

Report No.: KSCR220800138306

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1 Cover Page

RF Exposure Evaluation Report

Application No.:	KSCR2208001383AT
FCC ID:	SVN-HMC5100X
Applicant:	ZHEJIANG DAHUA VISION TECHNOLOGY CO., LTD.
Address of Applicant:	No.1199, Bin'an Road, Binjiang District, Hangzhou, P.R. China
Manufacturer:	ZHEJIANG DAHUA VISION TECHNOLOGY CO., LTD.
Address of Manufacturer:	No.1199, Bin'an Road, Binjiang District, Hangzhou, P.R. China
Equipment Under Test (EUT):	
EUT Name:	HIGH-PERFORMANCE MODULE COMPUTER
	DHI-HMC5100X-H-708C2-W10A-BW,DHI-HMC5100X,
	DH-HMC5100X###################################
	OEM-HMC5100X###################################
	DHI-HMC5100X###################################
Model No.:	HMC5100X###################################
	(The "#" symbols might consist of numbers from 0 to 9, letters from
	A to Z or a to z, "/", "-", space, and null, which indicates different
	sales regions, client codes, or software functions, and the product
	reliability and electromagnetic compatibility remain the same.)
	FCC Rules 47 CFR §2.1091
Standard(s) :	KDB 447498 D04 interim General RF Exposure Guidance v01
Date of Receipt:	2022-08-09
Date of Test:	2022-08-15 to 2022-09-25
Date of Issue:	2022-10-02
Test Result:	Pass*

* In the configuration tested, the EUT complied with the standards specified above.

Ena fri

Eric Lin Laboratory Manager



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Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2022-10-02		Original

Authorized for issue by:		
	Paun. Lin	
	Pawn.Liu/Project Engineer	
	En fri	
	Eric Lin/Reviewer	-



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3 General Information

3.1 General Description of E.U.T.

	DC 12V,7.5A or DC 19V,4.74A
	Adapter model:DPS-90AB-3
	Input:100-240V,1-2A,50/60Hz
Power supply:	Output:12V,7.5A,90W
	Adapter model:FSP090-DIEBN2
	Input:100-240V,1.5A,50/60Hz Output:12V,4.74A

3.2 Details of E.U.T.

2.4G

2.40	
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:	Antenna1:Dipole Antenna with RP-SMA connector,Antenna2:Dipole Antenna with RP-SMA connector
Antenna Gain:	Antenna1:4.43dBi(Provided by the manufacturer), Antenna2:4.43dBi(Provided by the manufacturer) Directional Gain: 7.44dBi

ΒT

ВІ	
Operation Frequency:	2402MHz to 2480MHz
Bluetooth Version:	V5.0 Dual mode
Modulation Type:	GFSK, π/4DQPSK, 8DPSK
Number of Channels:	79
Channel Spacing:	1MHz
Spectrum Spread	Frequency Hopping Spread Spectrum(FHSS)
Technology:	Trequency hopping Spread Spectrum (1133)
Antenna Type:	Antenna1:Dipole Antenna with RP-SMA connector
Antenna Gain:	Antenna1:4.43dBi(Provided by the manufacturer)



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BLE	
Operation Frequency:	2402MHz to 2480MHz
Bluetooth Version:	V5.0 Dual mode
Modulation Type:	GFSK
Number of Channels:	40
Channel Spacing:	2MHz
Data Rate:	1Mbps,2Mbps
Antenna Type:	Antenna1:Dipole Antenna with RP-SMA connector
Antenna Gain:	Antenna1:4.43dBi(Provided by the manufacturer)
5G	
Operation Frequency	U-NII-1: 5180-5240MHz; U-NII-2A: 5260-5320MHz; U-NII-2C: 5500-
(20MHz):	5700MHz; U-NII-3: 5745-5825MHz
Operation Frequency	U-NII-1: 5190-5230MHz; U-NII-2A: 5270-5310MHz; U-NII-2C: 5510-
(40MHz):	5670MHz; U-NII-3: 5755-5795MHz
Operation Frequency	U-NII-1: 5210MHz; U-NII-2A: 5290MHz; U-NII-2C: 5530-5610MHz; U-
(80MHz):	NII-3: 5775MHz
	802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK); 802.11n: OFDM
Moudulation Type:	(BPSK, QPSK, 16QAM, 64QAM); 802.11ac: OFDM (BPSK, QPSK,
	16QAM, 64QAM, 256QAM)
Channel Specing	802.11a/n(HT20)/ac(HT20): 20MHz; 802.11n(HT40)/ac(HT40): 40MHz;
Channel Spacing:	802.11ac(HT80): 80MHz
DFS Function:	Slave without Radar detection
TPC Function:	Without TPC function
Antonno Tuno:	Antenna1:Dipole Antenna with RP-SMA connector,Antenna2:Dipole
Antenna Type:	Antenna with RP-SMA connector



