including tune-up tolerance(mW) is 1.31 mW (1.16dBm) @ 2402MHz (With Tune-up tolerance),

The min. test separation distance (mm) is 5 mm,

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] = 0.41 \leq 3.0$.

For WLAN 2.4GHz:

WF1 antenna:

$(\text{max. power of channel, including tune-up tolerance, mW}) / 50 \cdot [\sqrt{2.412}] \leq 3.0$,

max. power of channel, (including tune-up tolerance)=96.58mW

WF6 antenna:

$(\text{max. power of channel, including tune-up tolerance, mW}) / 50 \cdot [\sqrt{2.412}] \leq 3.0$,

max. power of channel, (including tune-up tolerance)=96.58mW

For WLAN 5GHz:

For WF1 antenna:

$(\text{max. power of channel, including tune-up tolerance, mW}) / 50 \cdot [\sqrt{5.23}] \leq 3.0$,

max. power of channel, (including tune-up tolerance)=65.59mW

For WF6 Antenna:

$(\text{max. power of channel, including tune-up tolerance, mW}) / 50 \cdot [\sqrt{5.23}] \leq 3.0$,

max. power of channel, (including tune-up tolerance)=65.59mW

For BT:

WF1 antenna:

$(\text{max. power of channel, including tune-up tolerance, mW}) / 50 \cdot [\sqrt{2.402}] \leq 3.0$,

max. power of channel, (including tune-up tolerance)=96.78mW

WF6 antenna:

$(\text{max. power of channel, including tune-up tolerance, mW}) / 50 \cdot [\sqrt{2.402}] \leq 3.0$,

max. power of channel, (including tune-up tolerance)=96.78mW



4 According to KDB 447498 section 4.3.1 b), For 100 MHz to 6 GHz and test separation distances > 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:

$\{[Power\ allowed\ at\ numeric\ threshold\ for\ 50\ mm\ in\ step\ a)] + [(test\ separation\ distance - 50\ mm) \cdot (f(MHz)/150)]\}$ mW, for 100 MHz to 1500 MHz

$\{[Power\ allowed\ at\ numeric\ threshold\ for\ 50\ mm\ in\ step\ a)] + [(test\ separation\ distance - 50\ mm) \cdot 10]\}$ mW, for > 1500 MHz and ≤ 6 GHz

For WLAN 2.4GHz

So for WF1 antenna:

calculation limit = $96.58 + (116.5 - 50) \cdot (10) = 761.58\text{mW}$

Then the Max. average power (including tune-up tolerance) is $31.62\text{mW} < 761.58\text{mW}$

So for WF6 antenna:

calculation limit = $96.58 + (116 - 50) \cdot (10) = 761.58\text{mW}$

Then the Max. average power (including tune-up tolerance) is $44.67\text{mW} < 761.58\text{mW}$

For WLAN 5GHz

So for WF1 antenna:

calculation limit = $65.59 + (77.5 - 50) \cdot (10) = 340.59\text{mW}$

Then the Max. average power (including tune-up tolerance) is $50.12\text{mW} < 340.59\text{mW}$

So for WF6 antenna:

calculation limit = $65.59 + (77.5 - 50) \cdot (10) = 340.59\text{mW}$

Then the Max. average power (including tune-up tolerance) is $44.67\text{mW} < 340.59\text{mW}$

For BT

So for WF1 antenna:

calculation limit = $96.78 + (54 - 50) \cdot (10) = 136.78\text{mW}$

Then the Max. average power (including tune-up tolerance) is $45.19\text{mW} < 136.78\text{mW}$

So for WF6 antenna:

calculation limit = $96.78 + (54 - 50) \cdot (10) = 1396.78\text{mW}$

Then the Max. average power (including tune-up tolerance) is $49.43\text{mW} < 136.78\text{mW}$



5 According to KDB 447498 section 4.3.2 b), when an antenna qualifies for the standalone SAR test exclusion of 4.3.1 and also transmits simultaneously with other antennas, the standalone SAR value must be estimated according to the following to determine the simultaneous transmission SAR test exclusion criteria:

- (1) $[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})/x}] \text{ W/kg}$, for test separation distances $\leq 50 \text{ mm}$; where $x = 7.5$ for 1-g SAR and $x = 18.75$ for 10-g SAR.
- (2) 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distance is $>50\text{mm}$

For BT of the EUT, the max. average power of channel, including tune-up tolerance(mW) is 1.31 mW (1.16dBm) @ 2402MHz (With Tune-up tolerance),

The min. test separation distance (mm) is 5 mm,

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})/x}] = 0.0541$.

So, the estimated SAR1 for EUT is 0.0541 W/kg (1-g).

Refer to page 6 of SAR test report of Ipad Mini 5(FCC ID:BCGA2133)

Table 1-2
Simultaneous Transmission Scenarios

No.	Capable Transmit Configuration	Body
1	2.4 GHz Wi-Fi MIMO	Yes
2	5 GHz Wi-Fi MIMO	Yes
3	2.4 GHz Bluetooth + 5 GHz Wi-Fi	Yes
4	2.4 GHz Bluetooth + 5 GHz Wi-Fi MIMO	Yes

1. 2.4 GHz WLAN and 2.4 GHz Bluetooth cannot transmit simultaneously.
2. This device supports 2x2 MIMO Tx for WLAN. 802.11a/g/n/ac supports CDD and 802.11 n/ac additionally supports SDM. Each WLAN antenna can transmit independently or together when operating with MIMO.
3. 2.4 GHz WLAN and 5 GHz WLAN cannot transmit simultaneously.
4. This device supports VoWiFi.

The worst case of simultaneous transmission status is **2.4GHz Bluetooth + 5GHz Wi-Fi MIMO**



For WF6 Antenna (2.4GHz Bluetooth) of the Ipad Mini 5, the max. output power of channel, including tune-up tolerance(mW) is 49.43 mW (16.94dBm) @ 2402MHz (With Tune-up tolerance),
The min. test separation distance (mm) is 77.5mm>50mm,
So, the estimated SAR2 for WiFi of the Ipad Pro is 0.4W/kg (1-g).

For WF1 antenna (5GHz Wi-Fi) of the Ipad Mini 5, the max. output power of channel, including tune-up tolerance(mW) is 50.12 mW (17dBm) @ 5230MHz (With Tune-up tolerance),
The min. test separation distance (mm) is 54mm>50mm,
So, the estimated SAR3 for WiFi of the Ipad Pro is 0.4W/kg (1-g).

For WF6 antenna (5GHz Wi-Fi) of the Ipad Mini 5, the max. output power of channel, including tune-up tolerance(mW) is 44.67 mW (16.50dBm) @ 5230MHz (With Tune-up tolerance),
The min. test separation distance (mm) is 54mm>50mm,
So, the estimated SAR4 for WiFi of the Ipad Pro is 0.4W/kg (1-g).

The sum of SAR is (SAR1+SAR2+SAR3+SAR4) = (0.0541+0.4+0.4+0.4) = 1.2541 W/kg (1-g) <1.6 W/kg (1-g)

In conclusion, the SAR evaluation is not required.

- End of the Report -

