



**DATE: 15 February 2017**

**I.T.L. (PRODUCT TESTING) LTD.**  
**FCC Radio Test Report**  
**For**

**Aquatron Robotic Systems Ltd.**

**Equipment under test:**

**Aquabot**

**AQ21071W100**

Tested by:

M. Zohar

Approved by:

D. Shidowsky

This report must not be reproduced, except in full, without the written permission of I.T.L. (Product Testing) Ltd.

This report relates only to items tested.



## Measurement/Technical Report for Aquatron Robotic Systems Ltd.

Aquabot

AQ21071W100

FCC ID: VQBAQ21071W100

|  |  |
|--|--|
| This report concerns:  | Original Grant: <input checked="" type="checkbox"/> X        |
|  | Class I Change: <input type="checkbox"/>                     |
|  | Class II Change: <input type="checkbox"/>                    |
| Equipment type:  | Digital Transmission System                                  |
| Limits used:   | 47CFR15 Section 15.247                                       |
| Measurement procedure used is KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63. 10-2013. |  |
| Application for Certification prepared by:   | Applicant for this device:<br>(different from "prepared by") |
| R. Pinchuck  | Benny Attar  |
| ITL (Product Testing) Ltd.   | Aquatron Robotic Systems Ltd.                                |
| 1 Bat Sheva St.  | P.O. Box 1088  |
| Lod 7116002  | Alon Tavor Industrial Zone                                   |
| e-mail <a href="mailto:Rpinchuck@itl.co.il">Rpinchuck@itl.co.il</a>                          | Afula Elite 18550  |
| Tel: +972-8-918-6117   | Israel   |
| Fax: +972-8-915-3101   | Tel: +972- 4-658 0000  |
|  | Fax: +972- 4-640 3886  |
|  | Email: battar@aquatron.co.il                                 |



## TABLE OF CONTENTS

|  |           |
|--|-----------|
| <b>1. GENERAL INFORMATION -----</b>  | <b>5</b>  |
| 1.1 Administrative Information.....  | 5         |
| 1.2 List of Accreditations .....   | 6         |
| 1.3 Product Description .....  | 7         |
| 1.4 Test Methodology .....   | 7         |
| 1.5 Test Facility .....  | 7         |
| 1.6 Measurement Uncertainty .....  | 7         |
| <b>2. SYSTEM TEST CONFIGURATION-----</b>                                     | <b>8</b>  |
| 2.1 Justification.....   | 8         |
| 2.2 EUT Exercise Software .....  | 8         |
| 2.3 Special Accessories .....  | 8         |
| 2.4 Equipment Modifications .....  | 8         |
| 2.5 Configuration of Tested System .....                                     | 8         |
| <b>3. TEST SET-UP PHOTOS-----</b>  | <b>9</b>  |
| <b>4. CONDUCTED EMISSION FROM AC MAINS-----</b>                              | <b>12</b> |
| 4.1 Test Specification .....   | 12        |
| 4.2 Test Procedure .....   | 12        |
| 4.3 Test Limit.....  | 12        |
| 4.4 Test Results.....  | 13        |
| 4.5 Test Equipment Used; Conducted Emission.....                             | 18        |
| <b>5. 6 DB MINIMUM BANDWIDTH-----</b>  | <b>19</b> |
| 5.1 Test Specification .....   | 19        |
| 5.2 Test Procedure .....   | 19        |
| 5.3 Test Limit.....  | 19        |
| 5.4 Test Results.....  | 19        |
| 5.5 Test Equipment Used; 6dB Bandwidth .....                                 | 21        |
| <b>6. MAXIMUM TRANSMITTED PEAK POWER OUTPUT -----</b>                        | <b>22</b> |
| 6.1 Test Specification .....   | 22        |
| 6.2 Test Procedure .....   | 22        |
| 6.3 Test Limit.....  | 22        |
| 6.4 Test Results.....  | 23        |
| 6.5 Test Equipment Used; Maximum Peak Power Output.....                      | 27        |
| <b>7. BAND EDGE SPECTRUM-----</b>  | <b>28</b> |
| 7.1 Test Specification .....   | 28        |
| 7.2 Test Procedure .....   | 28        |
| 7.3 Test Limit.....  | 28        |
| 7.4 Test Results.....  | 28        |
| 7.5 Test Equipment Used; Band Edge Spectrum .....                            | 30        |
| <b>8. EMISSIONS IN NON-RESTRICTED FREQUENCY BANDS-----</b>                   | <b>31</b> |
| 8.1 Test Specification .....   | 31        |
| 8.2 Test Procedure .....   | 31        |
| 8.3 Test Limit.....  | 31        |
| 8.4 Test Results.....  | 32        |
| 8.5 Test Instrumentation Used, Emission in Non Restricted Frequency Bands .. | 33        |
| 8.6 Field Strength Calculation .....   | 34        |
| <b>9. EMISSIONS IN RESTRICTED FREQUENCY BANDS -----</b>                      | <b>35</b> |
| 9.1 Test Specification .....   | 35        |
| 9.2 Test Procedure .....   | 35        |
| 9.3 Test Limit.....  | 36        |
| 9.4 Test Results.....  | 36        |
| 9.5 Test Instrumentation Used; Emissions in Restricted Frequency Bands ..... | 39        |



