1. RF Exposure Requirements

1.1 General Information

Client Information

Applicant:	Guangzhou Lotim Technology Co., Ltd.
Address of applicant:	Room 626, Building A, No.257 Junye Rd, Huangpu District, Guangzhou, China
Manufacturer:	The same as Applicant
Address of manufacturer:	The same as Applicant

General Description of EUT:

Product Name:	4G ADAS DMS 2CH Dashcam
Trade Name	Lotimcloud
Model No.:	LCD02
Adding Model(s):	LCD03, LCD09, LCD10, LCD40, LCD45
Rated Voltage:	DC12V/24V
Battery Capacity:	/
Adapter Model:	/
FCC ID:	2BCRHLOTI01
Equipment Type:	Mobile device

Technical Characteristics of EUT:	
Bluetooth	
Bluetooth Version:	V5.0 (BR/EDR mode)
Frequency Range:	2402-2480MHz
RF Output Power:	6.67dBm (Conducted)
Data Rate:	1Mbps, 2Mbps, 3Mbps
Modulation:	GFSK, π/4 DQPSK, 8DPSK
Quantity of Channels:	79/40
Channel Separation:	1MHz/2MHz
Type of Antenna:	Ceramic Antenna
Antenna Gain:	5.19dBi
Wi-Fi	
Support Standards:	802.11b, 802.11g, 802.11n
Frequency Range:	2412-2462MHz for 802.11b/g/n(HT20) 2422-2452MHz for 802.11n(HT40)
RF Output Power:	15.66dBm (Conducted)
Type of Modulation:	CCK, OFDM, QPSK, BPSK, 16QAM, 64QAM
Quantity of Channels:	11 for 802.11b/g/n(HT20); 7 for 802.11n(HT40)
Channel Separation:	5MHz
Type of Antenna:	Ceramic Antenna

Antenna Gain:	5.19dBi
2G	
Support Networks:	GPRS, EDGE
Support Band:	GSM850/PCS1900
Uplink Frequency:	GPRS/EDGE 850: 824~849MHz GPRS/EDGE 1900: 1850~1910MHz
Downlink Frequency:	GPRS/EDGE 850: 869~894MHz GPRS/EDGE 1900: 1930~1990MHz
Max RF Output Power:	GPRS850: 32.69dBm, GPRS1900: 28.94dBm EDGE850: 27.35dBm, EDGE1900: 25.96dBm
Type of Emission:	GPRS850:245KGXW, GPRS1900: 245KGXW EDGE850: 255KG7W, EDGE1900: 252KG7W
Type of Modulation:	GMSK, 8PSK
Type of Antenna:	Integral Antenna
Antenna Gain:	GSM850: 0.89dBi; GSM1900: 5.11dBi
3G	
Support Networks:	WCDMA, HSDPA, HSUPA
Support Band:	WCDMA Band 2, WCDMA Band 5
Uplink Frequency:	WCDMA Band 2: 1850~1910MHz WCDMA Band 5: 824~849MHz
Downlink Frequency:	WCDMA Band 2: 1930~1990MHz WCDMA Band 5: 869~894MHz
RF Output Power:	WCDMA Band 2: 22.08dBm, WCDMA Band 5: 22.12dBm
Type of Emission:	WCDMA Band 2: 4M21F9W WCDMA Band 5: 4M20F9W
Type of Modulation:	BPSK, QPSK, 16QAM
Antenna Type:	Integral Antenna
Antenna Gain:	WCDMA Band 2: 5.11dBi, WCDMA Band 5:0.89dBi
4G	
Support Networks:	FDD-LTE,TDD-LTE
Support Band:	FDD-LTE Band 2, 4, 5, 7, TDD-LTE Band 38, 40, 41
Uplink Frequency:	FDD-LTE Band 2: Tx: 1850-1910MHz, FDD-LTE Band 4: Tx: 1710-1755MHz, FDD-LTE Band 5: Tx: 824-849MHz, FDD-LTE Band 7: Tx: 2500-2570MHz, TDD-LTE Band 38: Tx: 2570-2620MHz, TDD-LTE Band 40: Tx: 2305-2315MHz, TDD-LTE Band 40: Tx: 2350-2360MHz, TDD-LTE Band 41: Tx:2496-2690MHz,
Downlink Frequency:	FDD-LTE Band 2: Rx: 1930-1990MHz, FDD-LTE Band 4: Rx: 2110-2155MHz, FDD-LTE Band 5: Rx: 869-894MHz,

