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Aquana
MPE REPORT

SCOPE OF WORK
MPE CALCULATION
ON THE AQUANA SMART VALVE

REPORT NUMBER
105250409LEX-003

ISSUE DATE
3/24/2023

PAGES
13

DOCUMENT CONTROL NUMBER
Non-Specific EMC Report Shell Rev. December 2017

MPE TEST REPORT

Report Number: 105250409LEX-003
Project Number: G105250409

Report Issue Date: 3/24/2023

Product Name: Aquana Smart Valve, model SV-2-LORA

Standards: FCC Part 1.1310 Limits for Maximum Permissible Exposure (MPE)

Tested by:
Intertek Testing Services NA, Inc.
731 Enterprise Drive
Lexington, KY 40510
USA

Client:
Aquana
7007 Pinemont Drive
Houston, TX 77040
USA

Report prepared by

Brian Lackey, Team Leader

Report reviewed by

James Sudduth, Senior Staff Engineer

Table of Contents

1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. 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
9	FCC Part 1.1310 Limits for Maximum Permissible Exposure (MPE) (Limits for General Population / Uncontrolled Exposure)	Pass

3 Client Information

This product was tested at the request of the following:

Client Information	
Client Name:	Aquana
Address:	7007 Pinemont Drive Houston, TX 77040 USA
Contact:	Jeff Askew
Telephone:	+1 (888) 404-2782
Email:	info@aquana.com
Manufacturer Information	
Manufacturer Name:	Aquana
Manufacturer Address:	7007 Pinemont Drive Houston, TX 77040 USA

4 Description of Equipment under Test and Variant Models

Equipment Under Test	
Product Name	Aquana Smart Valve
Model Number	SV-2-LORA
Serial Number	NA
Embedded Module	Aquana (Nordic SoC) BLE
Embedded Module FCCID	2AQSE-AQSV1
Supported Transmit Bands	2.402GHz – 2.480GHz
Embedded Module	MultiTech Xdot LoRa
Embedded Module FCCID	AU79U13A16858
Supported Transmit Bands	902MHz – 928MHz
Device Received Condition	Good
Test Sample Type	Production
Ratings	3.1VDC – 3.7VDC
Description of Equipment Under Test (provided by client)	
The Aquana Smart Valve is a remotely controllable water valve that works over RF networks to provide monitoring and control via cloud-based software applications.	

4.1 Variant Models:

There were no variant models covered by this evaluation.

5 Output Power

The output power for the BLE radio was taken from the original FCC report 103553976LEX-003. Deviations from these values may affect compliance. Intertek does not make any claim of compliance for values other than those shown.

Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)	Margin (dB)	Result
2.402 GHz	2.188	30	27.812	Pass
2.440 GHz	2.660	30	27.340	Pass
2.480 GHz	3.242	30	26.758	Pass

The output power for the LoRa radio was taken from the module FCC report MLTI0058.1. Deviations from these values may affect compliance. Intertek does not make any claim of compliance for values other than those shown.

EUT:	MTXDOT-NA1-A00			Work Order:	MLTI0058
Serial Number:	18865140			Date:	09/15/16
Customer:	Multi-Tech Systems, Inc.			Temperature:	23.1 °C
Attendees:	Marcus Glass			Humidity:	49.6% RH
Project:	None			Barometric Pres.:	1023 mbar
Tested by:	Dustin Sparks	Power:	3.3VDC	Job Site:	MN08

TEST SPECIFICATIONS	Test Method
FCC 15.247:2016	ANSI C63.10:2013

COMMENTS

Module powered by USB connection to laptop.

