

1 Cover Page

RF MPE REPORT

Application No.: SHCR2110000845AT
FCC ID: UCZ-B451AJ-Z2
IC : 8575A-B451AJZ2
Applicant: Lorex Technology Inc.
Address of Applicant: 250 Royal crest Court, Markham, L3R 3S1, Ontario, Canada.
Manufacturer: Lorex Technology Inc.
Address of Manufacturer: 250 Royal crest Court, Markham, L3R 3S1, Ontario, Canada.

Equipment Under Test (EUT):

EUT Name: 1440p QHD Wi-Fi Smart Deterrence Video Doorbell
Model No.: B451AJ-Z
HVIN: B451AJ-Z2
 FCC Rules 47 CFR §2.1091
Standard(s) : KDB447498 D01 General RF Exposure Guidance v06
 RSS-102 Issue 5 Amendment 1 (February 2, 2021)
Date of Receipt: 2021-11-24
Date of Test: 2021-12-01 to 2021-12-10
Date of Issue: 2021-12-10

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards specified above.

Parlam Zhan

Parlam Zhan
E&E Section Manager



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Revision Record			
Version	Description	Date	Remark
00	Original	2021-12-10	/

Authorized for issue by:			
		<i>Michael Niu</i>	
		Micheal Niu / Project Engineer	
		<i>Parlam Zhan</i>	
		Parlam Zhan / Reviewer	



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3 General Information

3.1 General Description of E.U.T.

Power supply:	AC 16~24V,50/60Hz,0.7A
Serial Number:	2M0024EPAG03423
Firmware Version:	V2.8

3.2 Technical Specifications

2.4GHz

Antenna Gain:	Ant 1:1.68dBi (Provided by manufacturer) Ant 2:3.42dBi (Provided by manufacturer) Directional Gain: 5.6dBi
Antenna Type:	Antenna 1: PIFA Antenna Antenna 2: PIFA Antenna
Channel Spacing:	5MHz
Data Rate:	802.11b: 1/2/5.5/11Mbps, 802.11g: 6/9/12/18/24/36/48/54Mbps 802.11n: MCS 0 to 7 for HT20MHz; MCS 0 to 7 for HT40MHz
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
Operation Frequency:	802.11b/g/n(HT20): 2412MHz to 2462MHz

5G WiFi

Operation Frequency:	Band	Mode	Frequency Range(MHz)	Number of channels
	UNII Band I	802.11a/n(HT20)/ac(VHT20)	5180-5240	4
		802.11n(HT40)/ac(VHT40)	5190-5230	2
		802.11ac(VHT80)	5210	1
	UNII Band II-A	802.11a/n(HT20)/ac(VHT20)	5260-5320	4
		802.11n(HT40)/ac(VHT40)	5270-5310	2
		802.11ac(VHT80)	5290	1
	UNII Band II-C	802.11a/n(HT20)/ac(VHT20)	5500-5700	11
		802.11n(HT40)/ac(VHT40)	5510-5670	5
		802.11ac(VHT80)	5530-5610	2
UNII Band III	802.11a/n(HT20)/ac(VHT20)	5745-5825	5	
	802.11n(HT40)/ac(VHT40)	5755-5795	2	
	802.11ac(VHT80)	5775	1	
Note:	For frequencies falling between 5150-5250MHz and 5600-5650MHz will not be used in Canada.			
Modulation Type:	802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK) 802.11n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)			
Channel Spacing:	802.11a/n(HT20)/ac(VHT20): 20MHz 802.11n(HT40)/ac(VHT40): 40MHz 802.11ac(VHT80): 80MHz			
Data Rate:	802.11a: 6/9/12/18/24/36/48/54Mbps 802.11n: MCS0-15 802.11ac: MCS0-9			
Antenna Gain:	Antenna 1:2.99dBi; (Provided by manufacturer) Antenna 2:2.83dBi; (Provided by manufacturer) Directional Gain:5.92dBi			
Antenna Type:	Antenna 1: PIFA Antenna Antenna 2: PIFA Antenna			
DFS Function:	Slave without Radar detection			
TPC Function:	Not Support			



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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.

