

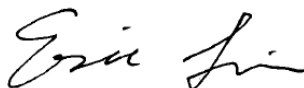
1 Cover Page

RF Exposure Evaluation Report

Application No.: KSCR2206001003AT
FCC ID: 2AXVM-HM-TP21XX
IC: 26572-HMTP21XX
Applicant: Hangzhou Microimage Software Co.,Ltd
Address of Applicant: Room 313, Unit B, Building 2, 399 Danfeng Road, Xixing Subdistrict, Binjiang District, Hangzhou, Zhejiang
Manufacturer: Hangzhou Microimage Software Co.,Ltd
Address of Manufacturer: Room 313, Unit B, Building 2, 399 Danfeng Road, Xixing Subdistrict, Binjiang District, Hangzhou, Zhejiang
Factory: Hangzhou Microimage Intelligent Technology Co., Ltd.
Address of Factory: Floor 2, Building A1, 299 Qiushi Road, Tonglu Economic Development Zone, Tonglu County, Hangzhou City, Zhejiang Province
Equipment Under Test (EUT):
EUT Name: Handheld Thermography Camera
Model No.: Refer for page 2
Trade mark: Hikmicro
Standard(s) : FCC Rules 47 CFR §2.1093
 KDB 447498 D04 interim General RF Exposure Guidance v01
 RSS-102 Issue 5 Amendment 1 (February 2, 2021)
Date of Receipt: 2022-06-20
Date of Test: 2022-06-21 to 2022-07-21
Date of Issue: 2022-07-21

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



Eric Lin
EMC Laboratory Manager



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Model No:

HM-TP21-6VF/W-M10, HM-TP23-10VF/W-M30, HM-TP21B-6VF/W, HM-TP21B-6VF HM-TP22-7VF/W, HM-TP22-7VF/W-M20, HM-TP21-6VF/W-M10UHK, HM-TP23-10VF/W-M30UHK, HM-TP21B-6VF/WUHK, HM-TP21B-6VUFUHK, HM-TP22-7VF/WUHK, HM-TP22-7VF/W-M20UHK, HM-TP21-6VF/W-M10CKV, HM-TP23-10VF/W-M30CKV, HM-TP21B-6VF/WCKV, HM-TP21B-6VFCCKV, HM-TP22-7VF/WCKV, HM-TP22-7VF/W-M20CKV, HM-TP21-6VF/W-M10UVS, HM-TP23-10VF/W-M30UVS, HM-TP21B-6VF/WUVS, HM-TP21B-6VUFUVS, HM-TP22-7VF/WUVS, HM-TP22-7VF/W-M20UVS, HM-TP21-6VF/W-M10KVO, HM-TP23-10VF/W-M30KVO, HM-TP21B-6VF/WKVO, HM-TP21B-6VFKVO, HM-TP22-7VF/WKVO, HM-TP22-7VF/W-M20KVO, HM-TP21-6VF/W-M10HUN, HM-TP23-10VF/W-M30HUN, HM-TP21B-6VF/WHUN, HM-TP21B-6VFHUN, HM-TP22-7VF/WHUN, HM-TP22-7VF/W-M20HUN, HM-TP21-6VF/W-M10/9, HM-TP23-10VF/W-M30/9

For IC Model No: HM-TP21-6VF/W-M10
HVIN: HMTP216VFWM10



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Revision Record			
Version	Description	Date	Remark
00	Original	2022-07-21	/

Authorized for issue by:			
		<i>Tommie Tang</i>	
		<hr/>	
		Tommie_Tang/Project Engineer	
		<i>Eric Lin</i>	
		<hr/>	
		Eric Lin/Reviewer	



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2 Contents

	Page
1 COVER PAGE	1
2 CONTENTS	4
3 GENERAL INFORMATION	5
3.1 GENERAL DESCRIPTION OF E.U.T.	5
3.2 DETAILS OF E.U.T.	5
3.3 TEST LOCATION.....	8
3.4 TEST FACILITY.....	8
4 FCC RADIOFREQUENCY RADIATION EXPOSURE LIMITS	10
4.1 BLANKET 1 MW BLANKET EXEMPTION	10
4.2 MPE-BASED EXEMPTION	10
4.3 SAR-BASED EXEMPTION.....	11
5 MEASUREMENT AND CALCULATION	15
5.1 MAXIMUM TRANSMIT POWER	15
5.2 RF EXPOSURE CALCULATION.....	16



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3 General Information

3.1 General Description of E.U.T.

Power supply:	DC 5V by USB or DC 3.7V by rechargeable Li-ion battery Battery Model: E097-13-1S1P26650 Voltage: 3.7V Capacity: 5Ah Energy: 18.5Wh
Serial Number:	240185725
Firmware Version:	V1.0.0.0 build191210
Product Type:	<input checked="" type="checkbox"/> Portable device
	<input type="checkbox"/> Mobile device
	<input type="checkbox"/> Fixed device