DEVIATIONS FROM TEST STANDARD

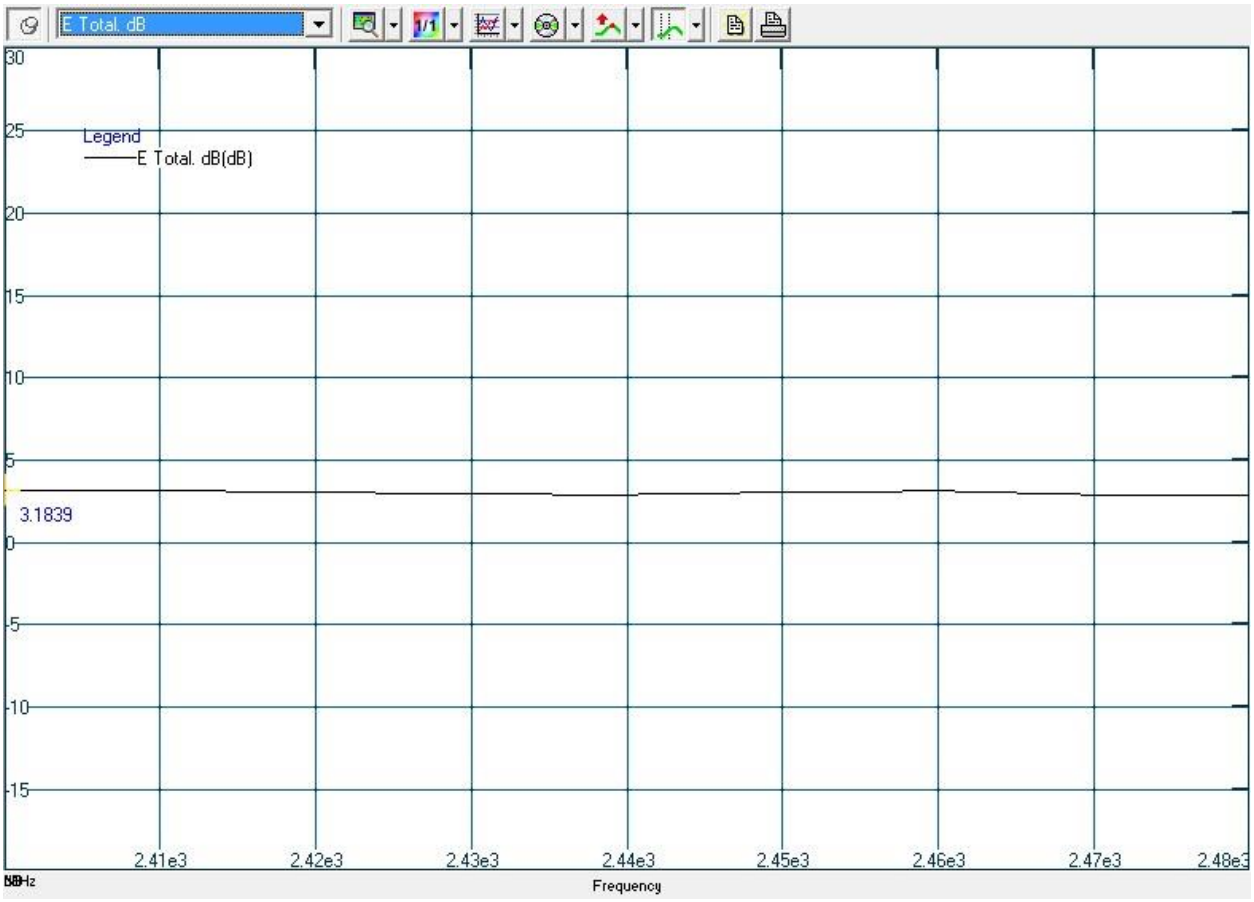
None

Configuration #	3	Signature	Dustin Sparks

	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Value (dBm)	Limit (dBm)	Results
125 kHz BW Data Rate					
Low Channel, 902.3 MHz	17.143	1.4	18.5	30	Pass
Mid Channel, 908.7 MHz	17.261	1.4	18.6	30	Pass
High Channel, 914.9 MHz	17.065	1.4	18.4	30	Pass
500 kHz BW Data Rate					
Low Channel, 903.0 MHz	11.406	7.9	19.3	30	Pass
Mid Channel, 909.4 MHz	11.508	7.9	19.4	30	Pass
High Channel, 914.2 MHz	11.11	7.9	19	30	Pass

6 Antenna Gain

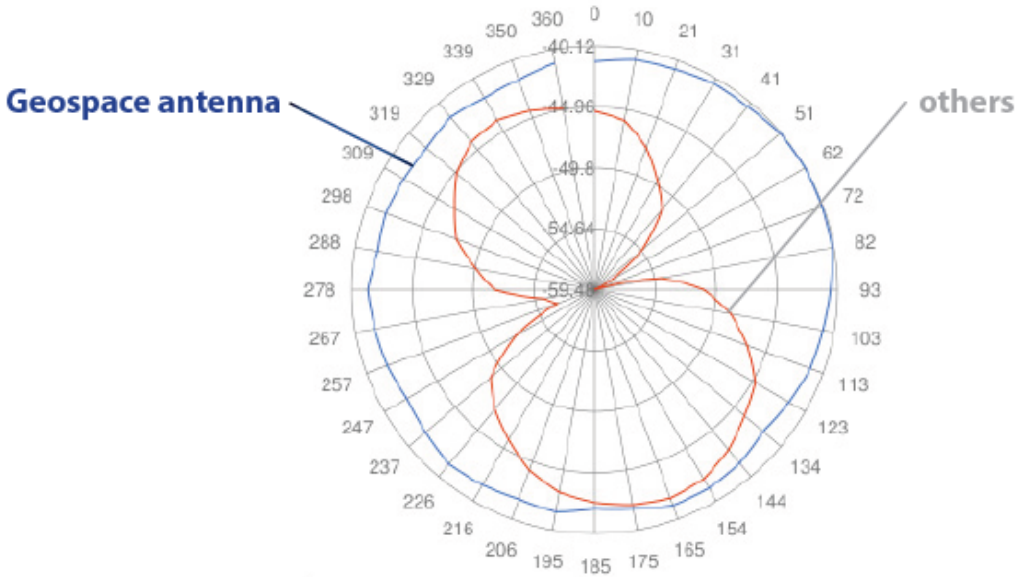
The antenna gain for the BLE radio was taken from the original filing for FCCID 2AQSE-AQSV1. The antenna is a PCB trace antenna with a peak gain of 3.18dBi. Deviations from these values may affect compliance. Intertek does not make any claim of compliance for values other than those shown.



