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# TEST REPORT

EN62311:2008

Report Reference No. ....: CTL1703042091-WH

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Product Name.....: Khadas VIM

Model/Type reference .....: VIM

List Model(s).....: VIM, VIM Pro

Trade Mark.....: Khadas

Applicant's name .....: Shenzhen Wesion Technology Co., Ltd.

Address of applicant .....: C301, Mingyou Caigou Zhongxin, Baoyuan Road, Xixiang,  
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Test Firm .....: Shenzhen CTL Testing Technology Co., Ltd.

Address of Test Firm .....: Floor 1-A, Baisha Technology Park, No.3011, Shahehexi Road,  
Nanshan District, Shenzhen, China 518055

Test specification.....:

Standard.....: EN62311:2008

TRF Originator .....: Shenzhen CTL Testing Technology Co., Ltd.

Master TRF .....: Dated 2011-01

Date of Receipt.....: Mar. 08, 2017

Date of Test Date.....: Mar. 09, 2017–Mar. 16, 2017

Data of Issue.....: Mar. 17, 2017

Result.....: Pass

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# EMF TEST REPORT

<b>Test Report No. :</b> CTL1703042091-WH	Mar. 17, 2017
	Date of issue

Equipment under Test : Khadas VIM

Model /Type : VIM

Listed Models : VIM, VIM Pro

**Applicant** : **Shenzhen Wesion Technology Co., Ltd.**

Address : C301, Mingyou Caigou Zhongxin, Baoyuan Road,  
Xixiang, Bao'an, Shenzhen, China

**Manufacturer** : **Shenzhen Wesion Technology Co., Ltd.**

Address : C301, Mingyou Caigou Zhongxin, Baoyuan Road,  
Xixiang, Bao'an, Shenzhen, China

<b>Test result</b>	<b>Pass *</b>
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\* In the configuration tested, the EUT complied with the standards specified page 5.

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.

**\*\* Modified History \*\***

Revision	Description	Issued Data	Report No.	Remark
Version 1.0	Initial Test Report Release	2017-03-17	CTL1703042091-WH	Tracy Qi



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# 1 TEST SUMMARY

## 1.1 Test Standards

**EN62311:** Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz – 300 GHz)

Council Recommendation 1999/519/EC of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0Hz to 300GHz) (Official Journal L 197 of 30 July 1999).

## 1.2 Test Facility

### 1.2.1 Address of the test laboratory

Shenzhen CTL Testing Technology Co., Ltd.

Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen 518055 China

There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4 and CISPR 22/EN 55022 requirements.

### 1.2.2 Laboratory accreditation

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

#### IC Registration No.: 9618B

The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration No.: 9618B on November 13, 2013.

#### FCC-Registration No.: 970318

Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 970318, December 19, 2013.

## 1.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen CTL Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for CTL laboratory is reported:

Test Items	Measurement Uncertainty	Notes
Occupied Channel Bandwidth	±2%	(1)
Transmitter power conducted	0.57 dB	(1)
Transmitter power Radiated	2.20 dB	(1)
Conducted spurious emission	1.60 dB	(1)
Radiated spurious emission	2.20 dB	(1)
Temperature	±1°C	(1)
Humidity	±3%	(1)
DC and low frequency voltages	±1.5%	(1)
Time	±2%	(1)
Duty cycle	±2%	(1)

Note 1: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

## 2 GENERAL INFORMATION

### 2.1 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature	Normal Temperature:	25°C
	High Temperature:	55°C
	Low Temperature:	-20°C
Voltage	Normal Voltage	230V
	High Voltage	254V
	Low Voltage	207V
Other	Relative Humidity	55 %
	Air Pressure	101 kPa

