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TEST REPORT

of

RF Exposure Evaluation

FCC ID: TQ8LI99700200

Equipment Under Test	:	Mission Service Platform
Model Name	:	LI99700200
Variant Model Name(s)	:	-
Applicant	:	HYUNDAI MOBIS CO., LTD.
Manufacturer	:	Hyundai Mobis Co., Ltd.
Date of Receipt	:	2022.07.11
Date of Test(s)	:	2022.07.11 ~ 2023.02.24
Date of Issue	:	2023.02.28

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: Murphy Kim

Technical Manager: Jinhyoung Cho

SGS Korea Co., Ltd. Gunpo Laboratory

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1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)
- 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
- 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
- CAB Identifier: KR0150

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1.2. Details of Applicant

Applicant : HYUNDAI MOBIS CO., LTD.
Address : 203, Teheran-ro, Gangnam-gu, Seoul, South Korea, 135-977
Contact Person : Choe, Seung-hoon
Phone No. : +82 31 260 0098

1.3. Details of Manufacturer

Company : Hyundai Mobis Co., Ltd.
Address : 203, Teheran-ro, Gangnam-gu, Seoul, 06141, Republic of Korea

1.4. Description of EUT

Kind of Product	Mission Service Platform
Model Name	LI99700200
Serial Number	863789050097240
Power Supply	DC 12.7 V
Rated Power	LTE Band 2, 4, 5, 7, 12, 13, 14, 25, 26, 66, 71: 23 ㏈m
Frequency Range	LTE Band 2: 1 850 ㎒ ~ 1 910 ㎒ LTE Band 4: 1 710 ㎒ ~ 1 755 ㎒ LTE Band 5: 824 ㎒ ~ 849 ㎒ LTE Band 7: 2 500 ㎒ ~ 2 570 ㎒ LTE Band 12: 699 ㎒ ~ 716 ㎒ LTE Band 13: 777 ㎒ ~ 787 ㎒ LTE Band 14: 788 ㎒ ~ 798 ㎒ LTE Band 25: 1 850 ㎒ ~ 1 915 ㎒ LTE Band 26(FCC Only): 814 ㎒ ~ 824 ㎒ LTE Band 26: 824 ㎒ ~ 849 ㎒ LTE Band 66: 1 710 ㎒ ~ 1 780 ㎒ LTE Band 71: 663 ㎒ ~ 698 ㎒
Uplink CA Bands	5B, 7C, 66B, 66C
Modulation Technique	QPSK, 16QAM, 64QAM
Antenna Type	Monopole antenna
Antenna Gain※	Refer to the clause 1.5
H/W Version	1.0
S/W Version	1.0

1.5. Antenna Designation

Operating Frequency (㎒)		Antenna Peak Gain (dB i)			
		Ant. No	Ant. Gain	Cable Loss[1)]	Final Gain[2)]
Band 71	663 ~ 698	Ant. 1	2.63	0.63	2.00
		Ant. 2	4.03	0.63	3.40
Band 12	699 ~ 716	Ant. 1	2.63	0.63	2.00
		Ant. 2	4.03	0.63	3.40
Band 13	777 ~ 787	Ant. 1	2.60	0.72	1.88
		Ant. 2	1.31	0.72	0.59
Band 14	788 ~ 798	Ant. 1	2.60	0.72	1.88
		Ant. 2	1.31	0.72	0.59
Band 26 Part 90	814 ~ 824	Ant. 1	1.98	0.72	1.26
		Ant. 2	1.22	0.72	0.50
Band 26/5 Part 22	824 ~ 849	Ant. 1	1.98	0.72	1.26
		Ant. 2	1.80	0.72	1.08
Band 66/4	1 710 ~ 1 780	Ant. 1	-1.48	1.08	-2.56
		Ant. 2	-0.95	1.08	-2.03
Band 25/2	1 850 ~ 1 915	Ant. 1	-0.05	1.08	-1.13
		Ant. 2	0.07	1.08	-1.01
Band 7	2 500 ~ 2 570	Ant. 1	3.53	1.21	2.32
		Ant. 2	2.67	1.21	1.46

Note;
1) It is a cable that is permanently connected between the antenna and the EUT
2) In this report, Final gain reflecting the cable loss was used.

1.6. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 2		
Section	**Test Item(s)**	**Result**
2.1091	RF Exposure Evaluation	Complied

1.7. Test Report Revision

Revision	Report Number	Date of Issue	Description
0	F690501-RF-RTL004053	2023.02.28	Initial

2. RF Exposure Evaluation

Test exemptions apply for devices used in general population/uncontrolled exposure environments, according to the SAR-based, or MPE-based exemption thresholds.

