

ETSI EN 300 440 V2.2.1 (2018-07)

TEST REPORT

For

Shenzhen Sonoff Technologies Co., Ltd.

1001, BLDG8, Lianhua Industrial Park, Shenzhen, GD, China

Tested Model: S-MATE

Report Type: Original Report	Product Type: SONOFF S-MATE Switch Mate
Report Number:	DG1210603-21202E-22
Report Date:	2021-08-09
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:	SONOFF S-MATE Switch Mate
EUT Model:	S-MATE
Rated Input Voltage:	DC 3V from battery
Antenna Gain[▲]:	0dBi
Operation Frequency:	2426MHz
Modulation Type:	GFSK
Output Power:	8.52dBm
Serial Number:	DG1210603-21202E-RF-S_8K7
EUT Received Date:	2021.06.06
EUT Received Status:	Good

Objective

This report is prepared on behalf of *Shenzhen Sonoff Technologies Co., Ltd.* in accordance with ETSI EN 300 440 V2.2.1 (2018-07) Short Range Devices (SRD); Radio equipment to be used in the 1 GHz to 40 GHz frequency range; Harmonised Standard for access to radio spectrum.

The objective is to determine the compliance of EUT with: ETSI EN 300 440 V2.2.1 (2018-07).

Test Methodology

All measurements contained in this report were conducted with ETSI EN 300 440 V2.2.1 (2018-07) Short Range Devices (SRD); Radio equipment to be used in the 1 GHz to 40 GHz frequency range; Harmonised Standard for access to radio spectrum.

Measurement Uncertainty

Parameter	Flab	Maximum allow uncertainty
Radio Frequency	$\pm 0.082 \times 10^{-6}$	$\pm 1 \times 10^{-7}$
RF Power (Conducted)	± 0.61 dB	$\pm 2,5$ dB
Radiated emission of transmitter, valid to 26,5 GHz	± 3.62 dB	± 6 dB
Radiated emission of transmitter, valid between 26,5 GHz and 66 GHz	± 3.62 dB	± 8 dB
Radiated emission of receiver, valid to 26,5 GHz	± 3.62 dB	± 6 dB
Radiated emission of receiver, valid between 26,5 GHz and 66 GHz	± 3.62 dB	± 8 dB
Humidity	$\pm 5\%$	$\pm 5\%$
Temperature	$\pm 1^{\circ}\text{C}$	$\pm 1^{\circ}\text{C}$
Voltage(DC)	$\pm 0.4\%$	$\pm 1\%$
Voltage(AC,<10kHz)	$\pm 1\%$	$\pm 2\%$

Note: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.

Declarations

BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol “▲”. Customer model name, addresses, names, trademarks etc. are not considered data.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

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FINAL

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured as engineering mode and it support 2426MHz only.

The extreme temperature test conditions which were declared by the manufacturer and the normal conditions are as below:

NT: Normal Temperature 25°C, NV: Normal Voltage 3Vdc

LT: Low Temperature -10°C, LV: Low Voltage 2.6Vdc

HT: High Temperature +40°C, HV: High Voltage 3Vdc

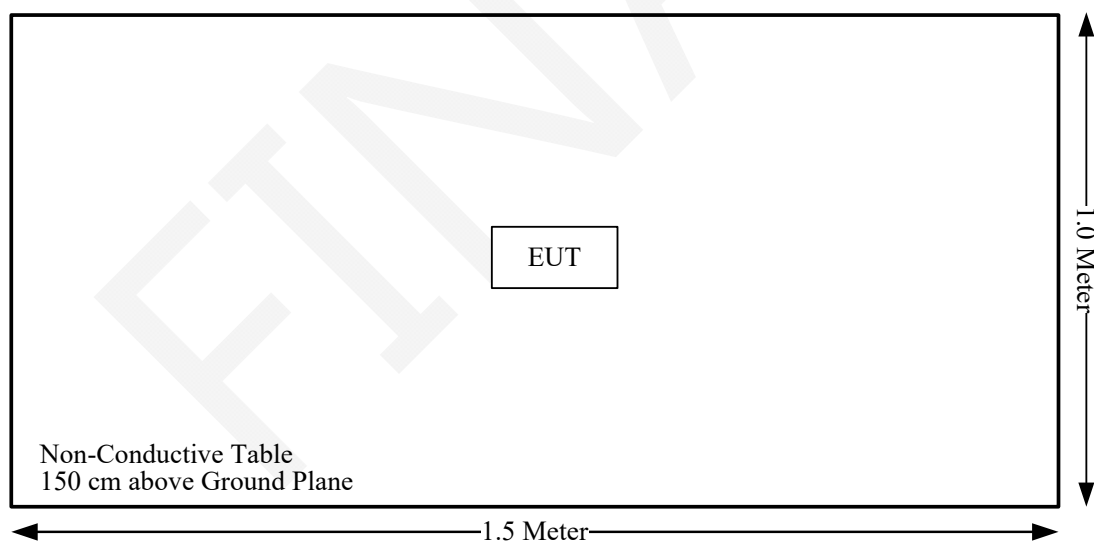
Equipment Modifications

No modification was made to the EUT.

