

TEST REPORT

of

FCC CFR 47 part 1, 1.1307(b), 1.1310

FCC ID: BEJTM05FNNAGM0

Equipment Under Test : Telematics Module
Model Name : TM05FNNAGM0
Variant Model Name(s) : TM05FNNAGM1
Applicant : LG Electronics USA
Manufacturer : LG Electronics Inc.
Date of Receipt : 2022.07.22
Date of Test(s) : 2022.07.25 ~ 2023.02.16
Date of Issue : 2023.03.03

In the configuration tested, the EUT complied with the standards specified above. This test report does not assure KOLAS accreditation.

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Tested by:



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Technical
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1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)

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- CAB Identifier: KR0150

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1.2. Details of Applicant

Applicant : LG Electronics USA

Address : 111 Sylvan Avenue, North Building, Englewood Cliffs, New Jersey, United States, 07632

Contact Person : Cho, Hee-jae

Phone No. : +1 201 470 2696

1.3. Details of Manufacturer

Company : LG Electronics Inc.

Address : 10, Magokjungang 10-ro, Gangseo-gu, Seoul, Korea, 07796

1.4. Description of EUT

Kind of Product		Telematics Module
Model Name		TM05FNNAGM0
Variant Model Name		TM05FNNAGM1
Serial Number		Conducted: 351015130056680 Radiated: 351015130065751
Power Supply		DC 3.90 V
Rated Power		WCDMA II, V: 24 dBm WCDMA IV: 23.5 dBm LTE Band 2, 7, 13, 14: 24 dBm LTE Band 5, 12: 24.2 dBm LTE Band 4, 66: 23.5 dBm NR Band 2, 5, 7, 12, 13, 14, 25, 26, 71: 24 dBm NR Band 66: 23.5 dBm NR Band 41, 77, 78: 25 dBm
Frequency Range	Port 1	WCDMA II: 1 850 MHz ~ 1 910 MHz WCDMA IV: 1 710 MHz ~ 1 755 MHz WCDMA V: 824 MHz ~ 849 MHz LTE Band 2: 1 850 MHz ~ 1 910 MHz LTE Band 4: 1 710 MHz ~ 1 755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2 500 MHz ~ 2 570 MHz LTE Band 12: 699 MHz ~ 716 MHz LTE Band 13: 777 MHz ~ 787 MHz LTE Band 14: 788 MHz ~ 798 MHz LTE Band 66: 1 710 MHz ~ 1 780 MHz NR Band 2: 1 850 MHz ~ 1 910 MHz NR Band 5: 824 MHz ~ 849 MHz NR Band 7: 2 500 MHz ~ 2 570 MHz NR Band 12: 699 MHz ~ 716 MHz NR Band 13: 777 MHz ~ 787 MHz NR Band 14: 788 MHz ~ 798 MHz NR Band 25: 1 850 MHz ~ 1 915 MHz NR Band 26(FCC Only): 814 MHz ~ 824 MHz NR Band 26: 824 MHz ~ 849 MHz NR Band 66: 1 710 MHz ~ 1 780 MHz NR Band 71: 663 MHz ~ 698 MHz NR Band 41: 2 496 MHz ~ 2 690 MHz NR Band 77: 3 450 MHz ~ 3 550 MHz NR Band 77: 3 700 MHz ~ 3 980 MHz NR Band 78: 3 450 MHz ~ 3 550 MHz NR Band 78: 3 700 MHz ~ 3 800 MHz
	Port 2	NR Band 41: 2 496 MHz ~ 2 690 MHz NR Band 77: 3 450 MHz ~ 3 550 MHz NR Band 77: 3 700 MHz ~ 3 980 MHz NR Band 78: 3 450 MHz ~ 3 550 MHz NR Band 78: 3 700 MHz ~ 3 800 MHz
Modulation Technique		QPSK, 16QAM, GSMK, 8PSK, BPSK, QPSK, 16QAM, 64QAM
Antenna Type		Metal antenna
Antenna Gain※		Refer to the clause 1.5
H/W Version		REV.D
S/W Version		SW168

1.5. Antenna Information

Band	Operating Frequency (MHz)	Antenna Peak Gain (dB i)
WCDMA II LTE 2 NR 25/2	1 850 ~ 1 910	5.12
NR 26	814 ~ 824	0.37
WCDMA V LTE 5 NR 26/5	824 ~ 849	0.37
LTE 7 NR 7	2 500 ~ 2 570	5.99
LTE 12 NR 12	699 ~ 716	-1.05
LTE 13 NR 13	777 ~ 787	-0.53
LTE 14 NR 14	788 ~ 798	-0.53
WCDMA IV	1 710 ~ 1 755	5.19
LTE 66/4 NR 66	1 710 ~ 1 780	5.54
NR 71	663 ~ 698	0.37
NR 41_Ant. 1	2 496 ~ 2 690	0.09
NR 41_Ant. 2		5.99
NR 41_Ant. 1 + Ant. 2		6.54
NR 77_Ant. 1	3 450 ~ 3 550	3.24
NR 77_Ant. 2		6.29
NR 77_Ant. 1 + Ant. 2		7.91
NR 77_Ant. 1	3 700 ~ 3 980	3.24
NR 77_Ant. 2		6.29
NR 77_Ant. 1 + Ant. 2		7.91
NR 78_Ant. 1	3 450 ~ 3 550	3.24
NR 78_Ant. 2		6.29
NR 78_Ant. 1 + Ant. 2		7.91
NR 78_Ant. 1	3 700 ~ 3 800	3.24
NR 78_Ant. 2		6.29
NR 78_Ant. 1 + Ant. 2		7.91

Remark;

- Port 1 means secondary cell and Port 2 means primary cell.

