

RF EXPOSURE REPORT



Applicant: DENSO International America, Inc.
2251 Rutherford Rd., Suite 100, Carlsbad, CA. 92008
Product Name: V2X On-Board Unit
Brand Name: DENSO
Model No.: Hercules H7.1E
Model Difference: N/A
Report Number: ER/2021/50135
FCC ID LXC-V2X-OBUE-HERC
Issue Date: August 18, 2021
Date of EUT Received: May 21, 2021

Approved By

John Yeh

We hereby certify that:

The above equipment was evaluate by SGS Taiwan Ltd. The evaluation in this report is in compliance with FCC Rule Part §2.1091.

The results of this report relate only to the sample identified in this report.

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Revision History

Report Number	Revision	Description	Issue Date	Revised By
ER/2021/50135	00	Original	August 18, 2021	Yuri Tsai

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1 DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

1.1 Product Description

Product Name:	V2X On-Board Unit
Brand Name:	DENSO
Model No.:	Hercules H7.1E
Model Difference:	N/A
Hardware Version:	N/A
Firmware Version:	N/A
EUT Series No.:	U12QL1800006C01
Power Supply:	DC 12V

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1.2 Antenna Information:

1.2.1 DSRC

Antenna Type	Freq. (MHz)	Ch0 / Ch1	Peak Antenna Gain (dBi)	Worst Antenna Gain
Magnetic Mount	5850~5925	Ch0	7	-
		Ch1	7	-

Note: Antenna information is provided by the applicant.

1.2.2 WWAN

Modulation	Frequency (MHz)	Peak Antenna Gain (dBi) w cable loss	Peak Antenna Gain (dBi) w/o cable loss
GSM/GPRS/EDGE 850	824.2 - 848.8	1.59	4.09
GSM/GPRS/EDGE 1900	1850.2 - 1909.8	1.76	5.86
WCDMA / HSPA+ Band II	1852.4 - 1907.6	1.76	5.86
WCDMA / HSPA+ Band IV	1712.4 - 1752.6	1.76	5.86
WCDMA / HSPA+ Band V	826.4 - 846.6	1.59	4.09

Modulation	Frequency (MHz)			Peak Antenna Gain (dBi) w cable loss	Peak Antenna Gain (dBi) w/o cable loss
LTE-Band 2	1850	~	1910	1.76	5.86
LTE-Band 4	1710	~	1755	1.76	5.86
LTE-Band 5	824	~	849	1.59	4.09
LTE-Band 7	2500	~	2570	-0.94	4.06
LTE-Band 12	699	~	716	1.59	4.09

Note: 1. Antenna information is provided by the applicant.

2. Cable length 10ft, cable model: RG-174.

3. The measurements were demonstrated by using the antenna gain with cable loss as the worst case scenarios.

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1.3 Rated Power

1.3.1 DSRC:

802.11	Freq. Range (MHz)	Max. Output Power (dBm)	Antenna Gain (dBi) w cable loss	EIRP (dBm)	Worst Case
802.11p	5900~5920	19.82	7	26.82	-

1.3.2 WWAN:

Operating Frequency (MHz)		Max. Output Power (dBm)	Antenna Gain (dBi) w cable loss	EIRP / ERP (dBm)	Operation Distance (cm)	Power Density (mW/cm ²)	Margin	FCC Worst Case
GSM / GPRS / EDGE 850	824 ~ 849	32.28	1.59	33.87	20	0.49	-0.06	V
GSM / GPRS / EDGE 1900	1850 ~ 1910	29.86	1.76	31.62	20	0.29	-0.71	
WCDMA / HSPA Band II	1850 ~ 1910	22.91	1.76	24.67	20	0.06	-0.94	
WCDMA / HSPA Band IV	1710 ~ 1753	23.53	1.76	25.29	20	0.07	-0.93	
WCDMA / HSPA Band V	824 ~ 849	22.72	1.59	24.31	20	0.05	-0.50	
LTE-Band 2	1850 ~ 1910	23.07	1.76	24.83	20	0.06	-0.94	
LTE-Band 4	1710 ~ 1755	23.17	1.76	24.93	20	0.06	-0.94	
LTE-Band 5	824 ~ 849	23.11	1.59	24.70	20	0.06	-0.49	
LTE-Band 7	2500 ~ 2570	23.02	-0.94	22.08	20	0.03	-0.97	
LTE-Band 12	699 ~ 716	22.83	1.59	24.42	20	0.06	-0.41	

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2 FCC MAXIMUM PERMISSIBLE EXPOSURE (MPE)

2.1 FCC Standard Applicable

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

This is a Mobile device, the MPE is required.

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
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
1500-100000	/	/	1.0	30

f = frequency in MHz

* = Plane-wave equipment power density

Prediction of MPE limit at a given distance

$$S = PG/4\pi R^2$$

Where: S = Power density

P = Power input to antenna

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Distance to the center of radiation of the antenna

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2.2 Power Density Calculation (Worst Case)

FCC Standalone MPE

Operation Mode	Evaluation Frequency (MHz)	Operation Distance (cm)	Max. output Power (dBm)	Antenna Gain (dBi)	Max. output Power EIRP (mW)	Power Density (PD) (mW/cm ²)	Limit (mW/cm ²)	Pass / Fail	Power Density / Limit
DSRC	5920.00	20	19.82	7.00	480.84	0.096	1.000	Pass	0.096
WWAN	824.20	20	32.28	1.59	2437.81	0.485	0.549	Pass	0.883

Note: For conservativeness, the lowest uplink frequency of each band is used to determine the MPE limit of that band.

2.3 Collocated Power Density Calculation

FCC Collocated MPE

Max DSRC PD / Limit	Max WWAN PD / Limit	Σ (Power Density / Limit)
0.096	0.883	0.979

Note:

1. Σ (E- Power Density / Limit): This is a summation of [(E- Power Density for each transmitter/antenna included in the simultaneous transmission) / (corresponding MPE limit)].
2. Considering the collocated transmitters, the aggregated (E- Power Density /limit) is smaller than 1, and MPE of collocated transmitters is compliant

~ End of Report ~

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