3.2 Details of E.U.T.

2.4G

Operation Frequency:	802.11b/g/n(HT20): 2412MHz to 2462MHz;802.11n(HT40): 2422MHz to 2452MHz
Modulation Type:	802.11b: DSSS (CCK, DQPSK, DBPSK);802.11g/n: OFDM (64QAM, 16QAM, QPSK, BPSK)
Number of Channels:	802.11b/g/n(HT20):11;802.11n(HT40):7
Channel Spacing:	5MHz
Antenna Type:	FPC Antenna
Antenna Gain:	2.75dBi (Provided by the manufacturer)



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BT

Operation Frequency:	2402MHz to 2480MHz
Bluetooth Version:	V4.2 Dual mode
Modulation Type:	GFSK, pi/4DQPSK, 8DPSK
Data rate:	1/2/3Mbps
Number of Channels:	79
Channel Spacing:	1MHz
Spectrum Spread Technology:	Frequency Hopping Spread Spectrum(FHSS)
Antenna Type:	FPC Antenna
Antenna Gain:	2.75dBi (Provided by the manufacturer)

BLE

Operation Frequency:	2402MHz to 2480MHz
Bluetooth Version:	V4.2 Dual mode
Modulation Type:	GFSK
Data Rate:	1Mbps
Number of Channels:	40
Channel Spacing:	2MHz
Antenna Type:	FPC Antenna
Antenna Gain:	2.75dBi (Provided by the manufacturer)



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3.3 Separation Distance

Separation distance between the antenna to person (R):	5mm
Remark: This minimum test separation distance is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander.	



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3.4 Test Location

All tests were performed at:

Compliance Certification Services (Kunshan) Inc.

No.10 Weiye Rd, Innovation park, Eco&Tec, Development Zone, Kunshan City, Jiangsu, China.

Tel: +86 512 5735 5888

Fax: +86 512 5737 0818

No tests were sub-contracted.

Note:

1.SGS is not responsible for wrong test results due to incorrect information (e.g. max. clock frequency, highest internal frequency, antenna gain, cable loss, etc) is provided by the applicant. (if applicable).

2.SGS is not responsible for the authenticity, integrity and the validity of the conclusion based on results of the data provided by applicant. (if applicable).



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3.5 Test Facility

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

- **CNAS (No. CNAS L4354)**

CNAS has accredited Compliance Certification Services (Kunshan) Inc. to ISO/IEC 17025:2017 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. 2541.01)**

Compliance Certification Services (Kunshan) Inc. is accredited by the American Association for Laboratory Accreditation (A2LA). Certificate No. 2541.01.

- **FCC (Designation Number: CN1172)**

Compliance Certification Services (Kunshan) Inc. has been recognized as an accredited testing laboratory.

Designation Number: CN1172.

- **ISED (CAB identifier: CN0072)**

Compliance Certification Services (Kunshan) Inc. has been recognized by Innovation, Science and Economic Development Canada (ISED) as an accredited testing laboratory.

Company Number: 2324E

- **VCCI (Member No.: 1938)**

The 3m and 10m Semi-anechoic chamber and Shielded Room of Compliance Certification Services (Kunshan) Inc. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-20134, R-11600, C-11707, T-11499, G-10216 respectively.



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4 FCC Radiofrequency radiation exposure limits

Test exemptions apply for devices used in general population/uncontrolled exposure environments, according to the SAR-based, or MPE-based exemption thresholds.

4.1 Blanket 1 mW Blanket Exemption

The 1 mW Blanket Exemption of §1.1307(b)(3)(i)(A) applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power of no more than 1 mW, regardless of separation distance.

The 1-mW blanket exemption applies at separation distances less than 0.5 cm, including where there is no separation. This exemption shall not be used in conjunction with other exemption criteria other than those for multiple RF sources in paragraph §1.1307(b)(3)(ii)(A).

The 1-mW exemption is independent of service type and covers the full range of 100 kHz to 100 GHz, but it shall not be used in conjunction with other exemption criteria or in devices with higher-power transmitters operating in the same time-averaging period. Exposure from such higher-power transmitters would invalidate the underlying assumption that exposure from the lower-power transmitter is the only contributor to SAR in the relevant volume of tissue.

4.2 MPE-based Exemption

General frequency and separation-distance dependent MPE-based effective radiated power (ERP) thresholds are in Table B.1 [Table 1 of §1.1307(b)(1)(i)(C)] to support an exemption from further evaluation from 300 kHz through 100 GHz.

