

# EMF TEST REPORT

**Test Report No.** : OT-22D-RWD-060  
**Reception No.** : 2204001280  
**Applicant** : LG Electronics USA  
**Address** : 111 Sylvan Avenue, North Building, Englewood Cliffs, New Jersey, 07632, United States  
**Manufacturer** : LG Electronics Inc.  
**Address** : 222 LG-ro, Jinwi-Myeon, Pyeongtaek -Si, Gyeonggi-Do, 451-713, Korea  
**Type of Equipment** : Car Navigation  
**FCC ID.** : BEJ-ICAS3GP  
**Model Name** : ICAS3GP  
**Multiple Model Name** : N/A  
**Serial number** : N/A  
**Total page of Report** : 13 pages (including this page)  
**Date of Incoming** : November 28, 2022  
**Date of issue** : December 29, 2022

## SUMMARY

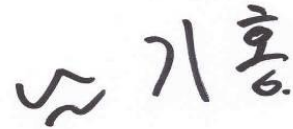
The equipment complies with the regulation; *FCC CFR 47 PART 1.1310*

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

This report is not correlated with the "KS Q ISO/IEC 17025 and KOLAS accreditation" of Korean Laboratory Accreditation Scheme.





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**Revision History**

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-22D-RWD-060	December 29, 2022	Initial Release	All

## 1. VERIFICATION OF COMPLIANCE

Applicant : LG Electronics USA  
 Address : 111 Sylvan Avenue, North Building, Englewood Cliffs, New Jersey, 07632, United States  
 Contact Person : Sung Soo, Kim / Director, Regulatory and Environmental Affairs  
 Telephone No. : +201-266-2215  
 FCC ID : BEJ-ICAS3GP  
 Model Name : ICAS3GP  
 Brand Name : LG, Volkswagen, Seat, Skoda, Ford  
 Serial Number : N/A  
 Date : December 29, 2022

EQUIPMENT CLASS	DSS – PART 15 SPREAD SPECTRUM TRANSMITTER
E.U.T. DESCRIPTION	Car Navigation
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC PART 15 SUBPART C Section 15.247 KDB 558074 D01 15.247 Meas Guidance v05r02
Modifications on the Equipment to Achieve Compliance	None
Final Test was Conducted On	3 m, Semi Anechoic Chamber

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

## 2. GENERAL INFORMATION

### 2.1 Product Description

The LG Electronics USA, Model ICAS3GP (referred to as the EUT in this report) is a Car Navigation. The product specification described herein was obtained from product data sheet or user’s manual.

DEVICE TYPE	Car Navigation	
OPERATING FREQUENCY	Bluetooth	2 402 MHz ~ 2 480 MHz
	WLAN 2.4 GHz	2 412 MHz ~ 2 462 MHz (802.11b/g/n(HT20))
	WLAN 5 150 MHz ~ 5 250 MHz Band	5 180 MHz ~ 5 240 MHz (802.11a/n(HT20))
		5 190 MHz ~ 5 230 MHz (802.11n(HT40))
		5 210 MHz (802.11ac(VHT80))
	WLAN 5 725 MHz ~ 5 850 MHz Band	5 745 MHz ~ 5 825 MHz (802.11a/n(HT20))
		5 755 MHz ~ 5 795 MHz (802.11n(HT40))
		5 775 MHz (802.11ac(VHT80))
MODULATION TYPE	Bluetooth	GFSK for 1Mbps, $\pi/4$ -DQPSK for 2Mbps, 8-DPSK for 3Mbps
	WLAN 2.4 GHz	802.11b: DSSS Modulation (DBPSK/DQPSK/CCK)
		802.11g/n(HT20): OFDM Modulation (BPSK/QPSK/16QAM/64QAM)
WLAN 5 GHz	802.11a/n(HT20)/n(HT40)/ac(VHT80): OFDM Modulation(BPSK/QPSK/16QAM/64QAM)	

