

RF Exposure evaluation

Product Name: Electric Toilet
Model Number: 20000002002300
FCCID: 2ACSF20000002002300

1.1 RF Exposure Limit

According to FCC 1.1310 table 1: The criteria listed in the following table shall be used to evaluate the environmental 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 Exposure				
300-1500	...	...	$f/1500$	6
1500-100,000	...	...	1.0	30

f = Frequency in MHz

1.2 EUT Operating condition

The EUT transmits at a single frequency and at the highest output power.

1.3 Antenna Gain

The maximum Gain measured in Semi-Anechoic Chamber is 8.0 dBi or 6.310 (numeric).

1.4 Output Power into Antenna & RF Exposure value at distance 20cm:

Calculations for this report are based on highest power measurement and the highest gain of the antenna. Limit for MPE (from FCC part 1.1310 table 1) is 1.0 mW/cm²

$$\text{eirp} = \text{pt} \times \text{gt} = (\text{E} \times \text{d})^2 / 30$$

Where:

Pt = transmitter output power in watts,

gt = numeric gain of the transmitting antenna (unitless),

E = electric field strength in V/m, --- $10^{(d\text{BuV/m})/20}/10^6$

d = measurement distance in meters (m) --- 3m

So $P_t = (E \times d)^2 / 30 \times g_t$

Maximum Field strength: 20000002002300: 110.340 dBuV/m @3m --10525MHz

Refer to 708881474503-00 FCC Part 15C 15.245 Test Report page 13.

Ant gain = 8dBi; so Ant numeric gain=6.310

So, for 20000002002300, $P_t = \{[(10^{(110.340/20)})/10^6] \times 3\}^2 / 30 \times 1\} \times 1000 \text{mW} = 32.443 \text{ mW}$

Highest Pout is 32.443 mW, highest antenna gain (in linear scale) is 6.310 R is 20cm, and f = 10525 MHz

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Note: This calculation is assuming 100% duty cycle, which would not be the case in normal operation.

Uncontrolled Exposures - Limit (mW/cm ²) =	1	
Pd =	0.040727	mW/cm ²
Uncontrolled Margin to Limit=	0.959273	mW/cm ²

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

1.5 Sample Calculation

The 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

$\pi \approx 3.1416$

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