ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LOW-POWER, NON-LICENSED TRANSMITTER

Test Report No.	**: OT-197-RWD-048**
AGR No.	**: A193A-241**
Applicant	**: LG Electronics USA**
Address	**: 1000 Sylvan Avenue, Englewood Cliffs, New Jersey, United States, 07632**
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-MEBICAS3**
Model Name	**: MEB ICAS3**
Serial number	**: N/A**
Total page of Report	**: 12 pages (including this page)**
Date of Incoming	**: May 20, 2019**
Date of issue	**: July 19, 2019**

SUMMARY

The equipment complies with the regulation; ***FCC PART 15 SUBPART C Section 15.247 & FCC PART 15 SUBPART E Section 15.407***

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.

Reviewed by: Ha-Ram Lee / Assistant Manager, ONETECH Corp.

Approved by: Jae-Ho Lee / Chief Engineer, ONETECH Corp.

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ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

REVISION HISTORY

Issued Report No.	Issued Date	Revisions	Effect Section
OT-197-RWD-048	July 19, 2019	Initial Issue	All

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

1. VERIFICATION OF COMPLIANCE

Applicant : LG Electronics USA

Address : 1000 Sylvan Avenue, Englewood Cliffs, New Jersey, United States, 07632

Contact Person : Kyung-Su Han / Director

Telephone No. : (201) 266-2215

FCC ID : BEJ-MEBICAS3

Model Name : MEB ICAS3

Brand Name : LG, Volkswagen, SKODA, SEAT, Volkswagen, Seat

Serial Number : N/A

Date : July 19, 2019

EQUIPMENT CLASS	DTS – DIGITAL TRNSMISSION SYSTEM NII – Unlicensed National Information Infrastructure(UNII)
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 FCC PART 15 SUBPART E Section 15.407 KDB 558074 D01 DTS Meas Guidance
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.

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2. GENERAL INFORMATION

2.1 Product Description

The LG Electronics USA, Model MEB ICAS3 (referred to as the EUT in this report) is a Car Navigation. Product specification information described herein was obtained from product data sheet or user's manual.

<table>
<tr><td>DEVICE TYPE</td><td colspan="4">Car Navigation</td></tr>
<tr><td rowspan="9">FREQUENCY RANGE</td><td>Bluetooth</td><td colspan="3">2 402 MHz ~ 2 480 MHz</td></tr>
<tr><td>WLAN
2.4 GHz Band</td><td colspan="3">2 412 MHz ~ 2 462 MHz (802.11b/g/n(HT20))</td></tr>
<tr><td rowspan="6">WLAN
5 GHz Band</td><td rowspan="3">5 150 MHz ~
5 250 MHz Band</td><td colspan="2">5 180 MHz ~ 5 240 MHz (802.11a/n/ac(HT20))</td></tr>
<tr><td colspan="2">5 190 MHz ~ 5 230 MHz (802.11n/ac(HT40))</td></tr>
<tr><td colspan="2">5 210 MHz (802.11ac(VHT80))</td></tr>
<tr><td rowspan="3">5 725 MHz ~
5 850 MHz Band</td><td colspan="2">5 745 MHz ~ 5 825 MHz (802.11a/n/ac(HT20))</td></tr>
<tr><td colspan="2">5 755 MHz ~ 5 795 MHz (802.11n/ac(HT40))</td></tr>
<tr><td colspan="2">5 775 MHz (802.11ac(VHT80))</td></tr>
<tr><td rowspan="12">MAX. RF OUTPUT POWER</td><td rowspan="3">Bluetooth</td><td>1 Mbps</td><td colspan="2">-1.56 dBm</td></tr>
<tr><td>2 Mbps</td><td colspan="2">-0.88 dBm</td></tr>
<tr><td>3 Mbps</td><td colspan="2">-0.54 dBm</td></tr>
<tr><td>WLAN
2.4 GHz Band</td><td colspan="3">Wi-Fi 802.11b (10.63 dBm)
Wi-Fi 802.11g (11.85 dBm)
Wi-Fi 802.11n(HT20) (10.93 dBm)</td></tr>
<tr><td rowspan="9">WLAN
5 GHz Band</td><td rowspan="9">5 150 MHz ~
5 250 MHz Band</td><td rowspan="3">Antenna 0</td><td>Wi-Fi 802.11a (10.97 dBm)
Wi-Fi 802.11n(HT20) (10.86 dBm)
Wi-Fi 802.11n(HT40) (8.64 dBm)
Wi-Fi 802.11ac(VHT80) (8.05 dBm)</td></tr>
<tr><td rowspan="3">Antenna 1</td><td>Wi-Fi 802.11a (10.03 dBm)
Wi-Fi 802.11n(HT20) (9.74 dBm)
Wi-Fi 802.11n(HT40) (7.92 dBm)
Wi-Fi 802.11ac(VHT80) (7.09 dBm)</td></tr>
<tr><td rowspan="3">Multiple transmit</td><td>Wi-Fi 802.11n(HT20) (13.34 dBm)
Wi-Fi 802.11n(HT40) (11.31 dBm)
Wi-Fi 802.11ac(VHT80) (10.61 dBm)</td></tr>
</table>