RF OUTPUT POWER	Bluetooth	2.42 dBm (1 Mbps) 1.70 dBm (2 Mbps) 2.00 dBm (3 Mbps)		
	WLAN 2.4 GHz	8.27 dBm (802.11b) 8.25 dBm (802.11g) 8.53 dBm (802.11n_HT20)		
	WLAN 5 150 MHz ~ 5 250 MHz Band	Antenna 0	9.20 dBm(802.11a) 9.18 dBm(802.11n_HT20) 9.20 dBm(802.11n_HT40) 9.18 dBm(802.11ac_VHT80)	
		Antenna 1	8.91 dBm(802.11a) 8.98 dBm(802.11n_HT20) 8.79 dBm(802.11n_HT40) 8.66 dBm(802.11ac_VHT80)	
		Multiple Antenna	12.07 dBm(802.11a) 12.09 dBm(802.11n_HT20) 12.01 dBm(802.11n_HT40) 11.94 dBm(802.11ac_VHT80)	
	WLAN 5 725 MHz ~ 5 850 MHz Band	Antenna 0	12.82 dBm(802.11a) 12.70 dBm(802.11n_HT20) 12.62 dBm(802.11n_HT40) 12.85 dBm(802.11ac_VHT80)	
		Antenna 1	11.56 dBm(802.11a) 11.34 dBm(802.11n_HT20) 11.43 dBm(802.11n_HT40) 11.56 dBm(802.11ac_VHT80)	
		Multiple Antenna	15.18 dBm(802.11a) 15.03 dBm(802.11n_HT20) 15.08 dBm(802.11n_HT40) 15.26 dBm(802.11ac_VHT80)	

ANTENNA TYPE	Bluetooth	PCB Antenna		
	WLAN 2.4 GHz	Chip Antenna		
	WLAN 5 GHz	Antenna 0	Chip Antenna	
Antenna 1		PCB Antenna		
ANTENNA GAIN	Bluetooth	3.38 dBi		
	WLAN 2.4 GHz	4.71 dBi		
	5 150 MHz ~ 5 250 MHz Band	Antenna 0	3.36 dBi	
		Antenna 1	4.97 dBi	
		Multiple Antenna	7.25 dBi	
	5 725 MHz ~ 5 850 MHz Band	Antenna 0	4.53 dBi	
		Antenna 1	5.17 dBi	
Multiple Antenna		7.87 dBi		
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)		32.786 kHz, 2.17 MHz, 2.2 MHz, 3 MHz, 19.2 MHz, 25 MHz, 26 MHz, 27 MHz, 38.4 MHz, 40 MHz, 55.466 67 MHz, 125 MHz		
RATED SUPPLY VOLTAGE		DC 14.0 V		

**2.2 Alternative type(s)/model(s); also covered by this test report.**

-. None

**3. EUT MODIFICATIONS**

-. None

## 4. MAXIMUM PERMISSIBLE EXPOSURE

### 4.1 RF Exposure Calculation

According to the FCC rule 1.1310 table 1B, the limit for the maximum permissible RF exposure for an uncontrolled environment are  $f/1500$  mW/cm<sup>2</sup> for the frequency range between 300 MHz and 1 500 MHz and 1.0 mW/cm<sup>2</sup> for the frequency range between 1 500 MHz and 100 000 MHz.

The electric field generated for a 1 mW/cm<sup>2</sup> exposure is calculated as follows:

$$E = \sqrt{(30 * P * G) / d}, \text{ and } S = E^2 / Z = E^2 / 377, \text{ because } 1 \text{ mW/cm}^2 = 10 \text{ W/m}^2$$

Where

S = Power density in mW/cm<sup>2</sup>, Z = Impedance of free space, 377 Ω

E = Electric field strength in V/m, G = Numeric antenna gain, and d = distance in meter

Combining equations and rearranging the terms to express the distance as a function of the remaining variable

$$d = \sqrt{(30 * P * G) / (377 * 10 S)}$$

Changing to units of mW and cm, using P (mW) = P (W) / 1 000, d (cm) = 0.01 \* d (m)

$$d = 0.282 * \sqrt{(P * G) / S}$$

Where

d = distance in cm, P = Power in mW, G = Numeric antenna gain, and S = Power density in mW/cm<sup>2</sup>