Antenna Gain:

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Antenna1:5.91dBi(Provided by the manufacturer), Antenna2:5.91dBi(Provided by the manufacturer)

Directional Gain: 8.92dBi



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3.3 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).

3.4 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.

RF Sou	urce Fre	equency	Minimum Distance		Threshold ERP	
<i>f</i> ∟ MHz		<i>f</i> ⊢ MHz	λ _L / 2π		λ _Η / 2π	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 R²/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.						

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

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 nearfield, 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)].

$$P_{\rm th} (\rm mW) = ERP_{20 \,\rm cm} (\rm mW) = \begin{cases} 2040f & 0.3 \,\rm GHz \le f < 1.5 \,\rm GHz \\ 3060 & 1.5 \,\rm GHz \le f \le 6 \,\rm GHz \end{cases}$$
(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) $R(N2\pi)$ (m) Threshold ERP(W)						
300~1500MHz	915	0.0522	0.032			
1500~100000MHz	2462	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.



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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).

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

where

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

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





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

		Tab	ole B.2—	Example	Power T	hreshold	ls (mW)			
Frequency					Distan	ce(mm)				
(MHz)	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

For 2.4G WiFi

Limit calculation							
Frequency range(GHz) Frequency(GHz) X Distance(cm) Pth (mW)							
1.5~6	2.462	1.903	20	3060.000			

For 5G WiFi

Limit calculation								
Frequency range(GHz)	Frequency range(GHz) Frequency(GHz) X Distance(cm) Pth (mW)							
1.5~6	5.825	2.090	20	3060.000				

For BT

Limit calculation							
Frequency range(GHz) Frequency(GHz) X Distance(cm) Pth (mW)							
1.5~6 2.48 1.905 20 3060.00							

For BLE

Limit calculation							
Frequency range(GHz) Frequency(GHz) X Distance(cm) Pth (mW)							
1.5~6	1.5~6 2.48 1.905 20 3060.000						



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5 Measurement and Calculation

5.1 Maximum transmit power

The Power Data is based on the RF Test Report KSCR220800138301, KSCR220800138302, KSCR220800138303, KSCR220800138304

_	2.4G WiFi							
		Test	Antenna 1	Antenna 2	MIMO	Antenna 1	Antenna 2	MIMO
	Test Mode	Frequency	Power	Power	Power	Power	Power	Power

	lest	Antenna 1	Antenna 2	MIMO	Antenna 1	Antenna 2	MIIMO
Test Mode	Frequency	Power	Power	Power	Power	Power	Power
	(MHz)	(dBm)	(dBm)	(dBm)	(mW)	(mW)	(mW)
	2412	13.39	13.56	/	21.83	22.70	/
11B	2437	13.23	13.69	/	21.04	23.39	/
	2462	13.69	13.62	/	23.39	23.01	/
	2412	13.45	13.41	/	22.13	21.93	/
11G	2437	13.69	13.41	/	23.39	21.93	/
_	2462	13.73	13.22	/	23.60	20.99	/
	2412	10.94	10.56	13.76	12.42	11.38	23.77
11N20MIMO	2437	10.83	10.87	13.86	12.11	12.22	24.32
	2462	10.45	10.38	13.43	11.09	10.91	22.03
	2412	10.81	10.35	13.60	12.05	10.84	22.91
11N20MIMO	2437	10.22	10.65	13.45	10.52	11.61	22.13
	2462	11.03	10.52	13.79	12.68	11.27	23.93