<table>
<tr><td rowspan="3">MAX. RF OUTPUT POWER</td><td rowspan="3">WLAN
5 GHz Band</td><td rowspan="3">5 725 MHz ~
5 850 MHz Band</td><td>Antenna 0</td><td colspan="2">Wi-Fi 802.11a (10.62 dBm)
Wi-Fi 802.11n(HT20) (10.53 dBm)
Wi-Fi 802.11n(HT40) (8.31 dBm)
Wi-Fi 802.11ac(VHT80) (7.63 dBm)</td></tr>
<tr><td>Antenna 1</td><td colspan="2">Wi-Fi 802.11a (9.48 dBm)
Wi-Fi 802.11n(HT20) (9.86 dBm)
Wi-Fi 802.11n(HT40) (8.07 dBm)
Wi-Fi 802.11ac(VHT80) (6.99 dBm)</td></tr>
<tr><td>Multiple transmit</td><td colspan="2">Wi-Fi 802.11n(HT20) (13.15 dBm)
Wi-Fi 802.11n(HT40) (11.20 dBm)
Wi-Fi 802.11ac(VHT80) (10.33 dBm)</td></tr>
<tr><td rowspan="3">MODULATION TYPE</td><td colspan="3">Bluetooth</td><td colspan="3">GFSK for 1 Mbps, π/4-DQPSK for 2 Mbps, 8-DPSK for 3 Mbps</td></tr>
<tr><td colspan="3">WLAN
2.4 GHz Band</td><td colspan="3">DSSS Modulation(DBPSK/DQPSK/CCK)
OFDM Modulation(BPSK/QPSK/16QAM/64QAM)</td></tr>
<tr><td colspan="3">WLAN
5 GHz Band</td><td colspan="3">OFDM Modulation(BPSK/QPSK/16QAM/64QAM)</td></tr>
<tr><td rowspan="4">ANTENNA TYPE</td><td colspan="3">Bluetooth</td><td colspan="3">PCB Antenna</td></tr>
<tr><td colspan="3">WLAN (2.4GHz Band)</td><td colspan="3">Chip Antenna</td></tr>
<tr><td rowspan="2">WLAN (5GHz Band)</td><td>Antenna 0</td><td colspan="3">PCB Antenna</td></tr>
<tr><td>Antenna 1</td><td colspan="3">Chip Antenna</td></tr>
<tr><td rowspan="6">ANTENNA GAIN</td><td colspan="3">Bluetooth</td><td colspan="3">2.5 dBi</td></tr>
<tr><td colspan="3">WLAN
2.4 GHz Band</td><td colspan="3">3.8 dBi</td></tr>
<tr><td rowspan="4">WLAN
5 GHz Band</td><td rowspan="2">5 150 MHz ~
5 250 MHz</td><td>ANT0</td><td>3.8 dBi</td></tr>
<tr><td>ANT1</td><td>1.6 dBi</td></tr>
<tr><td rowspan="2">5 725 MHz ~
5 850 MHz</td><td>ANT0</td><td>5.5 dBi</td></tr>
<tr><td>ANT1</td><td>2.4 dBi</td></tr>
<tr><td rowspan="2">5 GHz Band (ANT 0 + 1)</td><td>5 150 MHz ~
5 250 MHz</td><td colspan="2">5.78 dBi</td></tr>
<tr><td>5 725 MHz ~
5 850 MHz</td><td colspan="2">7.10 dBi</td></tr>
<tr><td colspan="3">List of each Osc. or crystal Freq.(Freq. >= 1 MHz)</td><td colspan="3">31.25 MHz, 28.63636 MHz</td></tr>
<tr><td colspan="3">RATED SUPPLY VOLTAGE</td><td colspan="3">DC 12.0 V</td></tr>
</table>

