

RF Exposure Evaluation Report

Report Reference No......: **MTEB23070019-H**

FCC ID..... : **2ATYP-HK9600**

Compiled by

(position+printed name+signature)...: File administrators Alisa Luo



Supervised by

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Approved by

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Date of issue.....: Jul.04,2023

Representative Laboratory Name.: **Shenzhen Most Technology Service Co., Ltd.**

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Applicant's name.....: **Shiji (US) Inc.**

Address: 730 Peachtree Street NE, Suite 375, Atlanta, Georgia, 30319,
United States

Test specification/ Standard: **47 CFR Part 1.1307;47 CFR Part 1.1310**
KDB447498D01 General RF Exposure Guidance v06

TRF Originator.....: Shenzhen Most Technology Service Co., Ltd.

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Test item description: POS COMPUTER

Trade Mark: Shiji

Manufacturer: Shiji (US) Inc.

Model/Type reference.....: HK9600

Listed Models: HK960U, HK968, HK968U

Modulation Type: GFSK

CCK/DSSS/ OFDM

GFSK, $\pi/4$ DQPSK, 8DPSK

OFDM

ASK

Operation Frequency.....: From 2402MHz to 2480MHz

From 2412 - 2462MHz

From 2402MHz to 2480MHz

From 5180MHz-5240MHz; 5745MHz-5825MHz

13.56MHz

Hardware Version.....: MTGU3BP

Software Version: F4e

Rating: DC 24V (by Adapter)

Result.....: PASS

TEST REPORT

Equipment under Test : POS COMPUTER

Model /Type : HK9600

Listed Models HK960U, HK968, HK968U

Remark All models are identical to each other, except model name.

Applicant : **Shiji (US) Inc.**

Address : 730 Peachtree Street NE, Suite 375, Atlanta, Georgia, 30319, United States

Manufacturer : **Shiji (US) Inc.**

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Test Result:	PASS
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The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

1. Revision History

Revision	Issue Date	Revisions	Revised By
00	2023-07-04	Initial Issue	Alisa Luo

2. SAR Evaluation

2.1 RF Exposure Compliance Requirement

2.1.1 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.

2.1.2 Limits

According to FCC Part1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in part1.1307(b)

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 Exposures				
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
300–1500			f/300	6
1500–100,000			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
300–1500			f/1500	30
1500–100,000			1.0	30

F= Frequency in MHz

Friis Formula

Friis transmission formula: $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2)$ Where

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

P_d is the limit of MPE, 1 mW/cm². If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

2.1.3 EUT RF Exposure

Antenna Gain: 1.8dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.4 in linear scale. Output Power Into Antenna & RF Exposure Evaluation Distance:

BLE

GFSK			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
Lowest(2402MHz)	4.187	4.187 ± 1	5.187
Middle(2440MHz)	-1.135	-1.135 ± 1	-0.135
Highest(2480MHz)	5.807	5.807 ± 1	6.807

Worst case: GFSK						
Channel	Maximum Peak Conducted Output Power (dBm)	Maximum Peak Conducted Output Power (MW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
Highest(2480 MHz)	6.807	4.79	1.8	0.0014	1.0	Pass

Note: 1) Refer to report **MTEB23070019-R1** for EUT test Max Conducted average Output Power value.Note: 2) $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2) = (4.79 \cdot 1.5) / (4 \cdot 3.1416 \cdot 20^2) = 0.0014$

Antenna Gain: 1.8dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.4 in linear scale. Output Power Into Antenna & RF Exposure Evaluation Distance:

BT classic

GFSK			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
Lowest(2402MHz)	1.505	1.505 ± 1	2.505
Middle(2441MHz)	2.106	2.106 ± 1	3.106
Highest(2480MHz)	3.175	3.175 ± 1	4.175

$\pi/4$ DQPSK			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
Lowest(2402MHz)	2.460	2.460 ± 1	3.46
Middle(2441MHz)	2.972	2.972 ± 1	3.972
Highest(2480MHz)	3.972	3.972 ± 1	4.972

8DPSK			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
Lowest(2402MHz)	2.759	2.759 ± 1	3.759
Middle(2441MHz)	3.285	3.285 ± 1	4.285
Highest(2480MHz)	4.338	4.338 ± 1	5.338

Worst case: 8DPSK						
Channel	Maximum Peak Conducted Output Power (dBm)	Maximum Peak Conducted Output Power (MW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
Highest(2480 MHz)	5.338	3.42	1.8	0.0010	1.0	Pass

Note: 1) Refer to report **MTEB23070019-R** for EUT test Max Conducted average Output Power value.

Note: 2) $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2) = (3.42 \cdot 1.5) / (4 \cdot 3.1416 \cdot 20^2) = 0.0010$

Note: 3) EUT's Bluetooth module is more than 20cm away from the human body.

