Shenzhen Global Test Service Co.,Ltd.
No.7-101 and 8A-104,Building 7 and 8,DCC Cultural and Creative Garden No.98,Pingxin North Road,Shangmugu,Pinghu Street, Longgang District,Shenzhen,Guangdong,Chin

TEST REPORT
EN IEC 62311:2020

Report Reference No.....:	**GTS20210827008-1-4**
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Approved by (position+printed name+signature)..:	Manager Jason Hu
Date of issue.....:	Aug. 28, 2021

Testing Laboratory Name .....:	**Shenzhen Global Test Service Co.,Ltd.**
Address.....:	No.7-101 and 8A-104,Building 7 and 8,DCC Cultural and Creative Garden No.98,Pingxin North Road,Shangmugu,Pinghu Street, Longgang District,Shenzhen,Guangdong,China
Applicant's name.....:	**Shenzhen Sonoff Technologies Co.,Ltd.**
Address.....:	1001, BLDG8, Lianhua Industrial Park, Shenzhen, GD, China
Test specification ..... **:**	
Standard .....:	**EN IEC 62311:2020**

Test item description .....:	**Wi-Fi Smart controller**
Trade Mark .....:	SONOFF
Manufacturer .....:	Shenzhen Sonoff Technologies Co.,Ltd.
Model/Type reference.....:	L2-C
List Model .....:	N/A
Ratings.....:	DC 12V From External circuit
Result.....:	**PASS**

T E S T R E P O R T

Equipment under Test	:	Wi-Fi Smart controller
Model /Type	:	L2-C
Listed Models	:	N/A
Applicant	:	**Shenzhen Sonoff Technologies Co.,Ltd.**
Address	:	1001, BLDG8, Lianhua Industrial Park, Shenzhen, GD, China
Manufacturer	:	**Shenzhen Sonoff Technologies Co.,Ltd.**
Address	:	1001, BLDG8, Lianhua Industrial Park, Shenzhen, GD, China

Test Result	**PASS**

Contents

1 . SUMMARY

1.1. General Remarks

Date of receipt of test sample	:	Jul. 01, 2021
Testing commenced on	:	Jul. 01, 2021
Testing concluded on	:	Aug. 28, 2021

1.2. Product Description

Product Name:	Wi-Fi Smart controller
Trade Mark:	SONOFF
Model/Type reference:	L2-C
List Model:	N/A
Power supply:	DC 12V From External circuit
Adapter 1 information:	Model:GA-1202000V Input:AC100-240V-50/60Hz，0.6A Output:DC 12.0V,2A
Adapter 2 information:	Model:KZ1202000S Input:AC100-240V-50/60Hz，1.0A Output:DC 12.0V,2A
2.4GWIFI	
WLAN	Supported 802.11b/802.11g/802.11n HT20
WLAN CE Operation frequency	IEEE 802.11b:2412-2472MHz IEEE 802.11g:2412-2472MHz IEEE 802.11n HT20:2412-2472MHz
WLAN CE Modulation Type	IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK)
Channel number:	13 for 802.11b/802.11g/802.11n(HT20)
Channel separation:	5MHz
BLE	
Operation frequency:	2402MHz-2480MHz
Modulation Type:	GFSK
Channel separation:	2MHz
Channel number:	40

1.3. Equipment under Test

Power supply system utilised

Power supply voltage	:	○	230V / 50 Hz	○	115V / 60Hz
		●	12 V DC	○	24 V DC
		○	Other (specified in blank below)		

DC 12.0V From External circuit

1.4. EUT operation mode

The EUT and test equipment were configured for testing While transmitting

2. TEST ENVIRONMENT

2.1. Address of the test laboratory

Shenzhen Global Test Service Co.,Ltd..
No.7-101 and 8A-104,Building 7 and 8,DCC Cultural and Creative Garden No.98,Pingxin North Road,Shangmugu,Pinghu Street,Longgang District,Shenzhen,Guangdong,China

2.2. Environmental conditions

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

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

2.3. 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 TR-100028-01"Electromagnetic compatibilityand Radio spectrum Matters (ERM);Uncertainties in the measurementof mobile radio equipment characteristics;Part 1"and TR-100028-02 "Electromagnetic compatibilityand Radio spectrum Matters (ERM);Uncertainties in the measurementof mobile radio equipment characteristics;Part 2 " and is documented in the Shenzhen Global Test Service 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.

Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.57 dB	(1)
Transmitter power Radiated	2.20 dB	(1)

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

3. Method of measurement

3.1. Applicable Standard

EN IEC 62311:2020: Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz to 300 GHz)

3.2. Limit

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

Frequency range	Magnetic flux density (mT)	Current density (mA/m^2)	Whole body average SAR(W/kg)	Localised SAR (head and trunk)(W/kg)	Localised SAR (limbs) (W/kg)	Power density, S (W/m^2)
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 1cm2 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=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 tp the equivalent frequency to apply in the basic restrictions should be calculated as=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-1 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^2)
0-1Hz	--	3.2×10^4	4×10^4	--
1-8Hz	10000	$3.2\times10^4/f^2$	$4\times10^4/f^2$	--
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.

Occupational Exposure limit and action values for relectromahnetic fields

Exposure limit values(Article3(1)).All conditions to be satisfied

Frequency range	Current density for head and trunk J (mA/m^2) (rms)	Whole body average SAR(W/kg)	Localised SAR (head and trunk)(W/kg)	Localised SAR (limbs) (W/kg)	Power density, S (W/m^2)
Up to 1Hz	40	--	--	--	--
1-4Hz	40/f	--	--	--	--
4-1000Hz	10	--	--	--	--
1000Hz-100kHz	f/100	--	--	--	--
100kHz-10MHz	f/100	0.4	10	20	--
10MHz-10GHz	--	0.4	10	20	--
10-300GHz	--	--	--	--	50

Notes:

1. f is the frequency in Hz.
2. The exposure limit values on the current density are intended to protect against acute exposure effects on central nervous system tissues in the head and trunk of the body.The exposure limit values in the frequency range 1Hz to 10MHz 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 exposure limit values for exposure of short duration. However, since the exposure limit values refer to adverse effects on the central nervous system, these exposure limit values may permit higher current densities in body tissues other than the central nervous system under the same exposure conditions.
3. Because of the electrical in homogeneity of the body,current densities should be calculated as averages over across-section of $1cm^2$ perpendicular to the current direction.
4. For frequencies up to 100kHz,peak current density values can be obtained by multiplying the rms value by $(2)^{½}$.
5. For frequencies up to 100kHz and for pulsed magneticfields, 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 exposure limit value. For pulses of duration t_p, the equivalent frequency to apply for the exposure limit values should be calculated as $f=1/(2t_p)$.
6. All SAR values are to be averaged over any six-minute period.
7. Localised SAR averaging massis any 10 g of contiguous tissue; the maximum SAR so obtained should be the value used for estimating exposure. These 10 g of tissue are intended to be a mass of contiguous tissue with nearly homo-geneous electrical properties. In specifying a contiguous mass of tissue, it is recognised that this concept can beused in computational dosimetry but may present difficulties for direct physical

measurements. As implegeometry such as cubict issue mass can be used providedth at the calculated dosimetric quantities have conservative values relative to the exposure guidelines.
8. 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 exposure limit value is recommended.This is that the SA should not exceed10mJ/kg averaged over 10g of tissue.
9. Power densities are to be averaged over any 20cm^2 of exposed area and any $68/f^{1.05}$-minute period (where f is in GHz) to compensate for progressively shorter penetration depth as the frequency increases.Spatial maximum power densities averaged over 1cm^2 should not exceed 20 times the value of 50W/m^2.
10. With regard to pulsed or transient electromagnetic fields,or generally with regard to simultaneous exposure to multiple frequency fields,appropriate methods of assessment,measurement and/or calculation capable of analysing the characteristics of the waveforms and nature of biological interactions have to be applied,taking account of European harmonised standards developed by Cenelec.
The action values referred to in Table are obtained from the exposure limit values according to the rationale used by the International Commission on Non-ionising Radiation Protection(ICNIRP) in its guidelines on limiting exposure to non-ionising radiation(ICNIRP7/99).