### 2.2 General Description of EUT

Product Name:	Khadas VIM
Model/Type reference:	VIM, VIM Pro
Power supply:	USB 5V from PC
<b>WIFI 2.4GHz</b>	
Supported type:	802.11b/802.11g/802.11n(H20)
Modulation:	802.11b: DSSS 802.11g/802.11n(H20): OFDM
Operation frequency:	802.11b/802.11g/802.11n(H20): 2412MHz~2472MHz
Channel number:	802.11b/802.11g/802.11n(H20): 13
Channel separation:	5MHz
Antenna type:	FPC Antenna
Antenna gain:	0dBi
<b>Bluetooth 3.0</b>	
Version:	Supported BT 3.0
Modulation:	GFSK, $\pi/4$ DQPSK, 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	FPC Antenna
Antenna gain:	0dBi
<b>Bluetooth BLE</b>	
Supported type:	Version 4.0 for low Energy
Modulation:	GFSK
Operation frequency:	2402MHz to 2480MHz
Channel number:	40
Channel separation:	2 MHz

Antenna type:	FPC Antenna
Antenna gain:	0dBi

WIFI 5GHz				
	20MHz system	40MHz system	80MHz system	160MHz system
Supported type:	802.11a 802.11n 802.11ac	802.11n 802.11ac	802.11ac	N/A
Operation frequency:	5180MHz-5240MHz	5190MHz-5230MHz	5210MHz	N/A
Modulation:	OFDM	OFDM	OFDM	N/A
Channel number:	4	2	1	N/A
Channel separation:	20MHz	40MHz	80MHz	N/A

Note: For more detailed features description, please refer to the manufacturer's specifications or the User's Manual.



### 3 Method of measurement

#### Limit

Basic restriction for electric, magnetic and electromagnetic fields (0Hz to 300GHz)

Frequency range	Magnetic flux density (mT)	Current density (mA/m <sup>2</sup> )	Whole body average SAR(W/kg)	Localised SAR (head and trunk)(W/kg)	Localised SAR (limbs) (W/kg)	Power density, S (W/m <sup>2</sup> )
0Hz	40	--	--	--	--	--
>0-1Hz	--	8	--	--	--	--
1-4Hz	--	8/f	--	--	--	--
4-1000Hz	--	2	--	--	--	--
1000Hz-100kHz	--	f/500	--	--	--	--
100kHz-10MHz	--	f/500	0.08	2	4	--
10MHz-10GHz	--	--	0.08	2	4	--
10-300GHz	--	--	--	--	--	10

Notes:

1. f is the frequency in Hz.
2. The basic restriction on the current density is intended to protect against acute exposure effects on central nervous system tissues in the head and trunk of the body and includes a safety factor. The basic restrictions for ELF fields are based on established adverse effects on the central nervous system. Such acute effects are essentially instantaneous and there is no scientific justification to modify the basic restrictions for exposure of short duration. However, since the basic restriction refers to adverse effects on the central nervous system, this basic restriction may permit higher current densities in body tissues other than the central nervous system under the same exposure conditions.
3. Because of electrical inhomogeneity of the body, current densities should be averaged over a cross section of 1cm<sup>2</sup> perpendicular to the current direction.
4. For frequencies up to 100 kHz, peak current density values can be obtained by multiplying the rms value by  $\sqrt{2}$ (=1.414). For pulses of duration  $t_p$  the equivalent frequency to apply in the basic restrictions should be calculated as  $f=1/(2t_p)$ .
5. For frequencies up to 100kHz and for pulsed magnetic fields, the maximum current density associated with the pulses can be calculated from the rise/fall times and the maximum rate of change of magnetic flux density. The induced current density can then be compared with the appropriate basic restriction.
6. All SAR values are to be averaged over any six-minute period.
7. Localised SAR averaging mass is any 10g of contiguous tissue; the maximum SAR so obtained should be the value used for the estimation of exposure. These 10g of tissue are intended to be a mass of contiguous tissue with nearly homogeneous electrical properties. In specifying a contiguous mass of tissue, it is recognised that this concept can be used in computational dosimetry but may present difficulties for direct physical measurements. A simple geometry such as cubic tissue mass can be used provided that the calculated dosimetric quantities have conservation values relative to the exposure guidelines.
8. For pulses of duration  $t_p$  the equivalent frequency to apply in the basic restrictions should be calculated as  $f=1/(2t_p)$ . Additionally, for pulsed exposures, in the frequency range 0.3 to 10GHz and for localised exposure of the head, in order to limit and avoid auditory effects caused by thermoelastic expansion, an additional basic restriction is recommended. This is that SA should not exceed 2mJ kg<sup>-1</sup> averaged over 10g of tissue.