EUT Exercise Software

No software was used.

Block Diagram of Test Setup



Test Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated emissions below 1GHz					
Sunol Sciences	Antenna	JB3	A060611-2	2020-08-25	2023-08-25
R&S	EMI Test Receiver	ESCI	100224	2020-09-12	2021-09-12
Unknown	Coaxial Cable	C-NJNJ-50	C-1000-01	2020-09-05	2021-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-02	2020-09-05	2021-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0530-01	2020-09-24	2021-09-24
Sonoma	Amplifier	310N	185914	2020-10-13	2021-10-13
EMCO	Adjustable Dipole Antenna	3121C	9109-753	N/A	N/A
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-02	2020-09-05	2021-09-05
Agilent	Signal Generator	E8247C	MY43321350	2021-04-25	2022-04-24
Radiated emissions above 1GHz					
ETS-Lindgren	Horn Antenna	3115	9912-5985	2020-10-13	2023-10-12
Agilent	Spectrum Analyzer	E4440A	MY44303352	2021-04-25	2022-04-24
HUBER+SUHNER	Coaxial Cable	SUCOFLEX 126EA	MY369/26/26EA	2020-09-25	2021-09-25
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2020-09-05	2021-09-05
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-02	2020-09-05	2021-09-05
Agilent	Signal Generator	E8247C	MY43321350	2021-04-25	2022-04-24
RF conducted					
R&S	Spectrum Analyzer	FSP 38	100478	2020-07-07	2021-07-07
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41005012	2020-09-05	2021-09-05
E-Microwave	Blocking Control	EMDCB-00036	0E01201047	2021-05-06	2022-05-05
E-Microwave	Coaxial Attenuators	EMCA10-5RN-6	0E01203239	2020-09-06	2021-09-06
Agilent	USB Wideband Power Sensor	U2021XA	MY54080014	2020-09-12	2021-09-12
R&S	Wideband Radio Communication Tester	CMW500	149216	2020-09-23	2021-09-22
ESPEC	Constant temperature and humidity Tester	ESX-4CA	018 463	2021-02-24	2022-02-23
Agilent	Signal Generator	E8247C	MY43321350	2021-04-25	2022-04-24

* Statement of Traceability: Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Environmental Conditions

Test Item:	Radiated emissions	RF conducted
Temperature:	24.2~28.8°C	25.2°C
Relative Humidity:	31~50 %	55%
ATM Pressure:	100~100.8kPa	100.7kPa
Tester:	Burt Hu, Jeremy Liang	Rennes Guo
Test Date:	2021.07.02~2021.07.07	2021.07.02

SUMMARY OF TEST RESULTS

SN	Rule and Clause	Description of Test	Test Result
1	EN 300 440 Clause 4.2.2	Equivalent isotropically radiated power	Compliance
2	EN 300 440 Clause 4.2.3	Permitted range of operating frequencies	Compliance
3	EN 300 440 Clause 4.2.4	Unwanted emission in the spurious emissions domain	Compliance
4	EN 300 440 Clause 4.2.5.4	Duty cycle	Not Applicable
5	EN 300 440 Clause 4.2.6	Additional requirements for FHSS equipment	Not applicable*
6	EN 300 440 Clause 4.3.3	Adjacent channel selectivity	Not applicable**
7	EN 300 440 Clause 4.3.4	Blocking or desensitization	Compliance
8	EN 300 440 Clause 4.3.5	Spurious emission	Compliance
9	EN 300 440 Clause 4.4	Spectrum access techniques	Not applicable***
10	EN 300 440 Clause 4.6.4	GBSAR antenna pattern	Not applicable****
11	EN 300 440 Clause Annex F	Limits for GBSAR	Not applicable****

Note:

The applicant declared that the equipment is belonging to category 3 receiver.

Not Applicable: For this device, it has no restriction.

Not Applicable*: The device is not FHSS equipment.

Not Applicable**: Testing is not required for equipment category 3 receiver.

Not Applicable***: Testing is only required for media access equipment.