1) According to KDB 662911 D01 Multiple Transmitter Output v02r01 F)2)d)(i),
Port 1 + Port 2 Antenna Gain = $10 * \log[(10^{G_1/20} + 10^{G_2/20})^2 / N_{ANT}]$

Where,

G_1 = antenna gain of port 1,

G_2 = antenna gain of port 2,

N_{ANT} = the number of antennas

1.6. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 1		
Section	Test Item(s)	Result
1.1307(b)(3)	RF Exposure Evaluation	Complied

1.7. Test Report Revision

Revision	Report Number	Date of Issue	Description
0	F690501-RF-RTL003826	2023.02.16	Initial
1	F690501-RF-RTL003826-1	2023.03.02	Added simultaneous mode result and modified antenna type
2	F690501-RF-RTL003826-2	2023.03.03	Added the MIMO mode result

1.8. Description of Variant Model

Model name		Description
Basic Model	TM05FNNAGM0	- Dual GNSS
Variant Model	TM05FNNAGM1	- Same RF circuit and PCB as basic model, except GNSS part - Single GNSS

2. SAR-based Exemption

A more comprehensive exemption, considering a variable power threshold that depends on both the separation distance and power, is provided in § 1.1307(b)(3)(i)(B). This exemption is applicable to the frequency range between 300 MHz and 6 GHz, with test separation distances between 0.5 cm and 40 cm, and for all RF sources in fixed, mobile, and portable device exposure conditions. Accordingly, a RF source is considered an RF exempt device if its available maximum time-averaged (matched conducted) power or its effective radiated power (ERP), whichever is greater, are below a specified threshold. This exemption threshold was derived based on general population 1-g SAR requirements and is detailed in Appendix C.

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

Where

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

and

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

d = the separation distance (cm);

3. Test Result

Mode	Frequency Range (MHz)	Maximum Average Power (dB m)	Antenna Gain (dB i)	Minimum Separation Distance (cm)	Maximum Average Power (mW)	ERP (mW)	Limits P _{th} (mW)	Ratio	Result
WCMDA II	1 850 ~ 1910	25	5.12	17	316.23	626.61	2 268.67	0.28	Pass
WCDMA IV	1 710 ~ 1 755	24.5	5.19	17	281.84	567.54	2 274.98	0.25	Pass
WCDMA V	824 ~ 849	25	0.37	17	316.23	209.89	1 337.72	0.24	Pass
LTE Band 2	1 850 ~ 1910	25	5.12	17	316.23	626.61	2 268.67	0.28	Pass
LTE Band 5	824 ~ 849	25.2	0.37	17	331.13	219.79	1 337.72	0.25	Pass
LTE Band 7	2 500 ~ 2 570	25	5.99	17	316.23	765.60	2 244.69	0.34	Pass
LTE Band 12	699 ~ 716	25.2	-1.05	17	331.13	158.49	1 154.73	0.29	Pass
LTE Band 13	777 ~ 787	25	-0.53	17	316.23	170.61	1 269.28	0.25	Pass
LTE Band 14	788 ~ 798	25	-0.53	17	316.23	170.61	1 285.34	0.25	Pass
LTE Band 66/4	1 710 ~ 1 780	24.5	5.54	17	281.84	615.18	2 274.98	0.27	Pass
5G NR Band 5	824 ~ 849	25	0.37	17	316.23	209.89	1 337.72	0.24	Pass
5G NR Band 7	2 500 ~ 2 570	25	5.99	17	316.23	765.60	2 244.69	0.34	Pass
5G NR Band 12	699 ~ 716	25	-1.05	17	316.23	151.36	1 154.73	0.27	Pass
5G NR Band 13	777 ~ 787	25	-0.53	17	316.23	170.61	1 269.28	0.25	Pass
5G NR Band 14	788 ~ 798	25	-0.53	17	316.23	170.61	1 285.34	0.25	Pass
5G NR Band 25/2	1 850 ~ 1 915	25	5.12	17	316.23	626.61	2 268.67	0.28	Pass
5G NR Band 26/5 Part 22	824 ~ 849	25	0.37	17	316.23	209.89	1 337.72	0.24	Pass
5G NR Band 26 Part 90	814 ~ 824	25	0.37	17	316.23	209.89	1 337.72	0.24	Pass
5G NR Band 66	1 710 ~ 1 780	24.5	5.54	17	281.84	615.18	2 274.98	0.27	Pass
5G NR Band 71	663 ~ 698	25	0.37	17	316.23	209.89	1 101.40	0.29	Pass