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BT			-
Test Mode	Test Frequency (MHz)	Output Power (dBm)	Reading Power (mW)
	2402	7.01	5.02
GFSK	2441	6.05	4.03
	2480	6.39	4.36
	2402	9.84	9.64
π/4DQPSK	2441	8.93	7.82
	2480	8.82	7.62
	2402	10.33	10.79
8DPSK	2441	9.41	8.73
	2480	8.86	7.69

BLE

Test Mode	Test Frequency (MHz)	Output Power (dBm)	Output Power (mW)
	2402	7.44	5.55
1M	2442	6.58	4.55
	2480	6.42	4.39
	2402	7.15	5.19
2M	2442	6.20	4.17
	2480	6.06	4.04



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G WiFi Test Mode	Test Frequency (MHz)	Antenna 1 Power (dBm)	Antenna 2 Power (dBm)	MIMO Power (dBm)	Antenna 1 Power (mW)	Antenna 2 Power (mW)	MIMO Power (mW)
	5180	15.14	15.00	/	32.66	31.62	/
	5200	13.98	15.41	/	25.00	34.75	/
	5240	14.82	14.77	/	30.34	29.99	/
	5260	15.17	16.56	/	32.89	45.29	/
	5300	14.55	15.80	/	28.51	38.02	/
44.0	5320	14.84	14.77	/	30.48	29.99	/
11A	5500	14.54	16.03	/	28.44	40.09	/
	5580	13.00	12.97	/	19.95	19.82	/
	5700	14.80	14.60	/	30.20	28.84	/
	5745	14.51	14.53	/	28.25	28.38	/
	5785	14.84	15.18	/	30.48	32.96	/
	5825	14.22	16.00	/	26.42	39.81	/
	5180	11.85	11.83	14.85	15.31	15.24	30.55
	5200	12.12	11.88	15.01	16.29	15.42	31.70
	5240	12.04	12.36	15.21	16.00	17.22	33.19
	5260	14.06	13.67	16.88	25.47	23.28	48.75
	5300	13.30	13.16	16.24	21.38	20.70	42.07
11N20	5320	12.26	12.25	15.27	16.83	16.79	33.65
MIMO	5500	11.85	13.71	15.89	15.31	23.50	38.82
	5580	11.31	14.14	15.96	13.52	25.94	39.45
	5700	13.17	12.93	16.06	20.75	19.63	40.36
	5745	11.77	10.81	14.33	15.03	12.05	27.10
	5785	11.91	11.55	14.74	15.52	14.29	29.79
	5825	11.44	12.31	14.91	13.93	17.02	30.97
	5190	10.17	10.18	13.19	10.40	10.42	20.84
	5230	12.22	12.35	15.30	16.67	17.18	33.88
	5270	13.87	13.59	16.74	24.38	22.86	47.21
11N40 MIMO	5310	12.04	12.21	15.14	16.00	16.63	32.66
	5510	10.89	12.91	15.03	12.27	19.54	31.84
	5550	11.01	13.55	15.47	12.62	22.65	35.24
	5670	12.00	12.56	15.30	15.85	18.03	33.88



