

RF Exposure Evaluation Declaration

Product Name : Vehicle Gateway
Trade Name : Samsara
Model No. : VG54-NA, VG54-NAE
FCC ID : 2AIHD0054

Applicant : SAMSARA NETWORKS INC

Address : 1900 Alameda Street, San Francisco, CA 94103

Date of Receipt : Jul. 02, 2020
Date of Declaration : Sep. 07, 2020
Report No. : 2070056R-E3032410101
Report Version : V1.0



The declaration results relate only to the samples calculated.

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RF Exposure Evaluation Declaration

Issued Date : Sep. 07, 2020

Report No. : 2070056R-E3032410101



Product Name : Vehicle Gateway

Applicant : SAMSARA NETWORKS INC

Address : 1900 Alameda Street, San Francisco, CA 94103

Manufacturer : Wistron Neweb Corporation

Address : 20 Park Avenue II, Hsinchu Science Park, Hsinchu 308,
Taiwan, R.O.C

Trade Name : Samsara

Model No. : VG54-NA, VG54-NAE

FCC ID : 2AIHD0054

EUT Voltage : DC 12/24/48V

Testing Voltage : DC 12V

Applicable Standard : FCC 47 CFR Part 2.1091 Radiofrequency radiation exposure
evaluation: mobile devices.

Test Lab : Hsin Chu Laboratory

Address : No.372-2, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu
County 310, Taiwan, R.O.C.
TEL: +886-3-582-8001 / FAX: +886-3-582-8958

Test Result : Complied

Tested By : 
(Elwin Lin / Engineer)

Approved By : 
(Louis Hsu / Deputy Manager)

Revision History

Version	Description	Issued Date
V1.0	Initial issue of report	Sep. 07, 2020

1.1. Test Facility

Ambient conditions in the laboratory:

Items	Test Item	Required	Test Site
Temperature (°C)	Peak Output Power	15 - 35	3
Humidity (%RH)		25 - 75	

Note: Test site information refers to Laboratory Information.

Laboratory Information

USA	:	FCC Registration Number: TW3024
Canada	:	IC Registration Number: 22397-1 / 22397-2 / 22397-3

The address and introduction of DEKRA Testing and Certification Co., Ltd. laboratories can be founded in our Web site: <http://www.dekra.com.tw>

If you have any comments, please don't hesitate to contact us. Our test sites as below:

Test Laboratory	DEKRA Testing and Certification Co., Ltd.
Address	1. No. 75-2, 3rd Lin, WangYe Keng, Yonghxing Tsuen, Qionglin Shiang, Hsinchu County 307, Taiwan, R.O.C. 2. No.372, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County 31061, Taiwan, R.O.C. 3. No.372-2, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County 31061, Taiwan, R.O.C.
Phone number	1. +886-3-592-8858 2. +886-3-582-8001 3. +886-3-582-8001
Fax number	1. +886-3-592-8859 2. +886-3-582-8958 3. +886-3-582-8958
Email address	info.tw@dekra.com
Website	http://www.dekra.com.tw

1.2. List of Test Equipment

Peak Output Power / SR12-H

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
High Speed Peak Power Meter Dual Input	Anritsu	ML2496A	1602004	2019/12/02	2020/12/01
Pulse Power Sensor	Anritsu	MA2411B	1531043	2019/12/02	2020/12/01
Pulse Power Sensor	Anritsu	MA2411B	1531044	2019/12/02	2020/12/01
Power Meter	Keysight	8990B	MY51000248	2020/05/20	2021/05/19
Power Sensor	Keysight	N1923A	MY57240005	2020/05/20	2021/05/19

Note: All equipment upon which need to calibrated are with calibration period of 1 year.

1.3. Uncertainty

Test item	Uncertainty
Peak Output Power	± 1.27 dB

Note: Determining compliance shall be based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2. RF Exposure Evaluation

2.1. Limits

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time (Minutes)
(A) Limits for Occupational/ Control Exposures				
300-1500	--	--	F/300	6
1500-100,000	--	--	5	6
(B) Limits for General Population/ Uncontrolled Exposures				
300-1500	--	--	F/1500	6
1500-100,000	--	--	1	30

F= Frequency in MHz

RF Field Strength Limits for Controlled Use Devices (Controlled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-1023	170	180	-	Instantaneous*
0.1-10	-	1.6/ f	-	6**
1.29-10	193/ f 0.5	-	-	6**
10-20	61.4	0.163	10	6
20-48	129.8/ f 0.25	0.3444/ f 0.25	44.72/ f 0.5	6
48-100	49.33	0.1309	6.455	6
100-6000	15.60 f 0.25	0.04138 f 0.25	0.6455 f 0.5	6
6000-15000	137	0.364	50	6
15000-150000	137	0.364	50	616000/ f 1.2
150000-300000	0.354 f 0.5	9.40 x 10 ⁻⁴ f 0.5	3.33 x 10 ⁻⁴ f	616000/ f 1.2
Note: f is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).				

Friis Formula

Friis transmission formula: $P_d = (P_{out} * G) / (4 * \pi * r^2)$

Where

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

P_d is the limit of MPE, 1 mW/cm². If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

2.2. Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

2.3. Test Result of RF Exposure Evaluation

Product	Vehicle Gateway
Test Mode	Transmit Mode
Test Condition	RF Exposure Evaluation

Antenna Gain: The maximum antenna gain is 2.7dBi.

