RF Exposure evaluation

Product Name：VEIL INTELLIGENT TOILET–WALL HUNG
Model Number: K-5402
FCC ID: N82-KOHLER018

IC ID: 4554A-KOHLER018

According to 447498 D01 General RF Exposure Guidance v06
The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where
f(GHz) is the RF channel transmit frequency in GHz
Power and distance are rounded to the nearest mW and mm before calculation
The result is rounded to one decimal place for comparison

eirp = pt × gt = $(E \times d)^2/30$
Where:
Pt = transmitter output power in watts,
gt = numeric gain of the transmitting antenna (unitless),
E = electric field strength in V/m, --- $10^{(dBuV/m)/20)}/10^6$
d = measurement distance in meters (m) --- 3m
So Pt = $(E \times d)^2/30 \times gt$

2.4GHz Maximum Field strength for K-5402: 92.371 dBuV/m @3m --Channel 1:2414.5MHz
Refer to 708881550726-00 FCC Part 15C 15.249 Test Report page 13.
Ant gain = 0dBi; so Ant numeric gain=1

So, for K-5402 2.4GHz, Pt= $\{[(10^{(92.371/20)}/10^6) \times 3]^2/30 \times 1\} \times 1000mW = 0.52$ mW
(0.52 mW/5mm) × √2.4145 =0.162 < 3

10.525GHz Maximum Field strength for K-5402: 110.448 dBuV/m @3m --at 10.525GHz
Refer to 708881550725-00 FCC Part 15C 15.245 Test Report page 13.
Ant gain = 8dBi; so Ant numeric gain=6.31

So, for K-5402 10.525GHz, Pt= $\{[(10^{(110.448/20)}/10^6) \times 3]^2/30 \times 6.31\} \times 1000mW = 209.87$ mW

Highest Pout is 209.87 mW, highest antenna gain (in linear scale) is 6.31 R is 20cm, and f = 10525 MHz

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

Uncontrolled Exposures - Limit (mW/cm2) =	1	
Pd =	0.0417	mW/cm2
Uncontrolled Margin to Limit=	0.9583	mW/cm2

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

Sample Calculation

The Friis transmission formula: $Pd = (Pout*G) / (4*\pi*R^2)$

Where;

Pd = power density in mW/cm^2
$Pout$ = 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

Then SAR evaluation is not required

Industry Canada MPE / Health Hazard

Requirement for the 2.4GHz

According to Industry Canada RSS-102 Issue 5, Section 2.5.1, SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1.

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance[4,5]

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

Per the test report included herein,

EIRP (PK) = 0.52mW < 4 mW (At separation distance of ≤5 mm)

Requirement for the 10.525GHz:

According to Industry Canada RSS-102 Issue 5, Section 2.5.2, RF exposure evaluation is not required if for devices operating above 6 GHz if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm and the EIRP rating of the device is less than 5W.

Per the test report included herein,

EIRP (PK) = 0.20987W < 5 W