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 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 Test Standards and Limits

4.1 FCC Radiofrequency radiation exposure limits:

According to §1.1310, the limit for general population/uncontrolled exposures

Frequency	Power density(mW/cm ²)	Averaging time(minutes)
300MHz~1.5GHz	f/1500	30
1.5GHz~100GHz	1.0	30

4.2 IC Radiofrequency radiation exposure limits:

According to RSS-102 section 2.5.2, RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);

- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

For 2.4G device, the limit of worse case is 2.68 W

For 5G device, the limit of worse case is 4.53W



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5 Measurement and Calculation

5.1 Maximum transmit power

The Power Data is based on the RF Test Report SHCR211000084501-2.4GHz

Test Mode	Channel	Antenna 1 Power[dBm]	Antenna 2 Power[dBm]	MIMO Power[dBm]	Antenna 1 Power[mW]	Antenna 2 Power[mW]	MIMO Power[mW]
11B	2412	14.34	13.46	/	27.16	22.18	/
	2437	14.23	12.48	/	26.49	17.70	/
	2462	15.51	13.71	/	35.56	23.50	/
11G	2412	14.11	14.25	/	25.76	26.61	/
	2437	14.32	13.28	/	27.04	21.28	/
	2462	12.10	13.45	/	16.22	22.13	/
11N20MIMO	2412	13.99	13.10	16.58	25.06	20.42	45.50
	2437	13.33	13.02	16.19	21.53	20.04	41.59
	2462	13.38	13.15	16.28	21.78	20.65	42.46



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The Power Data is based on the RF Test Report SHCR211000084502-5GHz

Test Mode	Test Channel	Antenna 1 Power[dBm]	Antenna 2 Power[dBm]	MIMO Power[dBm]	Antenna 1 Power[mW]	Antenna 2 Power[mW]	MIMO Power[mW]
11A	5180	12.10	12.20	/	16.22	16.60	/
	5200	13.84	13.86	/	24.21	24.32	/
	5240	12.45	11.49	/	17.58	14.09	/
	5260	12.75	12.23	/	18.84	16.71	/
	5300	12.29	11.73	/	16.94	14.89	/
	5320	9.97	10.24	/	9.93	10.57	/
	5500	13.79	14.33	/	23.93	27.10	/
	5580	10.12	10.65	/	10.28	11.61	/
	5700	12.49	12.65	/	17.74	18.41	/
	5745	11.55	10.32	/	14.29	10.76	/
	5785	10.93	10.01	/	12.39	10.02	/
	5825	10.40	9.38	/	10.96	8.67	/
11N20	5180	15.69	15.36	18.54	37.07	34.36	71.45
	5200	15.79	15.30	18.56	37.93	33.88	71.78
	5240	15.69	15.04	18.39	37.07	31.92	69.02
	5260	14.95	14.65	17.81	31.26	29.17	60.39
	5300	14.68	14.44	17.57	29.38	27.80	57.15
	5320	14.66	14.41	17.55	29.24	27.61	56.89
	5500	14.10	15.01	17.59	25.70	31.70	57.41
	5580	14.13	14.81	17.49	25.88	30.27	56.10
	5700	13.33	14.03	16.70	21.53	25.29	46.77
	5745	10.14	11.13	13.67	10.33	12.97	23.28
	5785	9.10	10.57	12.91	8.13	11.40	19.54
	5825	8.57	9.56	12.10	7.19	9.04	16.22
11N40	5190	12.02	11.84	14.94	15.92	15.28	31.19
	5230	11.96	11.30	14.65	15.70	13.49	29.17
	5270	10.61	10.43	13.53	11.51	11.04	22.54
	5310	10.07	9.92	13.01	10.16	9.82	20.00
	5510	11.49	12.11	14.82	14.09	16.26	30.34
	5550	11.24	11.83	14.56	13.30	15.24	28.58
	5670	10.14	10.89	13.54	10.33	12.27	22.59
	5755	9.50	9.00	12.27	8.91	7.94	16.87
	5795	9.00	8.32	11.68	7.94	6.79	14.72
11AC20	5180	14.91	15.23	18.08	30.97	33.34	64.27
	5200	14.69	15.17	17.95	29.44	32.89	62.37
	5240	14.83	14.45	17.65	30.41	27.86	58.21
	5260	13.63	13.65	16.65	23.07	23.17	46.24
	5300	13.46	13.23	16.36	22.18	21.04	43.25
	5320	13.15	13.31	16.24	20.65	21.43	42.07
	5500	14.58	15.03	17.82	28.71	31.84	60.53
	5580	14.46	14.81	17.65	27.93	30.27	58.21
	5700	13.63	13.69	16.67	23.07	23.39	46.45
	5745	13.07	12.11	15.63	20.28	16.26	36.56
	5785	11.94	11.40	14.69	15.63	13.80	29.44
5825	11.36	10.49	13.96	13.68	11.19	24.89	
11AC40	5190	12.61	12.69	15.66	18.24	18.58	36.81
	5230	12.60	12.46	15.54	18.20	17.62	35.81