|  |           |
|--|-----------|
| <b>10. TRANSMITTED POWER DENSITY -----</b>                         | <b>40</b> |
| 10.1 Test Specification .....                                      | 40        |
| 10.2 Test Procedure .....  | 40        |
| 10.3 Test Limit.....   | 40        |
| 10.4 Test Results.....   | 41        |
| 10.5 Test Equipment Used; Transmitted Power Density .....          | 43        |
| <b>11. ANTENNA GAIN/INFORMATION-----</b>                           | <b>44</b> |
| <b>12. R.F EXPOSURE/SAFETY-----</b>                                | <b>45</b> |
| <b>13. APPENDIX A - CORRECTION FACTORS -----</b>                   | <b>46</b> |
| 13.1 Correction factors for RF OATS Cable 35m.....                 | 46        |
| 13.2 Correction factors for RF OATS Cable 10m.....                 | 46        |
| 13.3 Correction factors for ACTIVE LOOP ANTENNA ITL # 1075:.....   | 47        |
| 13.4 Correction factors for biconical antenna – ITL # 1356 .....   | 48        |
| 13.5 Correction factors for log periodic antenna – ITL # 1349..... | 49        |
| 13.6 Correction factors for Horn ANTENNA.....                      | 50        |
| 13.7 Correction factors for Horn Antenna .....                     | 51        |
| 13.8 Correction factor for RF CABLE for Semi Anechoic Chamber..... | 52        |



## 1. General Information

### 1.1 ***Administrative Information***

Manufacturer: Aquatron Robotic Systems Ltd.

Manufacturer's Address: P.O. Box 1088  
Alon Tavor Industrial Zone  
Afula Elite 18550  
Israel

Manufacturer's Representative: Benny Attar

Equipment Under Test (E.U.T): Aquabot

Equipment Model No.: AQ21071W100

Equipment Serial No.: Not designated

Date of Receipt of E.U.T: September 27, 2016

Start of Test: September 27, 2016  
February 8, 2017\*

End of Test: 15 November 2016  
February 8, 2017\*

Test Laboratory Location: I.T.L (Product Testing) Ltd.  
1 Batsheva St.,  
Lod  
ISRAEL 7120101

Test Specifications: FCC Part 15, Subpart C, Section  
15.247

\*- Testing of Emissions in Restricted and Non-Restricted Frequency Bands for the 9kHz – 30MHz range was performed on February 8, 2017.



## 1.2 *List of Accreditations*

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), FCC Designation No. IL1005.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-3006, R-2729, T-1877, G-245.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site Nos. IC 4025A-1, IC 4025A-2.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.



### 1.3 **Product Description**

The EUT is a power and control unit for robotic pool cleaner. It operates on 29VDC output with a bluetooth remote control.

|                           |                  |
|---------------------------|------------------|
| Model name                | AQ21071W100      |
| Working voltage           | 100-264VAC       |
| Mode of operation         | Transceiver      |
| Modulations               | BLE              |
| Assigned Frequency Range  | 2400.0-2483.5MHz |
| Operating Frequency Range | 2402MHz-2480MHz  |
| Transmit power            | ~-1.4 dBm        |
| Antenna Gain              | 5.3dBi           |
| Modulation BW             | ~ 700MHz         |

### 1.4 **Test Methodology**

Both conducted and radiated testing was performed according to the procedures in KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63. 10-2013. Radiated testing was performed at an antenna to EUT distance of 3 meters.

### 1.5 **Test Facility**

Emissions tests were performed at I.T.L.'s testing facility in Lod, Israel. I.T.L.'s EMC Laboratory is accredited by A2LA, certificate No. 1152.01 and its FCC Designation Number is IL1005.

