

RF Exposure Evaluation Report

Client: Appareo Systems, LLC

Address: 1810 NDSU Research Circle
Fargo, ND 58102

Model: Gateway 375

Test Report No.: RFE230824-21-M1

Approved By: 
Fox Lane,
EMC Test Engineer

Date: August 28, 2024

Total Pages: 8

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Revision Page

Rev. No.	Date	Description
Original	28 June 2024	Issued by FLane Prepared by FLane

1 Regulatory Requirements:

FCC Part 1.1310, 2.1091, 2.1093
KDB 447498 D01
RSS-102, Issue 6

Summary:

The purpose of this report is to evaluate the EUT's transmitter for exemption from routine SAR testing.

EUT:

Model:

Gateway 375

FCC ID:

2AETC-GW375

IC:

12021A-GW375

HVIN:

Gateway 375

MPE Lab

Nebraska Center for Excellence in Electronics

MPE Labs FCC Cab Designation:

US1060

MPE Labs ISED Cab Designation:

US0177

2 FCC

FCC Limits, Part 1.1310

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
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
300-1,500			f/300	6
1,500-100,000			5	6
(B) 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
300-1,500			f/1500	30
1,500-100,000			1.0	30

Occupational/Controlled	☒
General Population/uncontrolled	☐

FCC Power Density Calculations								
Freq.	Peak Power / EIRP	Antenna Gain	Peak Power EIRP	Peak Power EIRP +10% for Tolerance	Power Density	Limit at specified distance	% of limit	Result
MHz	mW	numerical	mW	mW	mW/cm ²	mW/cm ²	%	
908.40	0.259	1.00	0.26	0.28	0.000	0.61	0.009	PASS
916.00	0.294	1.00	0.29	0.32	0.000	0.61	0.011	PASS
433.00	0.879	1.00	0.88	0.97	0.000	0.29	0.067	PASS
1616.00	1479.000	1.58	2336.82	2570.50	0.511	1.00	51.139	PASS
699.70	408.320	2.12	865.64	952.20	0.189	0.47	40.611	PASS
2402.00	51.300	1.99	102.09	112.30	0.022	1.00	2.234	PASS

Distance (d)	20	cm
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$S = (P \times G) / (4 \times \pi \times d^2)$ – used to calculate exposure at "d" cm

$EIRP = P \times G$, measured as field strength

$d = \sqrt{(S / (P \times G) \times 4 \times \pi)}$ – used to calculate minimum distance to meet limits

S = power density (mW/cm²)

P = transmitter conducted power (in mW)

G = antenna numeric gain (Numerical)

d = distance to radiation center (cm)

If Antenna gain = 1, EIRP

if antenna gain ≠ 1, Conducted Power measurements

Used worst case margins from RF exposure/reports provided by original grants of modules that were integrated.

Note:

The user's manual will stipulate that a 20cm distance from the user is to be maintained.

EIRP values in mW were multiplied by 1.1 to account for a 10% tolerance.

Results:

% of limits summed to show compliance of combined transmitters.

0.009 + 0.011 + 0.067 + 51.139 + 40.611 + 2.234 = **94.071%**

Complies

3 ISED

RSS 102, Issue 6, Section 6.4 (for distances less than 20cm)

Devices operating at or below the applicable output power levels (adjusted for tune-up tolerance) specified in table 11, based on the separation distance, are exempt from SAR evaluation. The separation distance, defined as the distance between the user and/or bystander and the antenna and/or radiating element of the device or the outer surface of the device, shall be less than or equal to 20 cm for these exemption limits to apply.

Table 11: Power limits for exemption from routine SAR evaluation based on the separation distance

Frequency (MHz)	≤ 5 mm(mW)	10 mm (mW)	15 mm(mW)	20 mm(mW)	25 mm(mW)	30 mm(mW)	35 mm(mW)	40 mm(mW)	45 mm(mW)	> 50 mm(mW)
≤ 300	45	116	139	163	189	216	246	280	319	362
450	32	71	87	104	124	147	175	208	248	296
835	21	32	41	54	72	96	129	172	228	298
1900	6	10	18	33	57	92	138	194	257	323
2450	3	7	16	32	56	89	128	170	209	245
3500	2	6	15	29	50	72	94	114	134	158
5800	1	5	13	23	32	41	54	74	102	128

The exemption limits in table 11 are based on measurements and simulations of half-wave dipole antennas at separation distances of 5 mm to 50 mm from a flat phantom, which provides a SAR value of approximately 0.4 W/kg for 1 g of tissue.

For limb-worn devices where the 10 gram of tissue applies, the exemption limits for routine evaluation in table 11 are multiplied by a factor of 2.5.

For controlled-use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in table 11 are multiplied by a factor of 5.

When the operating frequency of the device is between two frequencies located in table 11, linear interpolation shall be applied for the applicable separation distance. If the separation distance of the device is between two distances located in table 11, linear interpolation may be applied for the applicable frequency. Alternatively, the limit corresponding to the smaller distance may be employed. For example, in case of a 7 mm separation distance, either use the exception value for a 5 mm separation distance or interpolate between the limits corresponding to 5 mm and 10 mm separation distances.

For implanted medical devices, the exemption limit for routine SAR evaluation is set at an output power of 1 mW, regardless of frequency.

The SAR levels from exempted transmitters shall be included in the compliance assessment and the determination of the TER. Detailed guidance is included in sections 7.1.8 and 8.2.2.1.

RSS 102, Issue 6, Section 6.6 (for distances 20cm or greater)

Field reference level (FRL) exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm (i.e. mobile devices), except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 1 W (adjusted for tune-up tolerance)
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than $4.49/f^{0.5} W$ (adjusted for tune-up tolerance), where f is in MHz
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance)
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834} W$ (adjusted for tune-up tolerance), where f is in MHz
- at or above 6 GHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 5 W (adjusted for tune-up tolerance)

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the EIRP was derived.

Occupational/Controlled			☐					
General Population/uncontrolled			☒					
ISED Power Density Calculations								
Frequency	Peak Power / EIRP	Antenna Gain	Peak Power EIRP	Peak Power EIRP +10% for Tolerance	Power Density	Limit at specified distance	% of limit	Result
MHz	mW	numerical	mW	mW	mW/cm^2	mW/cm^2	%	
908.40	0.259	1.00	0.26	0.28	0.000	2.75	0.002	PASS
916.00	0.294	1.00	0.29	0.32	0.000	2.77	0.002	PASS
433.00	0.879	1.00	0.88	0.97	0.000	1.66	0.012	PASS
1616.00	1479.000	1.00	1479.00	1626.90	0.324	4.08	7.931	PASS
699.70	408.320	1.00	408.32	449.15	0.089	2.30	3.879	PASS
2402.00	51.300	1.00	51.30	56.43	0.011	5.35	0.210	PASS

Distance (d)	20	cm
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$S = (P \times G)/(4 \times \pi \times d^2)$ – used to calculate exposure at "d" cm

$EIRP = P \times G$, measured as field strength

$d = \sqrt{(S/(P \times G) \times 4 \times \pi)}$ – used to calculate minimum distance to meet limits

S = power density (mW/cm²)

P = transmitter conducted power (in mW)

G = antenna numeric gain (Numerical)

d = distance to radiation center (cm)

Results:

% of limits summed to show compliance of combined transmitters.

0.002 + 0.002 + 0.012 + 7.931 + 3.879 + 0.21 = **12.036%**

Result:

The EUT was found to be exempt from routine SAR testing and **COMPLIANT** with FCC and ISED RF exposure requirements.

REPORT END