	FDD-LTE Band 7: Rx: 2620-2690MHz, TDD-LTE Band 38: Rx: 2570-2620MHz, TDD-LTE Band 40: Tx: 2305-2315MHz, TDD-LTE Band 40: Tx: 2350-2360MHz, TDD-LTE Band 41: Rx:2496-2690MHz,
RF Output Power:	FDD-LTE Band 2: 22.27dBm, FDD-LTE Band 4: 24.13dBm, FDD-LTE Band 5: 22.96dBm, FDD-LTE Band 7: 22.14dBm, TDD-LTE Band 38: 21.99dBm, TDD-LTE Band 40(2305-2315MHz): 23.99dBm, TDD-LTE Band 40 (2350-2360MHz): 24.24dBm, TDD-LTE Band 41: 22.69dBm
Type of Emission:	FDD-LTE Band 2: 18M0G7D, 18M1W7D FDD-LTE Band 4: 18M0G7D, 18M1W7D FDD-LTE Band 5: 9M01G7D, 9M00W7D FDD-LTE Band 7: 18M1G7D, 18M1W7D TDD-LTE Band 38:18M1G7D, 18M0W7D TDD-LTE Band 40(2305-2315MHz): 9M00G7D, 9M00W7D TDD-LTE Band 40 (2350-2360MHz): 8M94G7D, 8M93W7D TDD-LTE Band 41: 18M1G7D, 18M0W7D
Type of Modulation:	QPSK, 16QAM
Antenna Type:	Integral Antenna
Antenna Gain:	FDD-LTE Band 2: 5.11dBi, FDD-LTE Band 4:3.65dBi, FDD-LTE Band 5: 1.4dBi, FDD-LTE Band 7: 3.23dBi, TDD-LTE Band 38: 3.58dBi, TDD-LTE Band 40: 2.22dBi, TDD-LTE Band 41: 3.58dBi

1.2 RF Exposure Exemption

According to §1.1307(b)(3) and KDB 447498 D04 Interim General RF Exposure Guidance v01, system operating under the provisions of this section shall be operating in a manner that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure.

Option A: FCC Rule Part 1.1307 (b)(3)(i)(A):The available maximum time-averaged power is no more than 1mW, regardless of separation distance.

Option B: FCC Rule Part 1.1307 (b)(3)(i)(B): The available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. P_{th} is given by:

$$P_{th}\ (\text{mW}) = \begin{cases} ERP_{20\ cm}(d/20\ \text{cm})^{x} & d \le 20\ \text{cm} \\ ERP_{20\ cm} & 20\ \text{cm} < d \le 40\ \text{cm} \end{cases}$$

Where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\ cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20\ cm}\ (\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \le f < 1.5\ \text{GHz} \\ 3060 & 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \end{cases}$$

d = the separation distance (cm);

Option C: FCC Rule Part 1.1307 (b)(3)(i)(C): The minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. R must be at least λ/2π, where λ is the free-space operating wavelength in meters.

Single RF Sources Subject to Routine Environmental Evaluation	
RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1,920 R^2
1.34-30	3,450 R^2/f^2
30-300	3.83 R^2
300-1,500	0.0128 R^2f
1,500-100,000	19.2R^2

For Multiple RF sources: FCC Rule Part 1.1307(b)(3)(ii):

(A) The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required).

(B) In the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

$$\sum_{i=1}^{a} \frac{P_i}{P_{th,i}} + \sum_{j=1}^{b} \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^{c} \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

1.3 Calculated Result

Radio Access Technology	Prediction Frequency	Tune-up Power	Antenna Gain	Duty Cycle Factor	Tune-up Time-Averaged Power	ERP
	(MHz)	(dBm)	(dBi)	(dB)	(dBm)	(dBm)
Bluetooth	2402	7.0	5.19	0	7.00	10.04
Wi-Fi	2412	16.0	5.19	0	16.00	19.04
GPRS850(1 slots)	824	33.0	0.89	9	24.00	22.74
GPRS850(2 slots)	824	32.5	0.89	6	26.50	25.24
GPRS850(3 slots)	824	30.5	0.89	4.25	26.25	24.99
GPRS850(4 slots)	824	29.5	0.89	3	26.50	25.24
GPRS1900(1 slots)	1850	29.5	5.11	9	20.50	23.46
GPRS1900(2 slots)	1850	28.5	5.11	6	22.50	25.46
GPRS1900(3 slots)	1850	27.0	5.11	4.25	22.75	25.71
GPRS1900(4 slots)	1850	26.0	5.11	3	23.00	25.96
EDGE850(1 slots)	824	27.5	0.89	9	18.50	17.24
EDGE850(2 slots)	824	26.5	0.89	6	20.50	19.24
EDGE850(3 slots)	824	24.5	0.89	4.25	20.25	18.99
EDGE850(4 slots)	824	23.5	0.89	3	20.50	19.24
EDGE1900(1 slots)	1850	26.5	5.11	9	17.50	20.46
EDGE1900(2 slots)	1850	25.0	5.11	6	19.00	21.96
EDGE1900(3 slots)	1850	23.0	5.11	4.25	19.00	21.96
EDGE1900(4 slots)	1850	22.0	5.11	3	19.00	21.96
WCDMA Band V	824	22.5	0.89	0	22.50	21.24
WCDMA Band II	1850	22.5	5.11	0	22.50	25.46
LTE Band 2	1850	22.5	5.11	0	22.50	25.46
LTE Band 4	1710	24.5	3.65	0	24.50	26.00