### 1.6 **Measurement Uncertainty**

#### Conducted Emission

(CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4)

0.15 – 30 MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 3.44 dB

#### Radiated Emission

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) for open site 30-1000MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 4.98 dB

## 2. System Test Configuration

### 2.1 Justification

The unit was evaluated while transmitting at the low channel (2402MHz), the mid channel (2440MHz) and the high channel (2480MHz) in BLE technology.

Testing was performed in typical operation installation position. The evaluation was done with dummy load termination for simulation of the robotic swimming pool device (which only works in water).

### 2.2 EUT Exercise Software

No special exercise software was used.

### 2.3 Special Accessories

No special accessories were needed to achieve compliance.

### 2.4 Equipment Modifications

No modifications were necessary in order to achieve compliance.

### 2.5 Configuration of Tested System

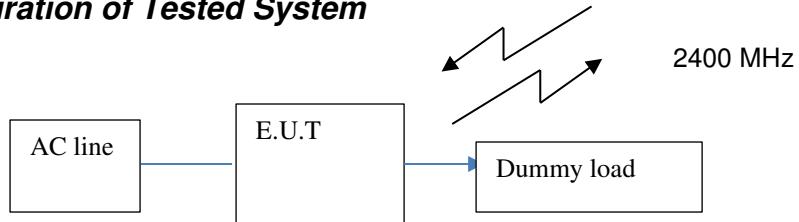


Figure 1. Configuration of Tested System

### 3. Test Set-Up Photos



Figure 2. Power Lines Conducted Emission Test



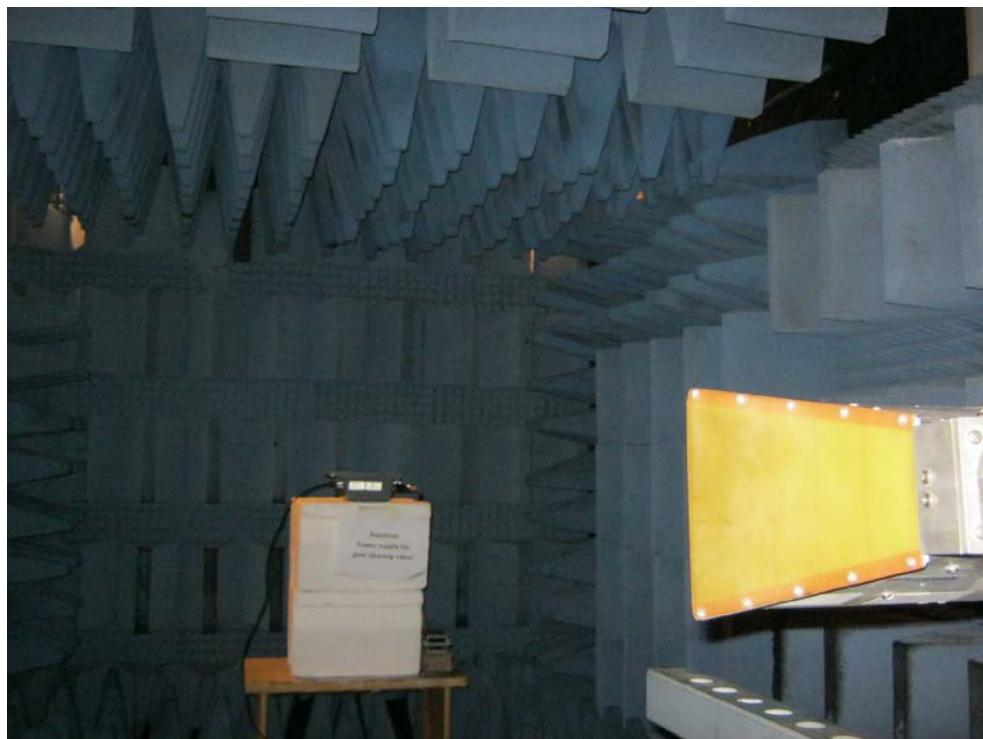
Figure 3. Radiated Emission Test



**Figure 4. Radiated Emission Test**



**Figure 5. Radiated Emission Test**



**Figure 6. Radiated Emission Test**



**Figure 7. Radiated Emission Test**

## 4. Conducted Emission From AC Mains

### 4.1 ***Test Specification***

FCC Part 15, Subpart C, Section 15.207

### 4.2 ***Test Procedure***

Temperature (22°C)/ Humidity (65%RH)

The E.U.T operation mode and test setup are as described in Section 2 of this report. In order to minimize background noise interference, the conducted emission testing was performed inside a shielded room, with the E.U.T placed on a 0.8 meter high wooden table, 0.4 meter from the room's vertical wall. In the case of a floor-standing E.U.T., it was placed on the horizontal ground plane.