Reference levels for electric, magnetic and electromagnetic fields (0Hz to 300GHz, unperturbed rms values)

Frequency range	E-field strength (V/m)	H-field strength (A/m)	B-field (uT)	Equivalent plane wave power density $S_{eq}$ (W/m <sup>2</sup> )
0-1Hz	--	$3.2 \times 10^4$	$4 \times 10^4$	--
1-8Hz	10000	$3.2 \times 10^4 / f^2$	$4 \times 10^4 / f^2$	--
8-25Hz	10000	$4000/f$	$5000/f$	--
0.025-0.8KHz	$250/f$	$4/f$	$5/f$	--
0.8-3KHz	$250/f$	5	6.25	--
3-150KHz	87	5	6.25	--
0.15-1MHz	87	$0.73/f$	$0.92/f$	--
1-10MHz	$87/f^{1/2}$	$0.73/f$	$0.92/f$	--
10-400MHz	28	0.073	0.092	2
400-2000MHz	$1.375f^{1/2}$	$0.0037f^{1/2}$	$0.0046f^{1/2}$	$f/200$
2-300GHz	61	0.16	0.20	10

Notes: 1. As indicated in the frequency range column.

2. For frequencies between 100kHz and 10GHz,  $S_{eq}$ ,  $E^2$ ,  $H^2$  and  $B^2$  are to be averaged over any six-minute period.

3. For frequencies exceeding 10GHz,  $S_{eq}$ ,  $E^2$ ,  $H^2$  and  $B^2$  are to be averaged over any  $68/f^{1.05}$ -minute period (.in GHz).

4. No E-field value is provided for frequencies <1Hz, which are effectively static electric fields. For most people the annoying perception of surface electric charges will not occur at field strengths less than 20kV/m. Spark discharges causing stress or annoyance should be avoided.

### **EMF Assessment Model**

Predication of EMF limit at a given distance

Equation from page 26 of EN 62311, Edition 2008

$$E = \eta_0 H = \frac{\sqrt{30PG(\theta, \phi)}}{r}$$

Where:

E: E-field strength (V/m)

P: power input to antenna (Watt)

G: is the antenna gain relative to an isotropic antenna;

$\theta, \phi$ : are elevation and azimuth angles to point of investigation;

r: is the distance from observation point to the antenna;

$\eta_0$ : is the characteristic impedance of free space.

**Test Result**

From the maximum EUT RF output power, the minimum mobile separation distance,  $r=20\text{cm}$ , as well as the maximum gain of the used antenna is 0.0dBi, the RF power density can be obtained.

**WIFI 2.4GHz**

Test Frequency (MHz)	Minimum Separation Distance (cm)	Output Power (dBm)	Output Power (W)	Antenna Gain (Nemeric)	E-field strength Limit (V/m)	E-field strength At 20 cm (V/m)
2412	20	14.44	0.0278	1.0000	61	4.5659
2442	20	14.56	0.0286	1.0000	61	4.6295
2472	20	14.57	0.0286	1.0000	61	4.6348

**WIFI 5GHz**

Test Frequency (MHz)	Minimum Separation Distance (cm)	Output Power (dBm)	Output Power (W)	Antenna Gain (Nemeric)	E-field strength Limit (V/m)	E-field strength At 20 cm (V/m)
5180	20	10.78	0.0120	1.0000	61	2.9959

**BT**

Modulation Type	Test Frequency (MHz)	Minimum Separation Distance (cm)	Output Power (dBm)	Output Power (W)	Antenna Gain (Nemeric)	E-field strength Limit (V/m)	E-field strength At 20 cm (V/m)
GFSK	Hopping mode	20	3.41	0.0022	1.0000	61	1.2824
$\pi/4$ DQPSK		20	2.96	0.0020	1.0000	61	1.2177
8DPSK		20	2.24	0.0017	1.0000	61	1.1208
BLE (GFSK)	2402	20	3.87	0.0024	1.0000	61	1.3522
	2440	20	4.01	0.0025	1.0000	61	1.3741
	2480	20	3.66	0.0023	1.0000	61	1.3199

\*\*\*\*\* End of Report \*\*\*\*\*