

Zurn Water, LLC

RF EXPOSURE REPORT

SCOPE OF WORK

RF EXPOSURE CALCULATION
ON THE HYDRO X FLUSH VALVE MODEL ZER6000AV-HYD

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RF EXPOSURE TEST REPORT

Report Number: 105711317LEX-003

Project Number: G105711317

Report Issue Date: 4/12/2024

Product Name: Hydro X Flush Valve

Product Model: ZER6000AV-HYD

**Variant Model(s) not Tested but Declared
By Manufacturer to be Electrically Identical:** ZER6003AV-HYD

Standards: FCC Title 47 CFR Part 1.1310(e)(1) Limits for
Maximum Permissible Exposure (MPE)

RSS-102 Issue 6 RF Field Strength Limits for
Devices Used by the General Public

Tested by:
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1 Introduction and Conclusion

The tests indicated in section 2 were performed on the product constructed as described in section 4. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

2 Test Summary

Section	Test full name	Result
10	FCC Title 47 CFR Part 1.1310(e)(1) Limits for Maximum Permissible Exposure (MPE) (Limits for General Population / Uncontrolled Exposure)	Pass
	RSS-102 Issue 6 RF Field Strength Limits (For Devices Used by the General Public)	Pass



3 Client Information

This product was tested at the request of the following:

Client Information	
Client Name:	Zurn Water, LLC
Address:	3700 Regency Parkway Suite 100 Cary, NC 37518 USA
Contact:	Malcolm James
Telephone:	+1 (919) 777-6413
Email:	malcolm.james@zurn.com
Manufacturer Information	
Manufacturer Name:	Zurn Water, LLC
Manufacturer Address:	5900 Elwin Buchanan Dr. Sanford, NC 27330 USA



4 Description of Equipment under Test and Variant Models

Equipment Under Test	
Product Name	Hydro X Flush Valve
Model Number	ZER6000AV-HYD
Hardware Version	Rev B
Software Version	Valve – 79 Nordic Radio Test 1.17.1
Embedded Module(s)	Nordic nRF52810
Wireless Technology	Bluetooth Low Energy (BLE)
Supported Transmit Bands	2402 – 2480MHz
Supported Transmit Modes	1Mbit/s, 2Mbit/s
Antenna Gain	1Mbit/s Data Rate: -0.60dBi (2402MHz), -1.58dBi (2440MHz), -2.05dBi (2480MHz) 2Mbit/s Data Rate: -0.99dBi (2402MHz), -2.34dBi (2440MHz), -2.13dBi (2480MHz)
Maximum Output Power	1Mbit/s Data Rate: 2.42dBm (2402MHz), 2.43dBm (2440MHz), 2.50dBm (2480MHz) 2Mbit/s Data Rate: 2.42dBm (2402MHz), 2.42dBm (2440MHz), 2.51dBm (2480MHz)
Ratings	BR Battery AA-2lev LIFEPO
Description of Equipment Under Test (provided by client)	
Hydro X Power Sensor Flush Valve	

4.1 Variant Models:

The following variant models were not tested as part of this evaluation, but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

- ZER6003AV-HYD – model paired with a urinal with 0.5 gpf or 1 gpf and identical electronics



5 Output Power

The output power was taken from Intertek report 105711317LEX-001.

Data Rate	Frequency (MHz)	Peak Output Power (dBm)
1Mbit/s	2402	2.42
	2440	2.43
	2480	2.50
2Mbit/s	2402	2.42
	2440	2.42
	2480	2.51

6 Antenna Gain

The antenna gain was taken from Intertek report 105704106LEX-012.

Data Rate	Frequency (MHz)	Maximum Realized Gain (dBi)
1Mbit/s	2402	-0.60
	2440	-1.58
	2480	-2.05
2Mbit/s	2402	-0.99
	2440	-2.34
	2480	-2.13



7 FCC RF Exposure Limits

Title 47 CFR Part 1.1310(d)(2):

For operations within the frequency range of 300 kHz and 6 GHz (inclusive), the limits for maximum permissible exposure (MPE), derived from whole-body SAR limits and listed in Table 1 in paragraph (e)(1) of this section, may be used instead of whole-body SAR limits as set forth in paragraphs (a) through (c) of this section to evaluate the environmental impact of human exposure to RF radiation as specified in § 1.1307(b) of this part, except for portable devices as defined in § 2.1093 of this chapter as these evaluations shall be performed according to the SAR provisions in § 2.1093.