Action values (Article3(2))(unperturbed rms values)

Frequency range	Electric field strength, E(V/m)	Magnetic field strength, H(A/m)	Magnetic field strength, H(A/m)	Equivalent plane wave power density, Seq(W/m^2)	Contact current, I_C(mA)	Limb induced current, I_L(mA)
0-1Hz	-	$1.63x10^5$	$2x10^5$	-	1.0	-
1-8Hz	20000	$1.63x10^5/f^2$	$2x10^5/f^2$	-	1.0	-
8-25Hz	20000	$2x10^4/f$	$2.5x10^4/f$	-	1.0	-
0.025-0.82kHz	50/f	20/f	25/f	-	1.0	-
0.82-2.5kHz	500/f	24.4	30.7	-	1.0	-
2.5-65kHz	610	24.4	30.7	-	0.4f	-
65-100kHz	610	1600/f	2000/f	-	0.4f	-
0.1-1MHz	610	1.6/f	2/f	-	40	-
1-10MHz	610/f	1.6/f	2/f	-	40	-
10-110MHz	61	0.16	0.2	10	40	100
110-400MHz	61	0.16	0.2	10	-	-
400-2000MHz	$3f^{½}$	$0.008f^{½}$	$0.01f^{1/2}$	f/40	-	-
2-300GHz	137	0.36	0.45	50	-	-

Notes: 1. As indicated in the frequency range column.
2. For frequencies between100kHz and 10GHz,S_{eq},E,H,Band I_L are to be averaged over any six-minute period.
3. For frequencies exceeding 10GHz, S_{eq},E,H and Bare to be averaged over any $68/f^{1.05}$-minute period(f in GHz)..
4. For frequencies up to 100kHz,peak action values for the field strength scan be obtained by multiplying the rms value by $(2)^{½}$. For pulses of duration t_p,the equivalent frequency to apply for the action values should be calculated as $f=1/(2t_p)$.
For frequencies between 100kHz and 10MHz,peak action values for the field strengths are calculated by multi-plying the relevant rms values by 10,where a=(0.665log(f/10)+0.176),finHz.
For frequencies between 10MHz and 300GHz, peak action values are calculated by multiplying the corresponding rms values by 32 for the field strengths and by 1000 for the equivalent planewave power density.
5. With regard to pulsed or transient electromagnetic fields,or generally with regard to simultaneous exposure to multiple frequency fields, appropriate methods of assessment, measurement and/or calculation capable of analysing the characteristics of the waveforms and nature of biologica linter actions have to be applied, taking account of harmonised European standards developed by Cenelec.
6. For peak values of pulsed modulated electromagnetic fields, it is also suggested that, for carrier frequencies exceeding 10MHz, S_{eq} as averaged over the pulse width should not exceed 1000 times the S_{eq} action values or that the field strength should not exceed 32 times the field strength action values for the carrier frequency.

3.3. EMF Assessment Method

Predication of MPE limit at a given distance
Equation from page 51 of EN50383, Edition 2002

$$E = \frac{\sqrt{30PG}}{r}$$

Where: E= E-field strength (V/m)
P=power input to antenna(Watt)
G=power gain of the antenna in the direction of interest relative to an isotropic radiator
r=distance to the center of radiation of the antenna

As declared by the Applicant, the EUT transmits with the maximum soure-baed Duty Cycle of 100%-see the User manual, and the EUT is a wireless device used in a mobile application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum mobile separation distance, r =20cm, as well as the gain of the used antenna is that 2.4GWIFIGain :2.68dBi, 5.GWIFIGain : 4.33dBi, 2.4G BLE Gain :2.68dBi, the RF power density can be obtained.

4. Test Result

Manufacturing Tolerance

2.4GwiFi (Conducted Port Power)

802.11b			
Channel	Channel 01	Channel 6	Channel 11
Target (dBm)	16.0	16.0	16.0
Tolerance ±(dB)	1.0	1.0	1.0
802.11g			
Channel	Channel 01	Channel 6	Channel 11
Target (dBm)	14.0	14.0	14.0
Tolerance ±(dB)	1.0	1.0	1.0
802.11n(HT20)			
Channel	Channel 01	Channel 6	Channel 11
Target (dBm)	15.0	15.0	15.0
Tolerance ±(dB)	1.0	1.0	1.0

BLE(Conducted Port Power)

BLE			
Channel	Channel 00	Channel 19	Channel 39
Target (dBm)	8.0	8.0	8.0
Tolerance ±(dB)	1.0	1.0	1.0

Test Frequency (MHz)	Minimum Separation Distance (cm)	Output Power (dBm)	Output Power (W)	Antenna Gain	Antenna Gain (Nemeric)	E-field Strength Limit (V/m)	E-field Strength At 20cm (V/m)
2.4G WIFI	20.00	17.00	0.05012	0.50	1.12201845	61.0	6.49
BLE	20.00	9.0	0.00794	0.50	1.12201845	61.0	2.58

5. Conclusion

The measurement results comply with the relevant limits for gerenal exposure specified as reference levels in the Council Recommendation 1999/5/EC.

.....End of Report.....