### 4.2 EUT Description

Kind of EUT	Car Navigation
Device Category	<input type="checkbox"/> Portable (< 20 cm separation) <input type="checkbox"/> Mobile (> 20 cm separation) <input checked="" type="checkbox"/> Others
Exposure Evaluation Applied	<input checked="" type="checkbox"/> MPE <input type="checkbox"/> SAR <input type="checkbox"/> N/A



### 4.3 Calculated MPE Safe Distance for WLAN

#### 4.3.1 DATA for Antenna 0

According to above equation, the following result was obtained.

Operating Freq. Band (MHz)	Operating Mode	Target Power W/tolerance (dBm)	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm <sup>2</sup> ) @ 20 cm Separation	Limit (mW/cm <sup>2</sup> )
			(dBm)	(mW)	Log	Linear			
2 400 ~ 2 483.5	802.11b	8.27 ± 0.5	8.77	7.53	4.71	2.96	1.33	0.004 4	1
	802.11g	8.25 ± 0.5	8.75	7.50			1.33	0.004 4	1
	802.11n_HT20	8.53 ± 0.5	9.03	8.00			1.37	0.004 7	1
5 150 ~ 5 250	802.11a	9.20 ± 0.5	9.70	9.33	3.36	2.17	1.27	0.004 0	1
	802.11n HT20	9.18 ± 0.5	9.68	9.29			1.27	0.004 0	1
	802.11n HT40	9.20 ± 0.5	9.70	9.33			1.27	0.004 0	1
	802.11ac80	9.18 ± 0.5	9.68	9.29			1.27	0.004 0	1
5 725 ~ 5 850	802.11a	12.82 ± 0.5	13.32	21.48	4.53	2.84	2.20	0.012 1	1
	802.11n HT20	12.70 ± 0.5	13.20	20.89			2.17	0.011 8	1
	802.11n HT40	12.62 ± 0.5	13.12	20.51			2.15	0.011 6	1
	802.11ac80	12.85 ± 0.5	13.35	21.63			2.21	0.012 2	1

According to above table, for 2 400 ~ 2483.5 MHz Band(802.11 b), safe distance,

$$D = 0.282 * \sqrt{(7.53 * 2.96)/1.00} = 1.33 \text{ cm.}$$

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 7.53 * 2.96 / (4 * \pi * 20^2) = 0.004 4$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

### 4.3.2 DATA for Antenna 1

According to above equation, the following result was obtained.

Operating Freq. Band (MHz)	Operating Mode	Target Power W/tolerance (dBm)	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm <sup>2</sup> ) @ 20 cm Separation	Limit (mW/cm <sup>2</sup> )
			(dBm)	(mW)	Log	Linear			
5 150 ~ 5 250	802.11a	8.91 ± 0.5	9.41	8.73	4.97	3.14	1.48	0.005 5	1
	802.11n HT20	8.98 ± 0.5	9.48	8.87			1.49	0.005 5	1
	802.11n HT40	8.79 ± 0.5	9.29	8.49			1.46	0.005 3	1
	802.11ac80	8.66 ± 0.5	9.16	8.24			1.43	0.005 1	1
5 725 ~ 5 850	802.11a	11.56 ± 0.5	12.06	16.07	5.17	3.29	2.05	0.010 5	1
	802.11n HT20	11.34 ± 0.5	11.84	15.28			2.00	0.010 0	1
	802.11n HT40	11.43 ± 0.5	11.93	15.60			2.02	0.010 2	1
	802.11ac80	11.56 ± 0.5	12.06	16.07			2.05	0.010 5	1

According to above equation, the following result was obtained.

According to above table, for 5 150 ~ 5250 MHz Band(802.11 a), safe distance,

$$D = 0.282 * \sqrt{(8.73 * 3.14)/1.00} = 1.48 \text{ cm.}$$

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 8.73 * 3.14 / (4 * \pi * 20^2) = 0.005 5$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

### 4.3.3 DATA for Multiple Transmit

According to above equation, the following result was obtained.