Not Applicable****: Testing is only required for GBSAR systems.

1 – EQUIVALENT ISOTROPICALLY RADIATED POWER

Applicable Standard

According to ETSI EN 300 440 section 4.2.2, the equivalent isotropically radiated power requirement shall apply to all transmitters.

The transmitter maximum e.i.r.p. under normal and extreme test conditions is provided in table 2.

Table 2: Maximum radiated peak power (e.i.r.p.)

Frequency Bands	Power	Application	Notes
2 400 MHz to 2 483,5 MHz	10 mW e.i.r.p.	Non-specific short range devices	
2 400 MHz to 2 483,5 MHz	25 mW e.i.r.p.	Radio determination devices	
(a) 2 446 MHz to 2 454 MHz	500 mW e.i.r.p.	Radio Frequency Identification (RFID) devices	See also table 4 and annex D
(b) 2 446 MHz to 2 454 MHz	4 W e.i.r.p.	Radio Frequency Identification (RFID) devices	See also table 4 and annex D
5 725 MHz to 5 875 MHz	25 mW e.i.r.p.	Non-specific short range devices	
9 200 MHz to 9 500 MHz	25 mW e.i.r.p.	Radio determination devices	
9 500 MHz to 9 975 MHz	25 mW e.i.r.p.	Radio determination devices	
10,5 GHz to 10,6 GHz	500 mW e.i.r.p.	Radio determination devices	
13,4 GHz to 14,0 GHz	25 mW e.i.r.p.	Radio determination devices	
17,1 GHz to 17,3 GHz	400 mW e.i.r.p.	Radio determination devices	See annex F
24,00 GHz to 24,25 GHz	100 mW e.i.r.p.	Non-specific short range devices and Radio determination devices	

Test Procedure

According to ETSI EN 300 440 V2.2.1 (2018-07) §4.2.2.3

Test Data

Please refer to following table:

Mode	Frequency (MHz)	Test Condition	Reading (dBm)	e.i.r.p. (dBm)	Limit (dBm)
SDR	2426	NTNV	8.45	8.45	10
		LTLV	8.26	8.26	10
		LTHV	8.31	8.31	10
		HTLV	8.52	8.52	10
		HTHV	8.46	8.46	10

2 – PERMITTED RANGE OF OPERATING FREQUENCIES

Applicable Standard

Per EN 300 440 section 4.2.3, The permitted range of operating frequencies includes all frequencies on which the equipment may operate within an assigned frequency band. The operating frequency range shall be declared by the manufacturer.

The frequency range of the equipment is determined by the lowest and highest frequencies occupied by the power envelope in accordance with clause 4.2.2.4, table 2. f_H is the highest frequency of the power envelope, it is the frequency furthest above the frequency of maximum power where the output power envelope drops below the level of -75 dBm/Hz spectral power density (e.g. -30 dBm if measured in a 30 kHz reference bandwidth) e.i.r.p.

f_L is the lowest frequency of the power envelope; it is the frequency furthest below the frequency of maximum power where the output power drops below the level of -75 dBm/Hz spectral power density (e.g. -30 dBm if measured in a 30 kHz reference bandwidth) e.i.r.p.

The occupied bandwidths and OCW of the transmitter shall be declared. Where differing modes of emission are available, all modes and their associated bandwidths shall be stated.

Test Procedure

According to ETSI EN 300 440 V2.2.1 (2018-07) §4.2.3.3

Test Data

Please refer to following table:

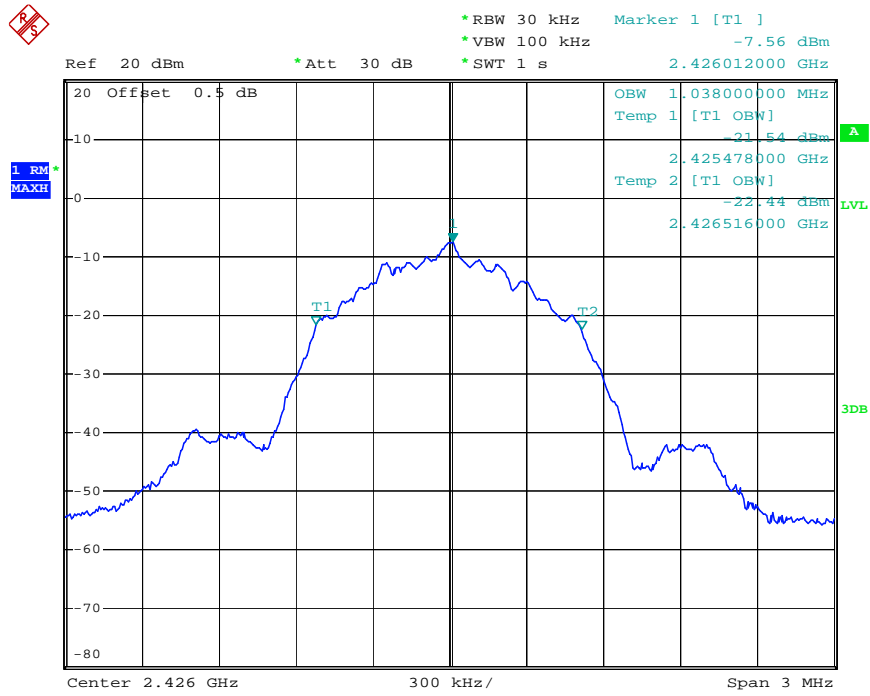
Mode	Test Conditions	Frequency (MHz)			
		f_L at Low Channel	f_H at High Channel	f_L Limit	f_H Limit
SDR	NTNV	2424.944	2427.020	2400	2483.5
	LTLV	2424.849	2427.115	2400	2483.5
	LTHV	2424.752	2427.149	2400	2483.5
	HTLV	2424.721	2427.247	2400	2483.5
	HTHV	2424.622	2427.288	2400	2483.5

Nominal Channel Bandwidth and Occupied Channel bandwidth

Mode	Frequency (MHz)	Result (MHz)	Limit
SDR	2426	1.038	Within an assigned frequency band

Please refer to following plots:

OBW



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3 – UNWANTED EMISSION IN THE SPURIOUS EMISSIONS DOMAIN

Applicable Standard

Per EN 300 440 section 4.2.4, the maximum power limits of any unwanted emissions in the spurious domain are given in following table.

Frequency Ranges	47 to 74 MHz 87.5 to 108 MHz 174 to 230 MHz 470 to 862 MHz	Other frequencies ≤ 1000 MHz	Frequencies > 1000 MHz
State			
Operating	4 nW	250 nW	1 μW
Standby	2 nW	2 nW	20 nW

EUT Setup

The radiated emission tests were performed in the 3-meter Chamber, using the setup accordance with ETSI EN 300 440. The specifications used were the ETSI EN 300 440 limits.

Test Procedure

According to ETSI EN 300 440 V2.2.1 (2018-07) §4.2.4.3

Test Data

Please refer to following table:

2426 MHz

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
4852.00	H	51.02	-45.00	14.09	1.52	-32.43	-30.00	2.43
4852.00	V	51.17	-44.38	14.09	1.52	-31.81	-30.00	1.81
7278.00	H	36.25	-53.20	13.13	1.55	-41.62	-30.00	11.62
7278.00	V	36.59	-53.05	13.13	1.55	-41.47	-30.00	11.47
57.16	H	39.35	-62.69	-11.61	0.18	-74.48	-54.00	20.48
78.50	V	38.44	-66.82	-0.75	0.18	-67.75	-36.00	31.75

Note 1: The unit of antenna gain is dBd for frequency below 1GHz and is dBi for frequency above 1GHz.

Note 2:

Absolute Level = Substituted Level - Cable loss + Antenna Gain

Margin = Limit- Absolute Level

7 –BLOCKING OR DESENSITIZATION

Applicable Standard

According to EN 300440§4.3.4, blocking is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted input signal at any frequencies other than those of the spurious responses or the occupied bandwidth.

Limits:

The blocking level, for any frequency within the specified ranges, shall not be less than the values given in table 6, except at frequencies on which spurious responses are found.

Table 6: Limits for blocking or desensitization

Receiver category	Limit
1	-30 dBm + k
2	-45 dBm + k
3	-60 dBm + k

The correction factor, k, is as follows:

$$k = -20\log f - 10\log BW$$

Where:

- f is the frequency in GHz;
- BW is the occupied bandwidth in MHz.

The factor k is limited within the following:

- $-40 \text{ dB} < k < 0 \text{ dB}$.

The measured blocking level shall be stated in the test report.

Test Procedure

According to ETSI EN 300 440 V2.2.1 (2018-07) §4.3.4.3

Test Data

Test Result: Compliance

Frequency (MHz)	BW (MHz)	Blocking Signal Frequency (MHz)		Blocking Signal (dBm)		Limit (dBm)
2426	1.038	2415.101	2436.899	-44.7	-56.7	-67.86
		2404.721	2447.279	-46.4	-45.8	-67.86
		2373.581	2478.419	-60.0	-57.1	-67.86

8 – SPURIOUS EMISSION

Applicable Standard

According to EN 300440§4.3.5, the power of any spurious emission shall not exceed 2 nW in the range 25 MHz to 1 GHz and shall not exceed 20 nW on frequencies above 1 GHz.