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ı ı		I			I	l	1
_	5755	11.62	10.83	14.25	14.52	12.11	26.61
	5795	11.55	11.43	14.50	14.29	13.90	28.18
	5180	12.39	11.99	15.20	17.34	15.81	33.11
- - 11AC20	5200	9.72	9.65	12.70	9.38	9.23	18.62
	5240	12.05	12.30	15.19	16.03	16.98	33.04
	5260	13.42	12.84	16.15	21.98	19.23	41.21
	5300	12.05	12.03	15.05	16.03	15.96	31.99
	5320	12.21	12.40	15.32	16.63	17.38	34.04
MIMO	5500	10.56	12.54	14.67	11.38	17.95	29.31
	5580	10.36	12.88	14.81	10.86	19.41	30.27
	5700	14.65	13.97	17.33	29.17	24.95	54.08
	5745	11.80	10.87	14.37	15.14	12.22	27.35
	5785	11.97	11.56	14.78	15.74	14.32	30.06
	5825	11.63	12.36	15.02	14.55	17.22	31.77
	5190	11.44	11.67	14.57	13.93	14.69	28.64
	5230	12.15	12.58	15.38	16.41	18.11	34.51
	5270	12.44	12.70	15.58	17.54	18.62	36.14
	5310	12.19	12.37	15.29	16.56	17.26	33.81
11N40 MIMO	5510	11.50	13.34	15.53	14.13	21.58	35.73
	5550	11.24	13.98	15.83	13.30	25.00	38.28
	5670	12.95	13.13	16.05	19.72	20.56	40.27
	5755	11.57	10.86	14.24	14.35	12.19	26.55
	5795	11.59	11.45	14.53	14.42	13.96	28.38
	5210	11.56	11.76	14.67	14.32	15.00	29.31
	5290	12.39	12.40	15.41	17.34	17.38	34.75
11AC80 MIMO	5530	11.18	13.49	15.50	13.12	22.34	35.48
	5610	12.19	13.88	16.13	16.56	24.43	41.02
	5775	11.50	11.23	14.38	14.13	13.27	27.42



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5.2 RF Exposure Calculation

2.4G WiFi

The Max Conducted Average Output Power is 23.60 mW for antenna1,. 23.39 mW for antenna2, 24.32 mW for MIMO mode.

. The best case gain of the antenna is 4.43dBi for antenna1 ,4.43dBi for antenna2 and 7.44dBi for Directional Gain:

4.43dBi logarithmic terms convert to numeric result is nearly 2.77

4.43dBi logarithmic terms convert to numeric result is nearly 2.77

7.44dBi logarithmic terms convert to numeric result is nearly 5.55

According to the formula. calculate the EIRP test result:

Antenna1: EIRP= P x G = 23.60 mW x 2.77= 65.37mW

Antenna2: EIRP= P x G = 23.39 mW x 2.77 = 64.79mW

In MIMO mode: EIRP= P x G = 24.32 mW x 5.55= 134.98mW

BT:

The Max Conducted Peak Output Power is 10.79mW,. The best case gain of the antenna is 4.43dBi.

4.43dBi logarithmic terms convert to numeric result is nearly 2.77

According to the formula. calculate the EIRP test result:

EIRP= P x G = 10.79 mW x 2.77 = 29.89mW

BLE:

The Max Conducted Peak Output Power is 5.55mW,. The best case gain of the antenna is 4.43dBi. 4.43dBi logarithmic terms convert to numeric result is nearly 2.77

According to the formula. calculate the EIRP test result:

EIRP= P x G =5.55 mW x 2.77= 15.37mW

5G WiFi

The Max Conducted Average Output Power is 32.89 mW for antenna1,. 45.29 mW for antenna2, 54.08 mW for MIMO mode.

. The best case gain of the antenna is 5.91dBi for antenna1 ,5.91dBi for antenna2 and 8.92dBi for Directional Gain:

5.91dBi logarithmic terms convert to numeric result is nearly 3.90

5.91dBi logarithmic terms convert to numeric result is nearly 3.90.

8.92dBi logarithmic terms convert to numeric result is nearly 7.80

According to the formula. calculate the EIRP test result:

Antenna1: EIRP= P x G = 32.89 mW x 3.90 = 128.27mW

Antenna2: EIRP= P x G = 45.29 mW x 3.90 = 176.63mW

In MIMO mode: EIRP= P x G = 54.08mW x 7.80 = 421.82mW



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The 2.4GHz WiFi,5GHz WiFi,BT can transmit simultaneously, but the maximum rate of MPE is 134.98/3060+29.89/3060+421.82/3060=0.1917≤1.

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

	Evaluation method	Exempt Limit(mW)	Verdict
	Blanket 1 mW Blanket Exemption	1mW	N/A
	MPE-based Exemption(ERP)	7mW(ERP) (2.4GHz Band)	N/A
\boxtimes	SAR-based Exemption(Pth)	3060mW(ERP) (1.5GHz~6GHz)	Yes

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

--End of the Report--



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