Operating Freq. Band (MHz)	Operating Mode	Target Power W/tolerance (dBm)	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density @ 20 cm Separation	Limit
			(dBm)	(mW)	Log	Linear			
5 150 ~ 5 250	802.11a	12.07 ± 0.5	12.57	18.07	7.25	5.31	2.76	0.019 1	1
	802.11n HT20	12.09 ± 0.5	12.59	18.16			2.77	0.019 2	1
	802.11n HT40	12.01 ± 0.5	12.51	17.82			2.74	0.018 8	1
	802.11ac80	11.94 ± 0.5	12.44	17.54			2.72	0.018 5	1
5 725 ~ 5 850	802.11a	15.18 ± 0.5	15.68	36.98	7.87	6.12	4.24	0.045 1	1
	802.11n HT20	15.03 ± 0.5	15.53	35.73			4.17	0.043 5	1
	802.11n HT40	15.08 ± 0.5	15.58	36.14			4.20	0.044 0	1
	802.11ac80	15.26 ± 0.5	15.76	37.67			4.28	0.045 9	1

According to above equation, the following result was obtained.

According to above table, for 5 150 ~ 5250 MHz Band(802.11 a), safe distance,

$$D = 0.282 * \sqrt{(18.07 * 5.31)/1.00} = 2.76 \text{ cm.}$$

For getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 18.07 * 5.31 / (4 * \pi * 20^2) = 0.019 1$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

#### 4.4 Calculated MPE Safe Distance for Bluetooth

According to above equation, the following result was obtained.

Operating Freq. Band (MHz)	Operating Mode	Target Power W/tolerance (dBm)	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm <sup>2</sup> ) @ 20 cm Separation	Limit (mW/cm <sup>2</sup> )
			(dBm)	(mW)	Log	Linear			
2 402 ~ 2 480	1 Mbps	2.42 ± 0.5	2.92	1.96	3.38	2.18	0.58	0.000 8	1
	2 Mbps	1.70 ± 0.5	2.20	1.66			0.54	0.000 7	1
	3 Mbps	2.00 ± 0.5	2.50	1.78			0.55	0.000 8	1

According to above table, for 2 402 ~ 2480 MHz Band(1 Mbps), safe distance,

$$D = 0.282 * \sqrt{(1.96 * 2.18)/1.00} = 0.58 \text{ cm.}$$

sFor getting power density at 20 cm separation in above table, following formula was used.

$$S = P * G / (4\pi * R^2) = 1.96 * 2.18 / (4 * \pi * 20^2) = 0.000 8$$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

#### 4.5 DATA for Intermodulation Transmit

According to above equation, the following result was obtained.

Operating Freq. Band	Operating Mode	Target Power W/tolerance (dBm)	Max tune up power		Power Density @ 20 cm Separation	Sum Power Density @ 20 cm Separation	Limit
			(dBm)	(mW)			
Bluetooth + WLAN 2 GHz	Bluetooth (1 Mbps)	2.42 ± 0.5	2.92	1.96	0.000 8	0.005 5	1.00
	WLAN 2 GHz (802.11n(HT20) _Antenna 0)	8.53 ± 0.5	9.03	8.00	0.004 7		
Bluetooth + WLAN 5 GHz	Bluetooth (1 Mbps)	2.42 ± 0.5	2.92	1.96	0.000 8	0.013 0	1.00
	WLAN 5 GHz (UNII 3 802.11ac(VHT80) _Antenna 0)	12.85 ± 0.5	13.35	21.63	0.012 2		
WLAN 2 GHz + WLAN 5 GHz	WLAN 2 GHz (802.11n(HT20) _Antenna 0)	8.53 ± 0.5	9.03	8.00	0.004 7	0.015 2	1.00
	WLAN 5 GHz (UNII 3 802.11ac(VHT80) _Antenna 1)	11.56 ± 0.5	12.06	16.07	0.010 5		