



1 Cover Page

RF MPE REPORT

Application No.: SHEM2007005660CR
FCC ID: UCZ-B451AJ-Z
IC : 8575A-B451AJZ
Applicant: LOREX Technology Inc.
Address of Applicant: 250 Royal Crest Court, Markham, ON L3R 3S1 Canada
Manufacturer: Lorex Technology Inc.
Address of Manufacturer: 250 Royal crest Court, Markham, L3R 3S1 Canada
Equipment Under Test (EUT):
EUT Name: 2K QHD Video Doorbell
Model No.: B451AJ-Z
Trade mark: LOREX
Standard(s) : FCC Rules 47 CFR §2.1091
KDB447498 D01 General RF Exposure Guidance v06
RSS-102 Issue 5 (March 2015)
Date of Receipt: 2020-07-15
Date of Test: 2020-07-14 to 2020-08-31
Date of Issue: 2020-09-03

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

Parlan Zhan

Parlan Zhan
E&E Section Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.



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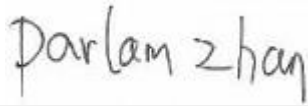
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Revision Record			
Version	Description	Date	Remark
00	Original	2020-09-03	/

Authorized for issue by:				
				
		Micheal Niu / Project Engineer		
				
		Parlam Zhan / Reviewer		



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3 General Information

3.1 General Description of E.U.T.

Power supply:	16V-24V 50/60Hz, 0.5A by Adapter
Serial Number:	ND012006271539
Firmware Version:	V1.000.0000000.8.R

3.2 Technical Specifications

2.4GHz

Antenna Gain:	ANT 1:1.68dBi, ANT 2:3.42dBi Directional gain:5.60dBi
Antenna Type:	Antenna 1: PIFA Antenna Antenna 2: PIFA Antenna
Channel Spacing:	5MHz
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
Operation Frequency:	802.11b/g/n(HT20): 2412MHz to 2462MHz 802.11n(HT40): 2422MHz to 2452MHz

5G WIFI

Operation Frequency:	Band	Mode	Frequency Range(MHz)	Number of channels
	UNII Band I	802.11a/n(HT20)/ac(HT20)	5180-5240	4
		802.11n(HT40)/ac(HT40)	5190-5230	2
		802.11ac(HT80)	5210	1
	UNII Band II-A	802.11a/n(HT20)/ac(HT20)	5260-5320	4
		802.11n(HT40)/ac(HT40)	5270-5310	2
		802.11ac(HT80)	5290	1
	UNII Band II-C	802.11a/n(HT20)/ac(HT20)	5500-5700	11
		802.11n(HT40)/ac(HT40)	5510-5670	5
		802.11ac(HT80)	5530-5610	2
	UNII Band III	802.11a/n(HT20)/ac(HT20)	5745-5825	5
		802.11n(HT40)/ac(HT40)	5755-5795	2
		802.11ac(HT80)	5775	1
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(HT20): 20MHz 802.11n(HT40)/ac(HT40): 40MHz 802.11ac(HT80): 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; Antenna 2: 2.83dBi Directional gain: 5.92dBi
Antenna Type:	Antenna 1: PIFA Antenna Antenna 2: PIFA Antenna

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.

CAB Identifier: CN0072.

- **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-1600, C-1707, T-1499, G-10216 respectively.

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



5 Measurement and Calculation

5.1 Maximum transmit power

2.4GHz for FCC

The Power Data is based on the RF Test Report SHEM200700566001-2.4GHz

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	15.20	15.95	NA	33.11	39.36	N/A
11B	2437	15.99	17.08	NA	39.72	51.05	N/A
11B	2462	16.58	16.96	NA	45.50	49.66	N/A
11G	2412	17.01	17.79	NA	50.23	60.12	N/A
11G	2437	17.64	17.70	NA	58.08	58.88	N/A
11G	2462	16.86	17.54	NA	48.53	56.75	N/A
11N20SISO	2412	13.52	14.43	17.01	22.49	27.73	50.23
11N20SISO	2437	14.27	15.02	17.67	26.73	31.77	58.48
11N20SISO	2462	14.88	15.65	18.29	30.76	36.73	67.45
11N40SISO	2422	13.13	12.62	15.89	20.56	18.28	38.82
11N40SISO	2437	12.71	12.53	15.63	18.66	17.91	36.56
11N40SISO	2452	13.18	12.67	15.94	20.80	18.49	39.26