LTE Band 5	824	23.0	1.4	0	23.00	22.25
LTE Band 7	2500	22.5	3.23	0	22.50	23.58
LTE Band 38	2570	23.0	3.58	0	23.00	24.43
LTE Band 40	2305	24.5	2.22	0	24.50	24.57
LTE Band 41	2496	23.0	3.58	0	23.00	24.43

Radio Access Technology	Option	Min. Distance	Max. Power		Exposure Limit	Ratio	Result
		(cm)	(dBm)	(mW)	(mW)		Pass/Fail
Bluetooth	C	20.00	10.04	10.09	768.00	0.01	Pass
Wi-Fi	C	20.00	19.04	80.17	768.00	0.10	Pass
GPRS850(1 slots)	C	20.00	22.74	187.93	421.89	0.45	Pass
GPRS850(2 slots)	C	20.00	25.24	334.20	421.89	0.79	Pass
GPRS850(3 slots)	C	20.00	24.99	315.50	421.89	0.75	Pass
GPRS850(4 slots)	C	20.00	25.24	334.20	421.89	0.79	Pass
GPRS1900(1 slots)	C	20.00	23.46	221.82	768.00	0.29	Pass
GPRS1900(2 slots)	C	20.00	25.46	351.56	768.00	0.46	Pass
GPRS1900(3 slots)	C	20.00	25.71	372.39	768.00	0.48	Pass
GPRS1900(4 slots)	C	20.00	25.96	394.46	768.00	0.51	Pass
EDGE850(1 slots)	C	20.00	17.24	52.97	421.89	0.13	Pass
EDGE850(2 slots)	C	20.00	19.24	83.95	421.89	0.20	Pass
EDGE850(3 slots)	C	20.00	18.99	79.25	421.89	0.19	Pass
EDGE850(4 slots)	C	20.00	19.24	83.95	421.89	0.20	Pass
EDGE1900(1 slots)	C	20.00	20.46	111.17	768.00	0.14	Pass
EDGE1900(2 slots)	C	20.00	21.96	157.04	768.00	0.20	Pass
EDGE1900(3 slots)	C	20.00	21.96	157.04	768.00	0.20	Pass
EDGE1900(4 slots)	C	20.00	21.96	157.04	768.00	0.20	Pass
WCDMA Band V	C	20.00	21.24	133.05	421.89	0.32	Pass
WCDMA Band II	C	20.00	25.46	351.56	768.00	0.46	Pass
LTE Band 2	C	20.00	25.46	351.56	768.00	0.46	Pass
LTE Band 4	C	20.00	26.00	398.11	768.00	0.52	Pass
LTE Band 5	C	20.00	22.25	167.88	421.89	0.40	Pass
LTE Band 7	C	20.00	23.58	228.03	768.00	0.30	Pass
LTE Band 38	C	20.00	24.43	277.33	768.00	0.36	Pass
LTE Band 40	C	20.00	24.57	286.42	768.00	0.37	Pass
LTE Band 41	C	20.00	24.43	277.33	768.00	0.36	Pass

Note: 1. For GSM, Duty cycle factor = 9 dB for 1 Tx slot, 6 dB for 2 Tx slots, 4.25 dB for 3 Tx slots, 3 dB for 4 Tx slots;

2. Tune-up time-average power = Tune-up Power - Duty cycle factor in dB

2. Output Power=EIRP- Antenna Gain; ERP=EIRP-2.15dB

3. Option A, B and C refers as clause 1.2.

4. For option B, Max (time-averaged power, effective radiated power (ERP)) converts to Max. Power. For option C, ERP converts to Max. Power;

5. For option B, P_{th} (mW) converts to Exposure Limit (mW); For option C, ERP (W) converts to Exposure

Limit (mW).

6. Ratio= Tune-up ERP (mW)/ Exposure Limit (mW)

Mode for Simultaneous Multi-band Transmission:

Radio Access Technology	Ratio 1	Ratio 2	Simultaneous Ratio	Limit	Result
					Pass/Fail
Bluetooth+WWAN	0.01	0.79	0.80	1	Pass
WLAN+WWAN	0.10	0.79	0.89	1	Pass

Result: Pass