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	5270	11.42	11.28	14.36	13.87	13.43	27.29
	5310	10.94	10.87	13.92	12.42	12.22	24.66
	5510	12.31	12.95	15.65	17.02	19.72	36.73
	5550	12.10	12.69	15.42	16.22	18.58	34.83
	5670	11.06	11.92	14.52	12.76	15.56	28.31
	5755	10.26	10.16	13.22	10.62	10.38	20.99
	5795	9.38	9.23	12.32	8.67	8.38	17.06
11AC80	5210	13.67	13.69	16.69	23.28	23.39	46.67
	5290	12.37	12.31	15.35	17.26	17.02	34.28
	5530	13.69	13.77	16.74	23.39	23.82	47.21
	5610	16.57	17.74	20.20	45.39	59.43	104.71
	5775	11.09	10.83	13.97	12.85	12.11	24.95



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5.2 MPE Calculation

According to the formula $S=P/4\pi R^2$, we can calculate S which is MPE.

Note:

- 1) P (mW)
- 2) R = distance to the center of radiation of antenna (in meter) = 20cm
- 3) MPE limit = 1mW/cm²

For FCC:

For 2.4G WiFi –Antenna1:

The max. antenna gain is		1.68	dBi		
Max. Conducted Power P(mW)	Gain in Linear Scale G	Operation Distance R(cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Result
35.56	1.472	20	0.01042	1	Pass

For 2.4G WiFi –Antenna2:

The max. antenna gain is		3.42	dBi		
Max. Conducted Power P(mW)	Gain in Linear Scale G	Operation Distance R(cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Result
26.61	2.198	20	0.01164	1	Pass

In MIMO mode:

Two antennas can transmit simultaneously and they are correlated.

The max. antenna gain is		5.6	dBi		
Max. Conducted Power P(mW)	Gain in Linear Scale G	Operation Distance R(cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Result
45.5	3.631	20	0.03287	1	Pass



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For 5G WiFi –Antenna1:

The max. antenna gain is		2.99	dBi		
Max. Conducted Power P(mW)	Gain in Linear Scale G	Operation Distance R(cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Result
45.39	1.991	20	0.01798	1	Pass

For 2.4G WiFi –Antenna2:

The max. antenna gain is		2.83	dBi		
Max. Conducted Power P(mW)	Gain in Linear Scale G	Operation Distance R(cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Result
59.43	1.919	20	0.02268	1	Pass

In MIMO mode:

Two antennas can transmit simultaneously and they are correlated.

The max. antenna gain is		5.92	dBi		
Max. Conducted Power P(mW)	Gain in Linear Scale G	Operation Distance R(cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Result
104.71	3.908	20	0.08142	1	Pass

2.4G WiFi and 5G WiFi modules can simultaneous transmitting, so the maximum rate of MPE is $0.03287/1.0+0.08142/1.0=0.114 \leq 1.0$. according to the KDB447498 section 7.2 determine the device is exclusion from SAR test

For IC:

For 2.4GHz WiFi SISO mode:

Antenna 1: $E.I.R.P. = P \cdot G = 0.03556 \times 1.472 = 0.052W < 2.68W$

Antenna 2: $E.I.R.P. = P \cdot G = 0.02661 \times 2.198 = 0.058W < 2.68W$

For 2.4GHz WiFi MIMO mode: $E.I.R.P. = P \cdot G = 0.0455 \times 3.631 = 0.165W < 2.68W$

For 5GHz WiFi SISO mode:

Antenna 1: $E.I.R.P. = P \cdot G = 0.04539 \times 1.991 = 0.904W < 4.53W$

Antenna 2: $E.I.R.P. = P \cdot G = 0.05943 \times 1.919 = 0.114W < 4.53W$

For 5GHz WiFi MIMO mode: $E.I.R.P. = P \cdot G = 0.10471 \times 3.908 = 0.409W < 4.53W$

2.4G WiFi and 5G WiFi modules can simultaneous transmitting, so the maximum rate of MPE is $0.165/2.68+0.409/4.50=0.153 \leq 1$

So the device is exclusion from SAR test

--End of the Report--



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