2.1. Blanket 1 ㎽ Blanket Exemption

The 1 ㎽ Blanket Exemption of § 1.1307(b)(3)(i)(A) applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power of no more than 1 ㎽, regardless of separation distance.
The 1 ㎽ blanket exemption applies at separation distances less than 0.5 ㎝, including where there is no separation. This exemption shall not be used in conjunction with other exemption criteria other than those for multiple RF sources in paragraph § 1.1307(b)(3)(ii)(A).
The 1 ㎽ exemption is independent of service type and covers the full range of 100 ㎑ to 100 ㎓, but it shall not be used in conjunction with other exemption criteria or in devices with higher-power transmitters operating in the same time-averaging period. Exposure from such higher-power transmitters would invalidate the underlying assumption that exposure from the lower-power transmitter is the only contributor to SAR in the relevant volume of tissue.

2.2. MPE-based Exemption

General frequency and separation-distance dependent MPE-based effective radiated power (ERP) thresholds are in Table B.1 [Table 1 of § 1.1307(b)(1)(i)(C)] to support an exemption from further evaluation from 300 ㎑ through 100 ㎓.

Table 1: THRESHOLDS FOR SINGLE RF SOURCES SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION

RF Source Frequency			Minimum Distance			Threshold ERP
f_L (㎒)		f_H (㎒)	$\lambda_L / 2\pi$		$\lambda_H / 2\pi$	W
0.3	-	1.34	159 m	-	35.6 m	1 920 R2
1.34	-	30	35.6 m	-	1.6 m	3 450 R^2/f^2
30	-	300	1.6 m	-	159 mm	3.83 R^2
300	-	1 500	159 mm	-	31.8 mm	0.012 8 R^2f
1 500	-	100 000	31.8 mm	-	0.5 mm	19.2 R^2
Subscripts L and H are low and high; λ is wavelength. From § 1.1307(b)(3)(i)(C), modified by adding Minimum Distance columns.						

The table applies to any RF source (i.e., single fixed, mobile, and portable transmitters) and specifies power and distance criteria for each of the five frequency ranges used for the MPE limits. These criteria apply at separation distances from any part of the radiating structure of at least λ/2π. The thresholds are based on the general population MPE limits with a single perfect reflection, outside of the reactive near-field, and in the main beam of the radiator.
For mobile devices that are not exempt per Table B.1 [Table 1 of § 1.1307(b)(1)(i)(C)] at distances from 20 ㎝ to 40 ㎝ and in 0.3 ㎓ to 6 ㎓, evaluation of compliance with the exposure limits in § 1.1310 is necessary if the ERP of the device is greater than ERP 20 ㎝ in Formula (B.1) [repeated from § 2.1091(c)(1) and § 1.1307(b)(1)(i)(B)].

$$P_{\text{th}}\,(\text{mW}) = ERP_{20\,\text{cm}}\,(\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \le f < 1.5\ \text{GHz} \\ 3060 & 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \end{cases} \qquad \text{(B.1)}$$

If the ERP is not easily obtained, then the available maximum time-averaged power may be used (i.e., without consideration of ERP only if the physical dimensions of the radiating structure(s) do not exceed the electrical length of λ/4 or if the antenna gain is less than that of a half-wave dipole.
SAR-based exemptions are constant at separation distances between 20 ㎝ and 40 ㎝ to avoid discontinuities in the threshold when transitioning between SAR-based and MPE-based exemption criteria at 40 ㎝, considering the importance of reflections.

2.3. SAR-based Exemption

SAR-based thresholds are derived based on frequency, power, and separation distance of the RF source. The formula defines the thresholds in general for either available maximum time-averaged power or maximum time-averaged ERP, whichever is greater.
If the ERP of a device is not easily determined, such as for a portable device with a small form factor, the applicant may use the available maximum time-averaged power exclusively if the device antenna or radiating structure does not exceed an electrical length of λ/4.
As for devices with antennas of length greater than λ/4 where the gain is not well defined, but always less than that of a half-wave dipole (length λ/2), the available maximum time-averaged power generated by the device may be used in place of the maximum time-averaged ERP, where that value is not known.
The separation distance is the smallest distance from any part of the antenna or radiating structure for all persons, during operation at the applicable ERP. In the case of mobile or portable devices, the separation distance is from the outer housing of the device where it is closest to the antenna.
The SAR-based exemption formula of § 1.1307(b)(3)(i)(B), repeated here as Formula (B.2), applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power or effective radiated power (ERP), whichever is greater, of less than or equal to the threshold P_{th} (㎽).
This method shall only be used at separation distances from 0.5 ㎝ to 40 ㎝ and at frequencies from 0.3 ㎓ to 6 ㎓ (inclusive). P_{th} is given by Formula (B.2).

$$P_{\text{th}}\,(\text{mW}) = \begin{cases} ERP_{20\text{ cm}}(d/20\text{ cm})^{x} & d \le 20\text{ cm} \\ ERP_{20\text{ cm}} & 20\text{ cm} < d \le 40\text{ cm} \end{cases} \qquad \text{(B.2)}$$

where

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

and f is in ㎓, d is the separation distance (㎝), and ERP 20 ㎝ is per Formula (B.1).