5GHz for FCC

The Power Data is based on the RF Test Report SHEM200700566002-5GHz

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]
802.11a	5180	10.61	12.44	NA	11.51	17.54	NA
	5200	10.49	12.28	NA	11.19	16.90	NA
	5240	11.31	12.33	NA	13.52	17.10	NA
	5260	15.04	14.88	NA	31.92	30.76	NA
	5300	14.8	15.2	NA	30.20	33.11	NA
	5320	15.48	14.66	NA	35.32	29.24	NA
	5500	15.52	16.34	NA	35.65	43.05	NA
	5600	13.48	16.03	NA	22.28	40.09	NA
	5700	12.41	16.16	NA	17.42	41.30	NA
	5745	16	15.42	NA	39.81	34.83	NA
	5785	15.48	15.65	NA	35.32	36.73	NA
	5825	14.34	15.16	NA	27.16	32.81	NA
802.11n(HT20)	5180	9.8	11.98	14.04	9.55	15.78	25.35
	5200	9.9	12.14	14.17	9.77	16.37	26.12
	5240	10.91	12.27	14.65	12.33	16.87	29.17
	5260	14.65	14.84	17.76	29.17	30.48	59.70
	5300	14.62	15.04	17.85	28.97	31.92	60.95
	5320	14.79	14.13	17.48	30.13	25.88	55.98
	5500	15.07	16.06	18.6	32.14	40.36	72.44
	5600	13.24	16.05	17.88	21.09	40.27	61.38
	5700	12.08	16.15	17.59	16.14	41.21	57.41
	5745	12.31	13.8	16.13	17.02	23.99	41.02
	5785	11.83	13.11	15.53	15.24	20.46	35.73
	5825	11.15	12.08	14.65	13.03	16.14	29.17
802.11n(HT40)	5190	10.21	12.55	14.55	10.50	17.99	28.51
	5230	10.79	12.82	14.93	11.99	19.14	31.12
	5270	14.92	15.38	18.17	31.05	34.51	65.61
	5310	14.67	14.93	17.81	29.31	31.12	60.39
	5510	15.11	16.15	18.67	32.43	41.21	73.62
	5590	13.66	16.28	18.17	23.23	42.46	65.61
	5670	12.22	16.28	17.72	16.67	42.46	59.16
	5755	12.02	13.9	16.07	15.92	24.55	40.46
	5795	11.84	13.05	15.5	15.28	20.18	35.48
802.11ac(VHT20)	5180	9.53	11.96	13.92	8.97	15.70	24.66



	5200	9.61	11.9	13.91	9.14	15.49	24.60
	5240	10.57	11.99	14.35	11.40	15.81	27.23
	5260	14.68	15.07	17.89	29.38	32.14	61.52
	5300	14.22	15.32	17.82	26.42	34.04	60.53
	5320	14.95	14.34	17.67	31.26	27.16	58.48
	5500	15.11	16.14	18.67	32.43	41.11	73.62
	5600	13.22	16.15	17.94	20.99	41.21	62.23
	5700	12.25	16.02	17.54	16.79	39.99	56.75
	5745	11.77	13.76	15.89	15.03	23.77	38.82
	5785	11.45	13.13	15.38	13.96	20.56	34.51
	5825	11.19	12.28	14.78	13.15	16.90	30.06
802.11ac(VHT40)	5190	9.95	12.4	14.36	9.89	17.38	27.29
	5230	10.95	12.92	15.06	12.45	19.59	32.06
	5270	11.25	12.26	14.79	13.34	16.83	30.13
	5310	11.74	11.94	14.85	14.93	15.63	30.55
	5510	15.22	16.51	18.92	33.27	44.77	77.98
	5590	13.89	16.85	18.63	24.49	48.42	72.95
	5670	12.6	16.55	18.02	18.20	45.19	63.39
	5755	12.53	14.22	16.47	17.91	26.42	44.36
	5795	12.07	13.29	15.73	16.11	21.33	37.41
802.11ac(VHT80)	5210	9.98	12.36	14.34	9.95	17.22	27.16
	5290	14.89	15.36	18.14	30.83	34.36	65.16
	5530	14.49	15.16	17.85	28.12	32.81	60.95
	5610	13.29	15.88	17.79	21.33	38.73	60.12
	5775	12.81	14.31	16.63	19.10	26.98	46.03