- Directional Gain Calculations

Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2 / N_{ANT}]$ dBi

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

-. The following lists consist of the added config and their differences:

Brand	Model	Feature	VW P/N	LG P/N	ABT (FPD-LINK)	FPK (FPD-LINK)	USB NO.	BT +WIFI	CAN NO.	ETH 1Gb/s	FM Always PD+BGS	A2B	DAB (MRC+BGS	AR-HUD	Tuner IC	Tested
LG VW, SKODA, SEAT	MEB ICAS3	Nav	(10A.035. 820)	NE9VW1-N2E	X	X	2	X	2	X	X	X	X		Mercury + Titan	☑
		AR HUD + Nav	(10A.035. 816)	NE9VW1-A2E	X	X	2	X	2	X	X	X	X	X	Mercury + Titan	□
		Nav	(10A.035. 842)	NE0VW1-N2N	X	X	2	X	2	X	X	X			Mercury + SDARS	□
		AR HUD + Nav	(10A.035. 877)	NE0VW1-A2N	X	X	2	X	2	X	X	X		X	Mercury + SDARS	□
		Nav	(5LA.035. 820)	NE0SK1-N4E	X	X	2	X	2	X	X	X	X		Mercury + Titan	□
		AR HUD + Nav	(5LA.035. 816)	NE0SK1-A4E	X	X	2	X	2	X	X	X	X	X	Mercury + Titan	□
		Nav	(10E.035. 820)	NE0SE1-N3E	X	X	2	X	2	X	X	X	X		Mercury + Titan	□
		AR HUD + Nav	(10E.035. 816)	NE0SE1-A3E	X	X	2	X	2	X	X	X	X	X	Mercury + Titan	□

Note: 1. Applicants must delegate only the models with all feautres applied to be tested, Therefore, this test report only guarantees the unit tested.

2. The Applicant/manufacturer is responsible for the compliance of all configs

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/cm² for the frequency range between 300 MHz and 1 500 MHz and 1.0 mW/cm² for the frequency range between 1 500 MHz and 100 000 MHz.

The electric field generated for a 1 mW/cm² exposure is calculated as follows:

$E = \sqrt{(30 * P * G)} / d$, and $S = E^2 / Z = E^2 / 377$, because 1 mW/cm² = 10 W/m²

Where

S = Power density in mW/cm², Z = Impedance of free space, 377 Ω

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

Combing 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/cm²

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4.2 EUT Description

Kind of EUT	Car Navigation
Operating Frequency Band	☐ Wireless Microphone: 494.000 MHz ~ 501.000 MHz and 498.200 MHz ~ 505.200 MHz ■ WLAN: 2 412 MHz ~ 2 462 MHz ☐ WLAN: 2 422 MHz ~ 2 452 MHz ■ WLAN: 5 180 MHz ~ 5 240 MHz ■ WLAN: 5 190 MHz ~ 5 230 MHz ■ WLAN: 5 210 MHz ■ WLAN: 5 745 MHz ~ 5 825 MHz ■ WLAN: 5 755 MHz ~ 5 795 MHz ■ WLAN: 5 775 MHz ■ FHSS: 2 402 MHz ~ 2 480 MHz ☐ GFSK Modulation: 2403 MHz , 2443 MHz , 2478 MHz
Device Category	☐ Portable (< 20 cm separation) ■ Mobile (> 20 cm separation) ☐ Others
Exposure Evaluation Applied	■ MPE ☐ SAR ☐ N/A

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5. Calculated MPE Safe Distance

5.1 Test data (2.4 GHz Band)

According to above equation, the following result was obtained.