Antenna Gain A: 2.58dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.4 in linear scale. Output Power Into Antenna & RF Exposure Evaluation Distance:

WIFI 2.4G

802.11b			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
Lowest(2412MHz)	15.82	15.82 ± 1	16.82
Middle(2437MHz)	15.24	15.24 ± 1	16.24
Highest(2462MHz)	13.00	13.00 ± 1	14

802.11g			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
Lowest(2412MHz)	16.67	16.67 ± 1	17.67
Middle(2437MHz)	17.29	17.29 ± 1	18.29
Highest(2462MHz)	14.28	14.28 ± 1	15.28

802.11n(H20)			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
Lowest(2412MHz)	17.67	17.67 ± 1	18.67
Middle(2437MHz)	18.21	18.21 ± 1	19.21
Highest(2462MHz)	15.24	15.24 ± 1	16.24

802.11n(H40)			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
Lowest(2422MHz)	15.62	15.62 ± 1	16.62
Middle(2437MHz)	17.03	17.03 ± 1	18.03
Highest(2452MHz)	14.94	14.94 ± 1	15.94

WIFI 2.4G

Worst case: 802.11n(H20)						
Channel	Maximum tune-up Power (dBm)	Maximum tune-up Power (MW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
Middle(2437MHz)	19.21	83.37	2.58	0.0300	1.0	Pass

Note: 1) Refer to report **MTEB23070019-R2** for EUT test Max Conducted average Output Power value.

Note: 2) $P_d = (P_{out} * G) / (4 * \pi * R^2) = (83.37 * 1.81) / (4 * 3.1416 * 20^2) = 0.0300$

Antenna Gain B: 1.89

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.4 in linear scale. Output Power Into Antenna & RF Exposure Evaluation Distance:

WIFI 2.4G

802.11b			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
Lowest(2412MHz)	13.97	13.97 ± 1	14.97
Middle(2437MHz)	14.84	14.84 ± 1	15.84
Highest(2462MHz)	13.20	13.20 ± 1	14.2

802.11g			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
Lowest(2412MHz)	16.68	16.68 ± 1	17.68
Middle(2437MHz)	17.15	17.15 ± 1	18.15
Highest(2462MHz)	14.42	14.42 ± 1	15.42

802.11n(H20)			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
Lowest(2412MHz)	17.93	17.93 ± 1	18.93
Middle(2437MHz)	17.09	17.09 ± 1	18.09
Highest(2462MHz)	14.19	14.19 ± 1	15.19

802.11n(H40)			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
Lowest(2422MHz)	15.72	15.72 ± 1	16.72
Middle(2437MHz)	16.40	16.40 ± 1	17.4
Highest(2452MHz)	14.66	14.66 ± 1	15.66

WIFI 2.4G

Worst case: 802.11n(H20)						
Channel	Maximum tune-up Power (dBm)	Maximum tune-up Power (MW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
Middle(2412MHz)	18.93	78.16	1.89	0.0241	1.0	Pass

Note: 1) Refer to report **MTEB23070019-R2** for EUT test Max Conducted average Output Power value.

Note: 2) $P_d = (P_{out} * G) / (4 * \pi * R^2) = (78.16 * 1.55) / (4 * 3.1416 * 20^2) = 0.0241$

Antenna Gain A+ Antenna Gain B:2.58dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.4 in linear scale. Output Power Into Antenna & RF Exposure Evaluation Distance:

WIFI 2.4G

802.11n(H20)			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
Lowest(2412MHz)	14.25	14.25 ± 1	15.25
Middle(2437MHz)	14.36	14.36 ± 1	15.36
Highest(2462MHz)	14.13	14.13 ± 1	15.13

802.11n(H40)			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
Lowest(2422MHz)	13.84	13.84 ± 1	14.84
Middle(2437MHz)	15.67	15.67 ± 1	16.67
Highest(2452MHz)	14.46	14.46 ± 1	14.46

WIFI 2.4G

Worst case: 802.11n(H40)						
Channel	Maximum tune-up Power (dBm)	Maximum tune-up Power (MW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
Middle(2412MHz)	16.67	46.45	2.58	0.017	1.0	Pass

Note: 1) Refer to report MTEB23070019-R2 for EUT test Max Conducted average Output Power value.

Note: 2) $P_d = (P_{out} * G) / (4 * \pi * R^2) = (46.45 * 1.81) / (4 * 3.1416 * 20^2) = 0.017$

Antenna Gain A: 1.93dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.4 in linear scale. Output Power Into Antenna & RF Exposure Evaluation Distance:

WIFI 5G

IEEE for 802.11a			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
149	14.042	14.042±1	15.042
157	12.843	12.843±1	13.843
165	13.544	13.544± 1	14.544

IEEE for 802.11n(HT20)			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
149	14.014	14.014±1	15.014
157	12.840	12.840 ±1	13.84
165	13.341	13.341 ± 1	14.341

IEEE for 802.11n(HT40)			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
151	13.234	13.234±1	14.234
159	12.664	12.664 ± 1	13.664

IEEE for 802.11ac(HT20)			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
149	13.969	13.969±1	14.969
157	12.768	12.768±1	13.768
165	13.299	13.299± 1	14.299

IEEE for 802.11 ac(HT40)			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
151	18.211	18.211±1	19.211
159	11.679	11.679 ±1	12.679

IEEE for 802.11ac(HT80)			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
155	11.526	11.526±1	12.526

Worst case: IEEE for 802.11 ac(HT40)						
Channel	Maximum Peak Conducted Output Power	Maximum Peak Conducted Output Power	Antenna Gain	Power Density at R = 20 cm	Limit	Result
	(dBm)	(MW)	(dBi)	(mW/cm ²)		
Lowest (5755MHz)	19.211	83.39	1.93	0.026	1.0	Pass

Note: 1) Refer to report **MTEB23070019-R4** for EUT test Max Conducted average Output Power value.