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5GHz EIRP for IC

Test Mode	Frequency (MHz)	Tx Type	Measured Output Power (dBm)			EIRP (dBm)			EIRP (mw)		
			Ant 1	Ant 2	Total	Ant 1	Ant 2	Total	Ant 1	Ant 2	Total
802.11a	5180	SISO	10.61	12.44	/	13.6	15.27	/	22.91	33.65	/
	5200	SISO	10.49	12.28	/	13.48	15.11	/	22.28	32.43	/
	5240	SISO	11.31	12.33	/	14.3	15.16	/	26.92	32.81	/
	5260	SISO	15.04	14.88	/	/	/	/	/	/	/
	5300	SISO	14.8	15.2	/	/	/	/	/	/	/
	5320	SISO	15.48	14.66	/	/	/	/	/	/	/
	5500	SISO	15.52	16.34	/	/	/	/	/	/	/
	5600	SISO	13.48	16.03	/	/	/	/	/	/	/
	5700	SISO	12.41	16.16	/	/	/	/	/	/	/
	5745	SISO	16	15.42	/	/	/	/	/	/	/
	5785	SISO	15.48	15.65	/	/	/	/	/	/	/
	5825	SISO	14.34	15.16	/	/	/	/	/	/	/
802.11n(HT20)	5180	MIMO	9.8	11.98	14.04	15.72	17.9	19.96	37.33	61.66	99.08
	5200	MIMO	9.9	12.14	14.17	15.82	18.06	20.09	38.19	63.97	102.09
	5240	MIMO	10.91	12.27	14.65	16.83	18.19	20.57	48.19	65.92	114.02
	5260	MIMO	14.65	14.84	17.76	/	/	/	/	/	/
	5300	MIMO	14.62	15.04	17.85	/	/	/	/	/	/
	5320	MIMO	14.79	14.13	17.48	/	/	/	/	/	/
	5500	MIMO	15.07	16.06	18.6	/	/	/	/	/	/
	5600	MIMO	13.24	16.05	17.88	/	/	/	/	/	/
	5700	MIMO	12.08	16.15	17.59	/	/	/	/	/	/
	5745	MIMO	12.31	13.8	16.13	/	/	/	/	/	/
	5785	MIMO	11.83	13.11	15.53	/	/	/	/	/	/
	5825	MIMO	11.15	12.08	14.65	/	/	/	/	/	/
802.11n(HT40)	5190	MIMO	10.21	12.55	14.55	16.13	18.47	20.47	41.02	70.31	111.43
	5230	MIMO	10.79	12.82	14.93	16.71	18.74	20.85	46.88	74.82	121.62
	5270	MIMO	14.92	15.38	18.17	/	/	/	/	/	/
	5310	MIMO	14.67	14.93	17.81	/	/	/	/	/	/
	5510	MIMO	15.11	16.15	18.67	/	/	/	/	/	/
	5590	MIMO	13.66	16.28	18.17	/	/	/	/	/	/
	5670	MIMO	12.22	16.28	17.72	/	/	/	/	/	/
	5755	MIMO	12.02	13.9	16.07	/	/	/	/	/	/
	5795	MIMO	11.84	13.05	15.5	/	/	/	/	/	/
802.11ac(VHT20)	5180	MIMO	9.53	11.96	13.92	15.45	17.88	19.84	35.08	61.38	96.38
	5200	MIMO	9.61	11.9	13.91	15.53	17.82	19.83	35.73	60.53	96.16
	5240	MIMO	10.57	11.99	14.35	16.49	17.91	20.27	44.57	61.80	106.41
	5260	MIMO	14.68	15.07	17.89	/	/	/	/	/	/
	5300	MIMO	14.22	15.32	17.82	/	/	/	/	/	/
	5320	MIMO	14.95	14.34	17.67	/	/	/	/	/	/
	5500	MIMO	15.11	16.14	18.67	/	/	/	/	/	/
	5600	MIMO	13.22	16.15	17.94	/	/	/	/	/	/