Table 1 to § 1.1310(e)(1)—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 (minutes)
(i) 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
(ii) 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

f = frequency in MHz. * = Plane-wave equivalent power density.



8 RSS-102 Issue 6 RF Exposure Limits

RSS-102 Issue 6 § 6.6:

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.

RSS-102 Issue 6 § 5.3.2:

The electric and magnetic field strength reference levels, power density reference levels, and associated reference period for devices employed by the general public (uncontrolled environment) and controlled-use devices (controlled environment) are specified in table 7 and table 8. Note that the power density limits specified in these tables apply to whole body exposure conditions.

Table 7: RF field strength and power density limits for devices used by the general public (uncontrolled environment)

Frequency range (MHz)	Electric field (V _{RMS} /m)	Magnetic field (A _{RMS} /m)	Power density (W/m ²)	Reference period (minutes)
10-20	27.46	0.0728	2	6
20-48	$58.07 / f^{0.25}$	$0.1540 / f^{0.25}$	$8.944 / f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142 f^{0.3417}$	$0.008335 f^{0.3417}$	$0.02619 f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000 / f^{1.2}$
150000-300000	$0.158 f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000 / f^{1.2}$

Note: f is frequency in MHz.



9 Test Procedure

An RF exposure calculation was performed to show that the device was compliant with the general population exposure limits from FCC Title 47 CFR Part 1.1310(e)(1), RSS-102 Issue 6, and ICNIRP Guidelines (2020). The maximum power density was calculated for each transmitter at a separation distance of 20cm using the maximum conducted output power (including tune up tolerance) plus antenna gain, or measured EIRP.

For each transmitter the maximum power density at a 20cm distance using the formula:

$$EIRP(dBm) = \text{Conducted Power}(dBm) + \text{Antenna Gain}(dBi)$$

$$EIRP(mW) = 10^{EIRP(dBm)/10}$$

$$\text{Power Density} \left(\frac{mW}{cm^2} \right) = \frac{EIRP(mW)}{4\pi \cdot (20cm)^2}$$

$$\text{Power Density} \left(\frac{W}{m^2} \right) = \left(\frac{100cm}{1m} \right)^2 \left(\frac{1W}{1000mW} \right) \text{Power Density} \left(\frac{mW}{cm^2} \right)$$

10 Results:

The calculated maximum power density at 20cm was less than or equal to the limits for general population exposure in FCC Title 47 CFR Part 1.1310(e)(1) and RSS-102 Issue 6.

10.1 FCC RF Exposure Data

Data Rate	Frequency (MHz)	Conducted Output Power ⁽¹⁾ (dBm)	Antenna Gain (dBi)	EIRP ⁽¹⁾ (dBm)	EIRP ⁽¹⁾ (mW)	Power Density ⁽¹⁾ (mW/cm ²)	Limit (mW/cm ²)
1Mbit/s	2402	2.42	-0.60	1.82	1.52	0.000303	1.0
	2440	2.43	-1.58	0.85	1.22	0.000242	1.0
	2480	2.50	-2.05	0.45	1.11	0.000221	1.0
2Mbit/s	2402	2.42	-0.99	1.43	1.39	0.000277	1.0
	2440	2.42	-2.34	0.08	1.02	0.000203	1.0
	2480	2.51	-2.13	0.38	1.09	0.000217	1.0

10.2 RSS-102 Issue 6 RF Exposure Data

Data Rate	Frequency (MHz)	Conducted Output Power ⁽¹⁾ (dBm)	Antenna Gain (dBi)	EIRP ⁽¹⁾ (dBm)	EIRP ⁽¹⁾ (mW)	Power Density ⁽¹⁾ (W/m ²)	Limit (W/m ²)
1Mbit/s	2402	2.42	-0.60	1.82	1.52	0.00303	5.35
	2440	2.43	-1.58	0.85	1.22	0.00242	5.41
	2480	2.50	-2.05	0.45	1.11	0.00221	5.47
2Mbit/s	2402	2.42	-0.99	1.43	1.39	0.00277	5.35
	2440	2.42	-2.34	0.08	1.02	0.00203	5.41
	2480	2.51	-2.13	0.38	1.09	0.00217	5.47

¹ Values reported are for source-based, time-averaged output as described in section 4.1 of this report.

**11 Revision History**

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	4/12/2024	105711317LEX-003	BZ	MC	Original Issue