Note: 2) $P_d = (P_{out} * G) / (4 * \pi * R^2) = (83.39 * 1.56) / (4 * 3.1416 * 20^2) = 0.026$

Antenna Gain B:0.88dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.4 in linear scale. Output Power Into Antenna & RF Exposure Evaluation Distance:

WIFI 5G

IEEE for 802.11a			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
149	13.365	13.365±1	14.365
157	12.142	12.142±1	13.142
165	12.564	12.564± 1	13.564

IEEE for 802.11n(HT20)			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
149	13.212	13.212±1	14.212
157	11.871	11.871±1	12.871
165	12.407	12.407 ± 1	13.407

IEEE for 802.11n(HT40)			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
151	12.562	12.562±1	13.562
159	11.823	11.823 ± 1	12.823

IEEE for 802.11ac(HT20)			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
149	13.186	13.186±1	14.186
157	11.861	11.861±1	12.861
165	12.406	12.406± 1	13.406

IEEE for 802.11 ac(HT40)			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
151	11.601	11.601±1	12.601
159	10.833	10.833 ±1	11.833

IEEE for 802.11ac(HT80)			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
155	9.747	9.747±1	10.747

Worst case: IEEE for 802.11a						
Channel	Maximum Peak Conducted Output Power	Maximum Peak Conducted Output Power	Antenna Gain	Power Density at R = 20 cm	Limit	Result
	(dBm)	(MW)	(dBi)	(mW/cm ²)		
Lowest (5745MHz)	14.365	27.32	0.88	0.0066	1.0	Pass

Note: 1) Refer to report **MTEB23070019-R4** for EUT test Max Conducted average Output Power value.

Note: 2) $P_d = (P_{out} * G) / (4 * \pi * R^2) = (27.32 * 1.22) / (4 * 3.1416 * 20^2) = 0.0066$

Antenna Gain A+ Antenna Gain B:1.93dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.4 in linear scale. Output Power Into Antenna & RF Exposure Evaluation Distance:

WIFI 5G

IEEE for 802.11n(HT20)			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
149	15.482	15.482 ± 1	16.482
157	16.168	16.168 ± 1	17.168
165	16.796	16.796 ± 1	17.796

IEEE for 802.11n(HT40)			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
151	12.385	12.385 ± 1	13.385
159	15.751	15.751 ± 1	16.751

IEEE for 802.11ac(HT20)			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
149	14.703	14.703 ± 1	15.703
157	15.221	15.221 ± 1	16.221
165	13.628	13.628 ± 1	14.628

IEEE for 802.11 ac(HT40)			
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
151	12.189	12.189 ± 1	13.189
159	11.377	11.377 ± 1	12.377

IEEE for 802.11ac(HT80)			
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Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power
			(dBm)
155	13.942	13.942 ± 1	14.942

Worst case: IEEE for 802.11n(HT20)						
Channel	Maximum Peak Conducted Output Power	Maximum Peak Conducted Output Power	Antenna Gain	Power Density at R = 20 cm	Limit	Result
	(dBm)	(MW)	(dBi)	(mW/cm ²)		
Lowest (5745MHz)	17.796	62.52	1.93	0.019	1.0	Pass

Note: 1) Refer to report **MTEB23070019-R4** for EUT test Max Conducted average Output Power value.

Note: 2) $P_d = (P_{out} * G) / (4 * \pi * R^2) = (62.52 * 1.56) / (4 * 3.1416 * 20^2) = 0.019$

NFC:

The worst case (refer to report **MTEB23070019-R3**) is below:

Antenna polarization: Horizontal		
Frequency (MHz)	Level (dBuV/m)	Polarization
13.56	78.6	Peak

$$E = EIRP - 20 \log d + 104.8$$

E: is the electric field strength in dBuV/m

EIRP: is the equivalent isotropically radiated power in dBm

d: is the specified measurement distance in m

d=3m

$$EIRP = 78.6 + 20 \log 3 - 104.8 = -16.66 \text{ dBm}$$

13.56MHz < 30MHz, Add a 6DB maximum ground factor.

$$EIRP = -16.66 \text{ dBm} + 6 = -10.66 \text{ dBm}$$

The EIPR of the product is small enough, RF Exposure meets the requirements.

.....**THE END OF REPORT**.....