EUT Setup

The radiated emission tests were performed in the 3-meter Chamber, using the setup accordance with ETSI EN 300 440. The specifications used were the ETSI EN 300 440 limits.

Test Procedure

According to ETSI EN 300 440 V2.2.1 (2018-07) §4.3.5.3

Test Data

Please refer to following table:

2426 MHz

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
1125.00	H	36.54	-67.09	7.38	1.04	-60.75	-47.00	13.75
1125.00	V	36.89	-67.31	7.38	1.04	-60.97	-47.00	13.97
1739.00	H	37.52	-66.40	10.92	0.72	-56.20	-47.00	9.20
1739.00	V	36.29	-68.23	10.92	0.72	-58.03	-47.00	11.03
134.70	H	39.90	-70.03	0.00	0.22	-70.25	-57.00	13.25
92.50	V	37.60	-69.69	0.00	0.17	-69.86	-57.00	12.86

Note 1: The unit of antenna gain is dBd for frequency below 1GHz and is dBi for frequency above 1GHz.

Note 2:

Absolute Level = Substituted Level - Cable loss + Antenna Gain

Margin = Limit- Absolute Level

EXHIBIT A – EUT PHOTOGRAPHS

For photos in this section, please refer to report No.: DG1210603-21202E-02 EXHIBIT A.

FURNIVAL

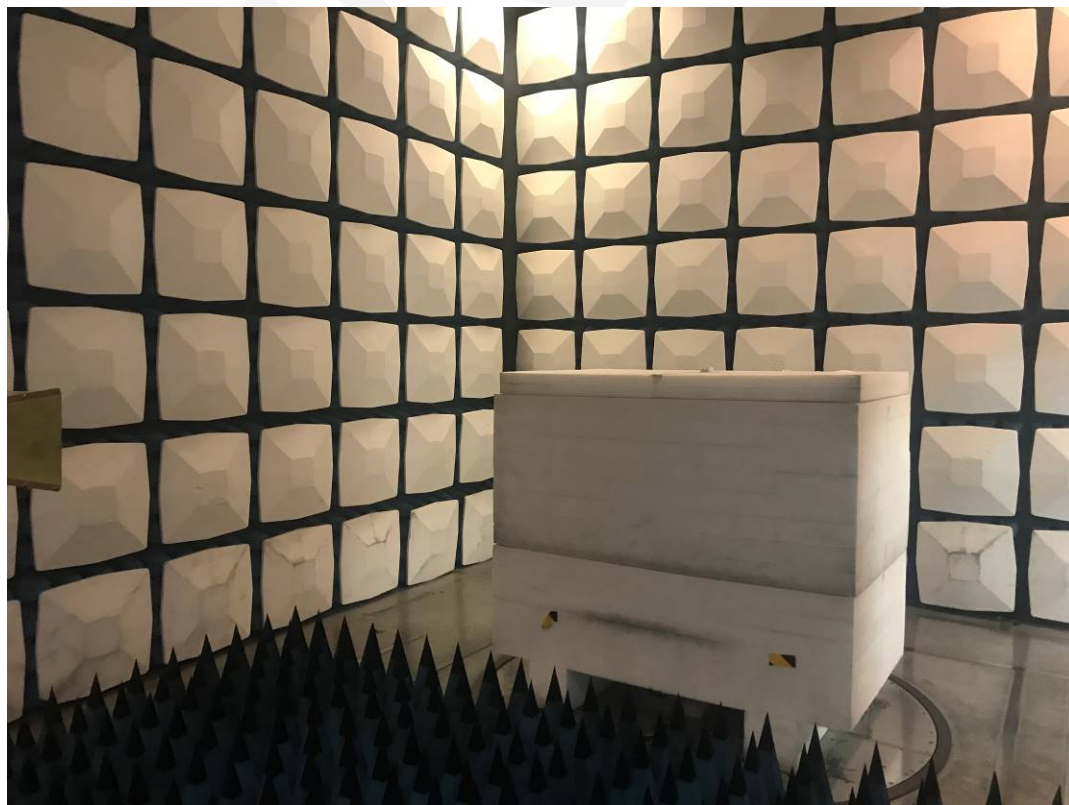
EXHIBIT B – TEST SETUP PHOTOGRAPHS

Radiated Emissions

Radiated Emissions Below 1G View



Radiated Emissions Above 1G View



*******END OF REPORT*******