Testing Laboratory 3787

RADIO EXPOSURE TEST REPORT

FCC ID	:	2AEIM-1616631
Equipment	:	Vehicle Millimeter-wave Radar Sensor
Brand Name	:	Tesla
Model Name	:	1616631
Applicant	:	Tesla, Inc. 3500 Deer Creek Road Palo Alto, California US 94304 United States Of America
Manufacturer	:	Tesla, Inc. 3500 Deer Creek Road Palo Alto, California US 94304 United States Of America
Standard	:	47 CFR Part 2.1091

The product was received on May 05, 2022, and testing was started from May 26, 2022 and completed on Jun. 17, 2022. We, Sporton International Inc. Hsinchu Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in 47 CFR Part 2.1091 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Hsinchu Laboratory, the test report shall not be reproduced except in full.

Approved by: Sam Chen

Sporton International Inc. Hsinchu Laboratory
No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issued Date
FA141246-01	01	Initial issue of report	Aug. 11, 2022

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
2	-	Exposure evaluation	PASS	-

Declaration of Conformity:
1. The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers. It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results. 2. The measurement uncertainty please refer to report "Measurement Uncertainty".
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Sam Chen

Report Producer: Jessie Wei

1 General Description

1.1 EUT General Information

RF General Information			
Frequency Range (GHz)	**Operating Frequency Range (GHz)**	**Test Frequency (GHz)**	**Modulation**
57-71 GHz	60-64 GHz	62.04	FMCW
		60.00 / 62.00 / 64.00	Sweeping-stop mode

Note: The test firmware two modes were made available, sweeping mode and Sweeping-stop mode. Sweeping mode is FM-CW signal sweeping in the operating band. Sweeping-stop mode is one carrier signal operating at fixed frequency.

1.2 Antenna Information

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	Tesla	1616631	Array Antenna	N/A	9.2

Note: The above information was declared by manufacturer.

1.3 Accessories

N/A

1.4 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR Part 2.1091
- KDB 447498 D04 Interim General RF Exposure Guidance v01

The following reference test guidance is not within the scope of accreditation of TAF.

- 47 CFR Part 1.1307
- 47 CFR Part 1.1310

1.5 Testing Location

Testing Location Information	
Test Lab.：Sporton International Inc. Hsinchu Laboratory	
Hsinchu	ADD: No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)
(TAF: 3787)	TEL: 886-3-656-9065 FAX: 886-3-656-9085
	Test site Designation No. TW3787 with FCC.
	Conformity Assessment Body Identifier (CABID) TW3787 with ISED.

2 Maximum Permissible Exposure

2.1 Limit of Maximum Permissible Exposure

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm²)	Averaging Time |E|²,|H|² or S (minutes)
0.3-3.0	614	1.63	*(100)	<6
3.0-30	1842/f	4.89/f	*(900/f^2)	<6
30-300	61.4	0.163	1.0	<6
300-1500	-	-	f/300	<6
1500-100,000	-	-	5	<6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm²)	Averaging Time |E|²,|H|² or S (minutes)
0.3-1.34	614	1.63	*(100)	<30
1.34-30	824/f	2.19/f	*(180/f^2)	<30
30-300	27.5	0.073	0.2	<30
300-1500	-	-	f/1500	<30
1500-100,000	-	-	1.0	<30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

2.2 MPE Calculation Method

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

E (V/m) = $\frac{\sqrt{30 \times P \times G}}{d}$ Power Density: *Pd* (W/m²) = $\frac{E^2}{377}$

E = Electric field (V/m)

P = RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

Pd = $\frac{30 \times P \times G}{377 \times d^2}$

2.3 MPE Exemption

Option (A): 1.1307(b)(3)(i)(A): Available maximum time-averaged power is < 1 mW

Option (B): 1.1307(b)(3)(i)(B): Device operates between 300 MHz and 6 GHz and the maximum time-averaged power or effective radiated power (ERP), whichever is greater, <= Pth.

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

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): 1.1307(b)(3)(i)(C): ERP is below a threshold calculated based on the distance R between the person and the antenna / radiating structure, where R > λ / 2 π.

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.
Note: R is in meters, f is in MHz.	

2.4 Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

Worst-case Integrated Band Power of Unwanted Emission (30MHz ~ 40GHz)						
Start (MHz)	Stop (MHz)	Limit (dBuV/m at 3m)	Limit (mW EIRP)	RBW (MHz)	Num Intervals	Integrated Band Power (mW)
30	88	40	3.01995E-06	0.1	580	0.002
88	216	43.5	6.76083E-06	0.1	1280	0.009
216	960	46	1.20226E-05	0.1	7440	0.089
960	1000	54	7.58578E-05	0.1	400	0.030
1000	2.958	2.958	2.958	2.958	2.958	2.958
Total						3.089

Total Integrated Band Power of All Emission (30MHz ~ 200GHz)				
Test Frequency (GHz)	30MHz ~ 40GHz Integrated Band Power (mW)	40 ~ 200GHz EIRP (dBm)	40 ~ 200GHz EIRP (mW)	30MHz ~200GHz Total Integrated Band Power (mW)
60.00	3.089	11.77	15.03	18.122
62.00	3.089	12.11	16.24	19.327
64.00	3.089	11.42	13.87	16.960

Maximum Permissible Exposure of Fundamental Emissions							
Separation Distance (cm)	20						
Maximum EIPR Power of Test Frequency (GHz)	Ant. Gain (dBi)	Peak EIRP Power (dBm)	Tolerance (dB)	Tune-up Peak EIRP Power (dBm)	Tune-up Peak EIRP Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)
60.00	9.2	11.77	0.25	12.02	15.92	0.003	1.00
62.00	9.2	12.11	0.25	12.36	17.20	0.003	1.00
64.00	9.2	11.42	0.25	11.67	14.69	0.003	1.00

Maximum Permissible Exposure of Fundamental + Unwanted Emissions								
Separation Distance (cm)	20							
Maximum EIPR Power of Test Frequency (GHz)	**Ant. Gain (dBi)**	**Peak EIRP Power (dBm)**	**Peak EIRP Power (mW)**	**Tolerance (dB)**	**Peak EIRP Power (dBm)**	**Tune-up Peak EIRP Power (mW)**	**Power Density (S) (mW/cm²)**	**Limit of Power Density (S) (mW/cm²)**
60.00	9.2	12.58	18.12	0.25	12.83	19.20	0.004	1.00
62.00	9.2	12.86	19.33	0.25	13.11	20.47	0.004	1.00
64.00	9.2	12.29	16.96	0.25	12.54	17.96	0.004	1.00

MPE Exemption Option C							
Frequency (MHz)	**λ/2π (m)**	**R (m)**	**Tune-up EIRP (dBm)**	**Tune-up ERP (dBm)**	**Tune-up ERP (W)**	**ERP Threshold (W)**	**MPE Exemption**
62000	0.0008	0.2	13.11	10.96	0.012	0.768	Complies

———THE END———