	5700	MIMO	12.25	16.02	17.54	/	/	/	/	/	/
	5745	MIMO	11.77	13.76	15.89	/	/	/	/	/	/
	5785	MIMO	11.45	13.13	15.38	/	/	/	/	/	/
	5825	MIMO	11.19	12.28	14.78	/	/	/	/	/	/
802.11ac(VHT40)	5190	MIMO	9.95	12.4	14.36	15.87	18.32	20.28	38.64	67.92	106.66
	5230	MIMO	10.95	12.92	15.06	16.87	18.84	20.98	48.64	76.56	125.31
	5270	MIMO	11.25	12.26	14.79	/	/	/	/	/	/
	5310	MIMO	11.74	11.94	14.85	/	/	/	/	/	/
	5510	MIMO	15.22	16.51	18.92	/	/	/	/	/	/
	5590	MIMO	13.89	16.85	18.63	/	/	/	/	/	/
	5670	MIMO	12.6	16.55	18.02	/	/	/	/	/	/
	5755	MIMO	12.53	14.22	16.47	/	/	/	/	/	/
802.11ac(VHT80)	5795	MIMO	12.07	13.29	15.73	/	/	/	/	/	/
	5210	MIMO	9.98	12.36	14.34	15.9	18.28	20.26	38.90	67.30	106.17
	5290	MIMO	14.89	15.36	18.14	/	/	/	/	/	/
	5530	MIMO	14.49	15.16	17.85	/	/	/	/	/	/
	5610	MIMO	13.29	15.88	17.79	/	/	/	/	/	/
	5775	MIMO	12.81	14.31	16.63	/	/	/	/	/	/

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 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
58.08	1.472	20	0.01701	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
60.12	2.198	20	0.02629	1	Pass

In MIMO mode:



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
67.45	3.631	20	0.04872	1	Pass

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
39.81	1.991	20	0.01577	1	Pass

For 5G 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
48.42	1.919	20	0.01848	1	Pass

In MIMO mode:

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
77.98	3.908	20	0.06063	1	Pass

2.4G WiFi and 5G WiFi modules can simultaneous transmitting, so the maximum rate of MPE is $0.04872/1.0+0.06063/1.0=0.11\leq 1.0$. 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.= $P \times G = 0.05808 \times 1.472 = 0.085W < 2.68W$

Antenna 2:E.I.R.P.= $P \times G = 0.06012 \times 2.198 = 0.132W < 2.68W$

For 2.4GHz WiFi MIMO mode: E.I.R.P.= $P \times G = 0.06745 \times 3.631 = 0.24W < 2.68W$

For 5GHz WiFi SISO mode:

Antenna 1:E.I.R.P.= $P \times G = 0.03981 \times 1.991 = 0.079W < 4.50W$

Antenna 2:E.I.R.P.= $P \times G = 0.04842 \times 1.919 = 0.093W < 4.50W$

For 5GHz WiFi MIMO mode: E.I.R.P.= $P \times G = 0.07798 \times 3.908 = 0.3W < 4.50W$

2.4G WiFi and 5G WiFi modules can simultaneous transmitting, so the maximum rate of MPE is $0.24/2.68+0.30/4.50=0.16\leq 1$

So the device is exclusion from SAR test

--End of the Report--