Mode	Frequency Range (kHz)	Maximum Average Power (dB m)	Antenna Gain (dB i)	Minimum Separation Distance (cm)	Maximum Average Power (mW)	ERP (mW)	Limits P _{th} (mW)	Ratio	Result
5G NR Band 41 Ant. 1	2 496 ~ 2 690	26	0.09	17	398.11	247.74	2 244.81	0.18	Pass
5G NR Band 41 Ant. 2	2 496 ~ 2 690	26	5.99	17	398.11	963.83	2 244.81	0.43	Pass
5G NR Band 41 MIMO	2 496 ~ 2 690	26	6.54	17	398.11	1 093.96	2 244.81	0.49	Pass
5G NR Band 77 Ant. 1	3 450 ~ 3 550	26	3.24	17	398.11	511.68	2 219.32	0.23	Pass
5G NR Band 77 Ant. 2	3 450 ~ 3 550	26	6.29	17	398.11	1 032.76	2 219.32	0.47	Pass
5G NR Band 77 MIMO	3 450 ~ 3 550	26	7.91	17	398.11	1 499.68	2 219.32	0.68	Pass
5G NR Band 77 Ant. 1	3 700 ~ 3 980	26	3.24	17	398.11	511.68	2 213.84	0.23	Pass
5G NR Band 77 Ant. 2	3 700 ~ 3 980	26	6.29	17	398.11	1 032.76	2 219.32	0.47	Pass
5G NR Band 77 MIMO	3 700 ~ 3 980	26	7.91	17	398.11	1 499.68	2 219.32	0.68	Pass
5G NR Band 78 Ant. 1	3 450 ~ 3 550	26	3.24	17	398.11	511.68	2 219.32	0.23	Pass
5G NR Band 78 Ant. 2	3 450 ~ 3 550	26	6.29	17	398.11	1 032.76	2 219.32	0.47	Pass
5G NR Band 78 MIMO	3 450 ~ 3 550	26	7.91	17	398.11	1 499.68	2 219.32	0.68	Pass
5G NR Band 78 Ant. 1	3 700 ~ 3 980	26	3.24	17	398.11	511.68	2 213.84	0.23	Pass
5G NR Band 78 Ant. 2	3 700 ~ 3 980	26	6.29	17	398.11	1 032.76	2 219.32	0.47	Pass
5G NR Band 78 MIMO	3 700 ~ 3 980	26	7.91	17	398.11	1 499.68	2 219.32	0.68	Pass

4. Simultaneous Transmission SAR Test Exemption with Respect to Multiple Exemption Criteria

Either SAR-based or MPE-based exemption may be considered for test exemption for fixed, mobile, or portable device exposure conditions; therefore, the contributions from each exemption in conjunction with the measured SAR (Evaluated_k term) shall be used to determine exemption for simultaneous transmission according to Formula (C.1) [repeated from § 1.1307(b)(3)(ii)(B)].

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

Mode	Band	P _i /P _{th} Ratio Mode A	P _i /P _{th} Ratio Mode B	Σ P _i /P _{th} Ratio Mode A+B	Result
Inter band CA	2A-5A	0.28	0.25	0.53	Pass
	2A-12A	0.28	0.29	0.57	Pass
	2A-13A	0.28	0.25	0.53	Pass
	4A-12A	0.27	0.29	0.56	Pass
	5A-66A	0.25	0.27	0.52	Pass
	12A-66A	0.29	0.27	0.56	Pass
	13A-66A	0.25	0.27	0.52	Pass
Intra band CA	5B	0.25	0.25	0.50	Pass
	7C	0.34	0.34	0.68	Pass
	66B/66C	0.27	0.27	0.54	Pass
EN-DC	NR 2 LTE 5, 12, 13, 14	0.28	0.29	0.57	Pass
	NR 5 LTE 2, 7, 66	0.24	0.34	0.58	Pass
	NR 7 LTE 5, 12	0.34	0.29	0.63	Pass
	NR 12 LTE 2, 66	0.27	0.28	0.55	Pass
	NR 13 LTE 66	0.25	0.27	0.52	Pass
	NR 25 LTE 12	0.28	0.29	0.57	Pass
	NR 66 LTE 5, 12, 13, 14	0.27	0.29	0.56	Pass
	NR 71 LTE 2, 7, 66	0.29	0.34	0.63	Pass

Mode	Band	P_i/P_{th} Ratio Mode A	P_i/P_{th} Ratio Mode B	$\Sigma P_i/P_{th}$ Ratio Mode A+B	Result
EN-DC	NR 41 LTE 5	0.18	0.25	0.43	Pass
	NR 77 LTE 7	0.23	0.34	0.57	Pass
	NR 78 LTE 2, 5, 7, 12, 66	0.23	0.34	0.57	Pass
MIMO	NR 41	0.18	0.43	0.61	Pass
	NR 77	0.23	0.47	0.70	Pass
	NR 78	0.23	0.47	0.70	Pass

Note;

Total power of each mode (Inter CA, Intra CA, EN-DC and MIMO) not exceed single mode output power.
 In case of EN-DC mode, only one combination was reported as worst case.

Conclusion: No SAR is required.