2.4. 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)].

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

3. Test Result

3.1. RF Exposure Test Exemptions for Single Source

SAR Based

Ant. 1

Mode	Frequency Range (㎒)	Minimum Separation Distance (㎝)	Maximum Average Target Power (dB m)	Maximum Tune up (dB)	Maximum Average Output Power (dB m)	Maximum Average Output Power (㎽)	Antenna Gain (dB i)	ERP		P_{th} (㎽)	Ratio	Result
								(dB m)	(㎽)			
LTE Band 71	663 ~ 698	20	23	1	24	251.19	2	23.85	242.66	1 352.52	**0.186**	Pass
LTE Band 12	699 ~ 716	20	23	1	24	251.19	2	23.85	242.66	1 425.96	0.176	Pass
LTE Band 13	777 ~ 787	20	23	1	24	251.19	1.88	23.73	236.05	1 585.08	0.158	Pass
LTE Band 14	788 ~ 798	20	23	1	24	251.19	1.88	23.73	236.05	1 607.52	0.156	Pass
LTE Band 26	814 ~ 824	20	23	0.7	23.7	234.42	1.26	22.81	190.99	1 660.56	0.141	Pass
LTE Band 26/5	824 ~ 849	20	23	0.7	23.7	234.42	1.26	22.81	190.99	1 680.96	0.139	Pass
LTE Band 66/4	1 710 ~ 1 780	20	23	1	24	251.19	-2.56	19.29	84.92	3 060	0.082	Pass
LTE Band 25/2	1 850 ~ 1915	20	23	1	24	251.19	-1.13	20.72	118.03	3 060	0.082	Pass
LTE Band 7	2 500 ~2 570	20	23	1	24	251.19	2.32	24.17	261.22	3 060	0.085	Pass

Ant. 2

Mode	Frequency Range (㎒)	Minimum Separation Distance (㎝)	Maximum Average Target Power (dB m)	Maximum Tune up (dB)	Maximum Average Output Power (dB m)	Maximum Average Output Power (㎽)	Antenna Gain (dB i)	ERP		P_{th} (㎽)	Ratio	Result
								(dB m)	(㎽)			
LTE Band 71	663 ~ 698	20	23	1	24	251.19	3.4	25.25	334.97	1 352.52	**0.248**	Pass
LTE Band 12	699 ~ 716	20	23	1	24	251.19	3.4	25.25	334.97	1 425.96	0.235	Pass
LTE Band 13	777 ~ 787	20	23	1	24	251.19	0.59	22.44	175.39	1 585.08	0.158	Pass
LTE Band 14	788 ~ 798	20	23	1	24	251.19	0.59	22.44	175.39	1 607.52	0.156	Pass
LTE Band 26	814 ~ 824	20	23	0.7	23.7	234.42	0.5	22.05	160.32	1 660.56	0.141	Pass
LTE Band 26/5	824 ~ 849	20	23	0.7	23.7	234.42	1.08	22.63	183.23	1 680.96	0.139	Pass
LTE Band 66/4	1 710 ~ 1 780	20	23	1	24	251.19	-2.03	19.82	95.94	3 060	0.082	Pass
LTE Band 25/2	1 850 ~ 1915	20	23	1	24	251.19	-1.01	20.84	121.34	3 060	0.082	Pass
LTE Band 7	2 500 ~2 570	20	23	1	24	251.19	1.46	23.31	214.29	3 060	0.082	Pass

Note ;

- Maximum Average Target Power is the manufacturer's declared rated power.
- Maximum Average Output Power = Maximum Average Target Power (dB m) + Maximum Tune up (dB)
- ERP (dB m) = Maximum average Power (dB m) + Antenna Gain (dB i) -2.15
- Ratio = The worst value between Maximum Average Output Power (㎽) and ERP (㎽) / P_{th} (㎽)

3.2. RF Exposure Test Exemptions for Simultaneous Transmission

Mode	P_i/P_{th} Ratio Mode A	P_i/P_{th} Ratio Mode B	$\Sigma P_i/P_{th}$ Ratio Mode A+B	Result
WWAN_Ant.1 + WWAN_Ant.2	0.186	0.248	0.434	Pass

4. Conclusion: No SAR is required.

- End of the Test Report -