Operating Freq. Band	Operating Mode	Target Power W/tolerance	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm²) @ 20 cm Separation	Limit (mW/cm²)
		(dBm)	(dBm)	(mW)	Log	Linear			
2 412 ~ 2 462	802.11b	10.13 ± 0.5	10.63	11.56	3.8	2.399	1.49	0.005 517	1.00
2 412 ~ 2 462	802.11g	11.35 ± 0.5	11.85	15.31	3.8	2.399	1.71	0.007 307	1.00
2 412 ~ 2 462	802.11n(HT20)	10.43 ± 0.5	10.93	12.39	3.8	2.399	1.54	0.005 912	1.00

According to above table, for 2 400 ~ 2 483.5 MHz Band, safe distance,

$D = 0.282 * \sqrt{(11.56 * 2.399)/1.00} = 1.49$ cm

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

$S = P * G / (4\pi * R^2) = 11.56 * 2.399 / (4 * 3.14 * 20^2) = 0.005\ 517$

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

Tested by: Sieon Lee / Assistant Manager

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5.2 Test data (5 GHz Band)

According to above equation, the following result was obtained.

Operating Freq. Band	Operating Mode	Target Power W/tolerance	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm²) @ 20 cm Separation	Limit (mW/cm²)
		(dBm)	(dBm)	(mW)	Log	Linear			
5 150 ~ 5 250	802.11a	10.47 ± 0.5	10.97	12.50	3.80	2.399	1.54	0.006 0	1.00
5 150 ~ 5 250	802.11n(HT20)	12.84 ± 0.5	13.34	21.58	5.78	3.784	2.55	0.016 2	1.00
5 150 ~ 5 250	802.11n(HT40)	10.81 ± 0.5	11.31	13.52	5.78	3.784	2.02	0.010 2	1.00
5 150 ~ 5 250	802.11ac(VHT80)	10.11 ± 0.5	10.61	11.51	5.78	3.784	1.86	0.008 7	1.00
5 725 ~5 850	802.11a	10.12 ± 0.5	10.62	11.53	2.40	1.738	1.26	0. 004 0	1.00
5 725 ~5 850	802.11n(HT20)	12.65 ± 0.5	13.15	20.65	7.10	5.129	2.90	0.021 1	1.00
5 725 ~5 850	802.11n(HT40)	10.70 ± 0.5	11.20	13.18	7.10	5.129	2.32	0.013 5	1.00
5 725 ~5 850	802.11ac(VHT80)	9.83 ± 0.5	10.33	10.79	7.10	5.129	2.10	0.011 0	1.00

According to above table, for 5 150 ~ 5 250 MHz Band, safe distance,

$D = 0.282 * \sqrt{(12.50 * 2.399)}/1.00 = 1.54$ cm

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

$S = P * G / (4\pi * R^2) = 12.50 * 2.399 / (4 * 3.14 * 20^2) = 0.006\ 0$

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

Tested by: Sieon Lee / Assistant Manager

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5.3 Calculation Result Of Maximum Conducted Power

Operating Freq. Band	Operating Mode	Target Power W/tolerance	Max tune up power		Antenna Gain		Safe Distance (cm)	Power Density (mW/cm²) @ 20 cm Separation	Limit (mW/cm²)
		(dBm)	(dBm)	(mW)	Log	Linear			
2.4G WLAN	802.11g	11.35 ± 0.5	11.85	15.31	3.8	2.399	1.71	0.007 307	1.00
BT	3 Mbps	-1.04 ± 0.5	-0.54	0.98	2.50	1.778	0.35	0.000 312	1.00
5 150 ~ 5 250	802.11n(HT20)	12.84 ± 0.5	13.34	21.58	5.78	3.784	2.55	0.016 2	1.00
5 725 ~5 850	802.11n(HT20)	12.65 ± 0.5	13.15	20.65	7.10	5.129	2.90	0.021 1	1.00

- Bluetooth transmit simultaneously with 2.4 GHz and 5 GHz WiFi.

Bluetooth + 2.4 GHz band =

(0.000 312 / 1) + (0.007 307 / 1) = 0.007 619

Bluetooth + 5 GHz band =

(0.000 312 / 1) + (0.021 1 / 1) = 0.021 312

- Therefore the maximum calculations of above situations are less than the “1” limit.

Tested by: Sieon Lee / Assistant Manager

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