Output Power into Antenna & RF Exposure Evaluation Distance:

WLAN Function					
2.4GHz Band					
Mode	Frequency (MHz)	Conducted Output Power		Power Density at R = 20cm (mW/cm ²)	Limit (mW/cm ²)
		dBm	mW		
802.11b	2412	22.030	159.588	0.059	1.000
	2437	21.560	143.219	0.053	1.000
	2462	22.760	188.799	0.070	1.000
802.11g	2412	17.280	53.456	0.020	1.000
	2437	20.890	122.744	0.045	1.000
	2462	18.530	71.285	0.026	1.000
802.11n (20MHz)	2412	16.690	46.666	0.017	1.000
	2437	22.260	168.267	0.062	1.000
	2462	20.830	121.060	0.045	1.000
802.11n (40MHz)	2422	13.920	24.660	0.009	1.000
	2437	18.470	70.307	0.026	1.000
	2452	16.420	43.853	0.016	1.000

Note:

1. The antenna information is from the customer declaration.
2. The results are evaluated using the maximum power.

Product	Vehicle Gateway
Test Mode	Transmit Mode
Test Condition	RF Exposure Evaluation

Antenna Gain: The maximum antenna gain is 3.28dBi (5GHz Band 1) / 3.9dBi (5GHz Band 4).

Output Power into Antenna & RF Exposure Evaluation Distance:

WLAN Function					
5GHz Band					
Mode	Frequency (MHz)	Conducted Output Power		Power Density at R = 20cm (mW/cm ²)	Limit (mW/cm ²)
		dBm	mW		
802.11a	5180	16.910	49.091	0.021	1.000
	5220	17.640	58.076	0.025	1.000
	5240	17.380	54.702	0.023	1.000
	5745	19.920	98.175	0.048	1.000
	5785	19.850	96.605	0.047	1.000
	5825	19.770	94.842	0.046	1.000
802.11n (20MHz)	5180	16.840	48.306	0.020	1.000
	5220	17.580	57.280	0.024	1.000
	5240	17.250	53.088	0.023	1.000
	5745	19.860	96.828	0.047	1.000
	5785	19.810	95.719	0.047	1.000
	5825	19.740	94.189	0.046	1.000
802.11n (40MHz)	5190	12.730	18.750	0.008	1.000
	5230	17.710	59.020	0.025	1.000
	5755	20.030	100.693	0.049	1.000
	5795	19.880	97.275	0.048	1.000

Note:

1. The antenna information is from the customer declaration.
2. The results are evaluated using the maximum power.

Product	Vehicle Gateway
Test Mode	Transmit Mode
Test Condition	RF Exposure Evaluation

Antenna Gain: The maximum antenna gain is 2.7dBi.

Output Power into Antenna & RF Exposure Evaluation Distance:

Bluetooth Function					
BT 5.0					
Mode	Frequency (MHz)	Conducted Output Power		Power Density at R = 20cm (mW/cm ²)	Limit (mW/cm ²)
		dBm	mW		
GFSK	2402	6.610	4.581	0.002	1.000
	2440	7.650	5.821	0.002	1.000
	2480	4.140	2.594	0.001	1.000

Note:

1. The antenna information is from the customer declaration.
2. The results are evaluated using the maximum power.

Product	Vehicle Gateway
Test Mode	Transmit Mode
Test Condition	RF Exposure Evaluation

Output Power into Antenna & RF Exposure Evaluation Distance:

WWAN Function (Certified Module FCC ID: NKRM18QF)						
Band	Frequency (MHz)	Maximum conducted output power (per tune-up)		Ant. Gain (dBi)	Power Density at R = 20cm (mW/cm ²)	Limit (mW/cm ²)
		(dBm)	(mW)			
LTE Band 12	699.7	24.490	281.190	-0.520	0.050	0.466
LTE Band 13	779.5	24.530	283.792	-0.140	0.055	0.520
WCDMA Band 5	826.4	25.260	335.738	-0.010	0.067	0.551
LTE Band 5	824.7	24.250	266.073	-0.010	0.053	0.550
LTE Band 4	1710.7	23.020	200.447	1.540	0.057	1.000
WCDMA Band 2	1850.2	24.530	283.792	0.860	0.069	1.000
LTE Band 2	1850.7	22.970	198.153	0.860	0.048	1.000

Note:

1. The antenna information is from the customer declaration.
2. The results are evaluated using the maximum power.

Collocation Power Density

Product	Vehicle Gateway
Test Mode	Transmit Mode
Test Condition	RF Exposure Evaluation

Power Density for WiFi 2.4GHz (mW/cm ²)	Power Density for 3G (mW/cm ²)	Collocation Power Density (mW/cm ²)	Limit (mW/cm ²)
0.070	0.069	0.1390	1.0000

Power Density for WiFi 5GHz (mW/cm ²)	Power Density for 3G (mW/cm ²)	Collocation Power Density (mW/cm ²)	Limit (mW/cm ²)
0.049	0.069	0.1180	1.0000

Power Density for BT 5.0 (mW/cm ²)	Power Density for 3G (mW/cm ²)	Collocation Power Density (mW/cm ²)	Limit (mW/cm ²)
0.002	0.069	0.0710	1.0000

Power Density for WiFi 2.4GHz (mW/cm ²)	Power Density for LTE (mW/cm ²)	Collocation Power Density (mW/cm ²)	Limit (mW/cm ²)
0.070	0.057	0.1270	1.0000

Power Density for WiFi 5GHz (mW/cm ²)	Power Density for LTE (mW/cm ²)	Collocation Power Density (mW/cm ²)	Limit (mW/cm ²)
0.049	0.057	0.1060	1.0000

Power Density for BT 5.0 (mW/cm ²)	Power Density for LTE (mW/cm ²)	Collocation Power Density (mW/cm ²)	Limit (mW/cm ²)
0.002	0.057	0.0590	1.0000