The antenna gain for the LoRa radio was taken from the GeoSpace Technologies Omnidirectional Screw on Lid antenna datasheet provided by the client. Deviations from these values may affect compliance. Intertek does not make any claim of compliance for values other than those shown.

ELECTRICAL SPECIFICATIONS	
Freqency Band	902–928 MHz
Impedance	50 Ω
E-Plane HPBW	30° typical
Power Handling	5 W
VSWR	< 1.3 : 1 typical
Gain	2 dbi
H-Plane HPBW	Onmidirectional
Polarization	Vertical

MECHANICAL SPECIFICATIONS	
Height	2 ½ inches (6.35 cm)
Connector	Proprietary waterproof GNC
Operational Range	–40 to 158° F (–40 to 70° C)
Diameter (Ground Plane)	4 ¼ inches (10.8 cm)
Mounting Type	1.75-8 ACME Thread Dual Blunt Start, Blunt End



Comparison with industry standard

7 FCC Limits

§ 1.1310: The criteria listed in table 1 shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

Part 1.1310 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)
(A) Limits for Occupational/Controlled Exposures				
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
300–1500	.....	.....	f/300	6
1500–100,000	.....	.....	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
300–1500	.....	.....	f/1500	30
1500–100,000	.....	.....	1.0	30

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

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

8 Test Procedure

An MPE evaluation for was performed in order to show that the device was compliant with the general population exposure limits from FCC §2.1091. The maximum power density was calculated for each transmitter band at a separation distance of 20cm using the maximum declared output power including tune up tolerance.

For each transmitter the maximum RF exposure at a 20 cm distance using the formula:

$$ConductedPower_{mW} = 10^{ConductedBwer(dBm)/10}$$

$$PowerDensity = \frac{ConductedPower_{mW} \times Ant.Gain}{4\pi \times (20_{cm})^2}$$

For transmitters that could operate simultaneously, the MPE to limit ratio for each was calculated and then summed. If the sum of the MPE to limit ratios was less than 1, that specific combination of transmitters was deemed to comply.

9 Results:

The calculated maximum power density at 20cm distance was equal to or less than the required limits for general population exposure for FCC Part 1.1310.

Additionally, to demonstrate compliance for simultaneous transmission between the BLE and LoRa radios the worst-case limit to MPE ratios for each radio were summed. Since that sum was less than 1 that combination of radios is deemed to comply with the simultaneous transmission RF exposure criteria.

FCC MPE Data

Radio	Channel	Frequency (MHz)	Declared Max Cond. Power (Inc. Tolerance) (dBm)	Duty Cycle (%)	Duty Cycle Adjusted Cond. Output Power (dBm)	Antenna Gain (dB)	MPE Value @ 20cm (mW/cm^2)	MPE Limit (mW/cm^2)	MPE / Limit Ratio (for Co-Location)
BLE	37	2402	2.188	100%	2.188	3.18	0.0007	1.0000	0.0007
	17	2440	2.660	100%	2.660	3.18	0.0008	1.0000	0.0008
	39	2480	3.242	100%	3.242	3.18	0.0009	1.0000	0.0009
LoRa	Low	903.0	19.3	100%	19.3	2	0.0268	0.6020	0.0446
	Mid	909.4	19.4	100%	19.4	2	0.0275	0.6063	0.0453
	High	914.2	19.0	100%	19.0	2	0.0250	0.6095	0.0411

0.0453 + 0.0009 = 0.0462 < 1

10 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	3/24/2023	105250409LEX-003	BL	JTS	Original Issue