



## 1 Cover Page

# RF Exposure Evaluation Report

**Application No.:** SHEM2105004480CR  
**FCC ID:** 2A2I2-YMX600AS  
**IC:** 27470-YMX600AS  
**Applicant:** Yimeixu WitChip Energy Hitech Co., Ltd  
**Address of Applicant:** Building 2-4, No 355 Ruifeng Road, Gaozhao Street, Jiaxing, Zhejiang 324000 China  
**Manufacturer:** Yimeixu WitChip Energy Hitech Co., Ltd  
**Address of Manufacturer:** Building 2-4, No 355 Ruifeng Road, Gaozhao Street, Jiaxing, Zhejiang 324000 China  
**Factory:** Yimeixu WitChip Energy Hitech Co., Ltd  
**Address of Factory:** Building 2-4, No 355 Ruifeng Road, Gaozhao Street, Jiaxing, Zhejiang 324000 China  
**Equipment Under Test (EUT):**  
**EUT Name:** Smart photovoltaic optimizer  
**Model No.:** YMX600A  
**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:** 2022-08-04  
**Date of Test:** 2022-08-10 to 2022-10-10  
**Date of Issue:** 2023-01-05

<b>Test Result:</b>	<b>Pass*</b>
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\* In the configuration tested, the EUT complied with the standards specified above.

Parlam Zhan

Parlam Zhan  
Laboratory Manager



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Revision Record			
Version	Description	Date	Remark
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Authorized for issue by:			
		Bill Wu	
		Bill Wu/Project Engineer	
		Parlam Zhan	
		Parlam Zhan / Reviewer	



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t (86-21) 61915666

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### 3 General Information

#### 3.1 General Description of E.U.T.

Power supply:	DC 12-80V
---------------	-----------

#### 3.2 Details of E.U.T.

Operation Frequency:	2420MHz-2465MHz
Modulation Type:	GFSK
Number of Channels:	10
Channel Spacing:	5MHz
Antenna Type:	PCB Antenna
S/N:	2597
Firmware version:	2.29.11

#### 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:

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Tel: +86 21 6191 5666

Fax: +86 21 6191 5678

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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• **FCC (Designation Number: CN1301)**

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• **ISED (CAB Identifier: CN0020)**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been recognized by Innovation, Science and Economic Development Canada (ISED) as an accredited testing laboratory.

ISED#: 8617A.

• **VCCI (Member No.: 3061)**

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t (86-21) 61915666

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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 <sup>2</sup>
1.34	—	30	35.6 m	—	1.6 m	3,450 R <sup>2</sup> /f <sup>2</sup>
30	—	300	1.6 m	—	159 mm	3.83 R <sup>2</sup>
300	—	1,500	159 mm	—	31.8 mm	0.0128 R <sup>2</sup> f
1,500	—	100,000	31.8 mm	—	0.5 mm	19.2R <sup>2</sup>

Subscripts L and H are low and high;  $\lambda$  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 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



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necessary if the ERP of the device is greater than  $ERP_{20\text{cm}}$  in Formula (B.1) [repeated from §2.1091(c)(1); also in §1.1307(b)(1)(i)(B)].

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

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)	$R(\lambda/2\pi)(\text{m})$	Threshold ERP(W)
300~1500MHz	<b>915</b>	0.0522	0.032
1500~100000MHz	<b>2460</b>	0.0194	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.

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  $P_{\text{th}}$  (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).  $P_{\text{th}}$  is given by Formula (B.2).

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

where



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

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

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)
0.3~1.5	<b>0.915</b>	1.474	<b>0.5</b>	<b>8.133</b>
1.5~6	<b>2.46</b>	1.903	<b>0.5</b>	<b>2.735</b>



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## 5 Test Standards and Limits

### 5.1 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.

The practical use condition for this device is as a handheld accessories. So the applicable limit is 10-g extremity SAR

For 2.4G band device, the limit is  $P_{max} \leq 2.5 \times 4 = 10 \text{ mW}$





## 6 Measurement and Calculation

### 6.1 Maximum transmit power

The Power Data is based on the RF Test Report SHEM210500448001

the max average power is  $91.98 \text{ dBuV/m} \approx 0.48 \text{ mW} < 1 \text{ mW (For FCC)} < 10 \text{ mW (For IC)}$

**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 checked="" type="checkbox"/>	Blanket 1 mW Blanket Exemption	No distance requirement	1mW	Yes
<input type="checkbox"/>	MPE-based Exemption(ERP)	$(\lambda / 2 \pi) < R$	7mW(ERP)	N/A
<input type="checkbox"/>	SAR-based Exemption( $P_{th}$ )	$0.5 \text{ cm} < R < 40 \text{ cm}$	2.7mW	N/A

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

--End of the Report--



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SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd.  
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NO.588 West Jindu Road, Songjiang District, Shanghai China 201612  
中国·上海·松江区金都西路588号 邮编: 201612

t (86-21) 61915666  
t (86-21) 61915666

f (86-21) 61915678  
f (86-21) 61915678

[www.sgsgroup.com.cn](http://www.sgsgroup.com.cn)  
[sgs.china@sgs.com](mailto:sgs.china@sgs.com)