Table B.1—Thresholds For Single RF Sources Subject to Routine Environmental Evaluation

RF Source Frequency			Minimum Distance			Threshold ERP
f_L MHz		f_H MHz	$\lambda_L / 2\pi$		$\lambda_H / 2\pi$	W
0.3	–	1.34	159 m	–	35.6 m	1,920 R ²
1.34	–	30	35.6 m	–	1.6 m	3,450 R ² /f ²
30	–	300	1.6 m	–	159 mm	3.83 R ²
300	–	1,500	159 mm	–	31.8 mm	0.0128 R ² f
1,500	–	100,000	31.8 mm	–	0.5 mm	19.2R ²

Subscripts L and H are low and high; λ is wavelength.
From §1.1307(b)(3)(i)(C), modified by adding Minimum Distance columns.

The table applies to any RF source (i.e. single fixed, mobile, and portable transmitters) and specifies power and distance criteria for each of the five frequency ranges used for the MPE limits. These criteria apply at separation distances from any part of the radiating structure of at least $\lambda/2\pi$. The thresholds are



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based on the general population MPE limits with a single perfect reflection, outside of the reactive near-field, and in the main beam of the radiator.

For mobile devices that are not exempt per Table B.1 [Table 1 of §1.1307(b)(1)(i)(C)] at distances from 20 cm to 40 cm and in 0.3 GHz to 6 GHz, evaluation of compliance with the exposure limits in §1.1310 is necessary if the ERP of the device is greater than ERP_{20cm} in Formula (B.1) [repeated from §2.1091(c)(1); also in §1.1307(b)(1)(i)(B)].

$$P_{th} \text{ (mW)} = ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases} \quad (\text{B. 1})$$

If the ERP is not easily obtained, then the available maximum time-averaged power may be used (i.e., without consideration of ERP only if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole.

SAR-based exemptions are constant at separation distances between 20 cm and 40 cm to avoid discontinuities in the threshold when transitioning between SAR-based and MPE-based exemption criteria at 40 cm, considering the importance of reflections.

Limit calculation			
Frequency range	Frequency(MHz)	R($\lambda/2\pi$)(m)	Threshold ERP(W)
300~1500MHz	915	0.0522	0.032
1500~10000MHz	2480	0.0193	0.007

4.3 SAR-based Exemption

SAR-based thresholds are derived based on frequency, power, and separation distance of the RF source. The formula defines the thresholds in general for either available maximum time-averaged power or maximum time-averaged ERP, whichever is greater.

If the ERP of a device is not easily determined, such as for a portable device with a small form factor, the applicant may use the available maximum time-averaged power exclusively if the device antenna or radiating structure does not exceed an electrical length of $\lambda/4$.

As for devices with antennas of length greater than $\lambda/4$ where the gain is not well defined, but always less than that of a half-wave dipole (length $\lambda/2$), the available maximum time-averaged power generated by the device may be used in place of the maximum time-averaged ERP, where that value is not known.

The separation distance is the smallest distance from any part of the antenna or radiating structure for all persons, during operation at the applicable ERP. In the case of mobile or portable devices, the separation distance is from the outer housing of the device where it is closest to the antenna.



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The SAR-based exemption formula of §1.1307(b)(3)(i)(B), repeated here as Formula (B.2), applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power or effective radiated power (ERP), whichever is greater, of less than or equal to the threshold P_{th} (mW).

This method shall only be used at separation distances from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by Formula (B.2).

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}}(d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases} \quad (\text{B.2})$$

where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right)$$

and f is in GHz, d is the separation distance (cm), and $ERP_{20\text{cm}}$ is per Formula (B.1).



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Example values shown in Table B.2 are for illustration only.

Table B.2—Example Power Thresholds (mW)

Frequency (MHz)	Distance(mm)									
	5	10	15	20	25	30	35	40	45	50
300	39	65	88	110	129	148	166	184	201	217
450	22	44	67	89	112	135	158	180	203	226
835	9	25	44	66	90	116	145	175	207	240
1900	3	12	26	44	66	92	122	157	195	236
2450	3	10	22	38	59	83	111	143	179	219
3600	2	8	18	32	49	71	96	125	158	195
5800	1	6	14	25	40	58	80	106	136	169

Limit calculation				
Frequency range(GHz)	Frequency(GHz)	X	Distance(cm)	Pth (mW)
For WIFI 1.5~6	2.462	1.903	0.5	2.733
For BT: 1.5~6	2.48	1.905	0.5	2.717

So, for the hand,

The SAR-based exemption threshold for WIFI: $2.733 \times 2.5\text{mW} = 6.83\text{mW}$

The SAR-based exemption threshold for BT: $2.717 \times 2.5\text{mW} = 6.79\text{mW}$



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4.4 IC Radiofrequency radiation exposure limits

According to RSS-102 section 2.5.1, SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance

MHz	5	10	15	20	25	30	35	40	45	50	mm
≤300	71	101	132	162	193	223	254	284	315	345	mW
450	52	70	88	106	123	141	159	177	195	213	
835	17	30	42	55	67	80	92	105	117	130	
1900	7	10	18	34	60	99	153	225	316	431	
2450	4	7	15	30	52	83	123	173	235	309	
3500	2	6	16	32	55	86	124	170	225	290	
5800	1	6	15	27	41	56	71	85	97	106	

Output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in Table 1, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required

So, for the hand, the SAR-based exemption threshold for WIFI and BT is: $4 \times 2.5 \text{mW} = 10 \text{mW}$



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5 Measurement and Calculation

5.1 Maximum transmit power

The Power Data is based on the RF Test Report

KSCR220600100301&KSCR220600100302&KSCR220600100303.

2.4G

Test Mode	Test Channel	Ant	Power [dBm]	Power [mW]
11B	2412	Ant1	2.86	1.93
11B	2437	Ant1	2.93	1.96
11B	2462	Ant1	2.73	1.87
11G	2412	Ant1	2.80	1.91
11G	2437	Ant1	2.55	1.80
11G	2462	Ant1	2.65	1.84
11N20SISO	2412	Ant1	2.68	1.85
11N20SISO	2437	Ant1	2.35	1.72
11N20SISO	2462	Ant1	2.32	1.71
11N40SISO	2422	Ant1	2.35	1.72
11N40SISO	2437	Ant1	2.35	1.72
11N40SISO	2452	Ant1	2.22	1.67

BT

Test Mode	Test Frequency (MHz)	Output Power (dBm)	Reading Power (mW)
GFSK	2402	1.45	1.40
	2441	0.37	1.09
	2480	-0.98	0.80
π/4DQPSK	2402	-2.31	0.59
	2441	-3.23	0.48
	2480	-4.76	0.33
8DPSK	2402	-1.76	0.67
	2441	-2.72	0.53
	2480	-4.26	0.37



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BLE

Test Mode	Test Channel	Power[dBm]	Peak Power (mW)
		1M	1M
BLE	2402	-1.95	0.64
BLE	2440	-2.82	0.52
BLE	2480	-4.53	0.35

5.2 RF Exposure Calculation

For 2.4G WIFI:

The Max Conducted Output Power is 1.96mW. The best case gain of the antenna is 2.75dBi.

2.75dBi logarithmic terms convert to numeric result is nearly 1.88.

For BT:

The Max Conducted Output Power is 1.40mW. The best case gain of the antenna is 2.75dBi.

2.75dBi logarithmic terms convert to numeric result is nearly 1.88.

For BLE:

The Max Conducted Output Power is 0.64mW. The best case gain of the antenna is 2.75dBi.

2.75dBi logarithmic terms convert to numeric result is nearly 1.88.

For FCC:

2.4G WIFI: According to the formula. calculate the power test result:

$$P = 1.96 * 1.88mW = 3.6848mW < 6.83mW$$

BT: According to the formula. calculate the power test result:

$$P = 1.40 * 1.88mW = 2.632mW < 6.79mW$$

BLE: According to the formula. calculate the power test result:

$$P = 0.64 * 1.88mW = 1.2032mW < 6.79mW$$

2.4G WIFI and BT can transmit simultaneously, and $3.6848/6.83 + 2.632/6.79 = 0.93 < 1$, so the device is to qualify for SAR test exemption.



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Remark: we used the maximum power between the conducted power and ERP/EIRP to perform RF exposure exemption evaluation.

	Evaluation method	Separation distance between the antenna to person (R)	Exempt Limit(mW)	Verdict
<input type="checkbox"/>	Blanket 1 mW Blanket Exemption	No distance requirement	1mW	N/A
<input type="checkbox"/>	MPE-based Exemption(ERP)	$(\lambda / 2 \pi) \leq R$	7mW(ERP)	Yes
<input checked="" type="checkbox"/>	SAR-based Exemption(P_{th})	0.5cm	WIFI: 6.83mW BT: 6.79mW	Yes

So, the device is to qualify for SAR test exemption, the exemption report is in lieu of the SAR report.

For IC:

2.4G WIFI: According to the formula. calculate the power test result:

$$P = 1.96 * 1.88mW = 3.6848mW < 10mW$$

BT: According to the formula. calculate the power test result:

$$P = 1.40 * 1.88mW = 2.632mW < 10mW$$

BLE: According to the formula. calculate the power test result:

$$P = 0.64 * 1.88mW = 1.2032mW < 10mW$$

2.4G WIFI and BT can transmit simultaneously, and $3.6848/10 + 2.632/10 = 0.63 < 1$, so the device is to qualify for SAR test exemption.

So the SAR report is not required.

--End of the Report--



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