The E.U.T was powered from 115 V AC / 60 Hz via 50 Ohm / 50  $\mu$ Hn Line Impedance Stabilization Network (LISN) on the phase and neutral lines. The LISN's were grounded to the shielded room ground plane (floor), and were kept at least 0.8 meters from the nearest boundary of the E.U.T

The center of the E.U.T.'s AC cable was folded back and forth, in order to form a bundle less than 0.40 meters and a total cable length of 1 meter.

The effect of varying the position of the cables was investigated to find the configuration that produces maximum emission. The configuration tested is shown in the photograph, *Figure 2. Power Lines Conducted Emission Test*

The emission voltages at the LISN's outputs were measured using a computerized receiver, complying with CISPR 16 requirements. The specification limits are loaded to the receiver and are displayed on the receiver's spectrum display.

The E.U.T was evaluated in TX operation mode

A frequency scan between 0.15 and 30 MHz was performed at 9 kHz I.F. band width, using peak detection.

The spectral components having the highest level on each line were measured using a quasi-peak and average detector.

### 4.3 ***Test Limit***

| Frequency of emission (MHz) | Conducted limit (dB $\mu$ V) |           |
|-----------------------------|------------------------------|-----------|
|                             | Quasi-peak                   | Average   |
| 0.15-0.5                    | 66 to 56*                    | 56 to 46* |
| 0.5-5                       | 56                           | 46        |
| 5-30                        | 60                           | 50        |

\* Decreases with the logarithm of the frequency.



#### 4.4 **Test Results**

JUDGEMENT: Passed by 2.6 dB

The margin between the emission levels and the specification limit is, in the worst case, 2.6 dB for the phase line at 12.66 MHz and 2.7 dB at 9.64 MHz for the neutral line.

The EUT met the F.C.C. Part 15, Subpart C specification requirements.

The details of the highest emissions are given in *Figure 8* to *Figure 11*.



## Conducted Emission

E.U.T Description      Aquabot  
Type                    AQ21071W100  
Serial Number:        Not designated

Specification:        FCC Part 15, Subpart C  
Lead:                   Phase  
Detectors: :           Peak, Quasi-peak, Average

| EDIT PEAK LIST (Final Measurement Results) |                       |                  |         |          |
|--|-----------------------|------------------|---------|----------|
| Trace1:                                    | CE22BQP               | Trace2:          | CE22BAP | Trace3:  |
|  | ---                   |                  |         |          |
| TRACE                                      | FREQUENCY             | LEVEL dB $\mu$ V | DELTA   | LIMIT dB |
| 1  | Quasi Peak 230 kHz    | 44.48            | -17.96  |          |
| 2  | Average 230 kHz       | 43.51            | -8.93   |          |
| 1  | Quasi Peak 338 kHz    | 46.45            | -12.80  |          |
| 2  | Average 342 kHz       | 43.13            | -6.01   |          |
| 1  | Quasi Peak 566 kHz    | 42.61            | -13.38  |          |
| 2  | Average 570 kHz       | 35.72            | -10.27  |          |
| 2  | Average 1.026 MHz     | 34.69            | -11.30  |          |
| 1  | Quasi Peak 1.03 MHz   | 41.67            | -14.32  |          |
| 1  | Quasi Peak 1.51 MHz   | 42.88            | -13.12  |          |
| 2  | Average 1.51 MHz      | 35.69            | -10.30  |          |
| 2  | Average 2.902 MHz     | 33.12            | -12.87  |          |
| 1  | Quasi Peak 3.554 MHz  | 44.45            | -11.54  |          |
| 2  | Average 4.758 MHz     | 38.16            | -7.83   |          |
| 1  | Quasi Peak 4.962 MHz  | 49.21            | -6.78   |          |
| 1  | Quasi Peak 10.314 MHz | 56.07            | -3.92   |          |
| 2  | Average 10.322 MHz    | 44.33            | -5.66   |          |
| 2  | Average 11.258 MHz    | 45.68            | -4.31   |          |
| 1  | Quasi Peak 12.658 MHz | 57.37            | -2.62   |          |
| 2  | Average 18.698 MHz    | 44.60            | -5.39   |          |
| 1  | Quasi Peak 19.502 MHz | 53.63            | -6.36   |          |

Date: 9.OCT.2016 16:27:56

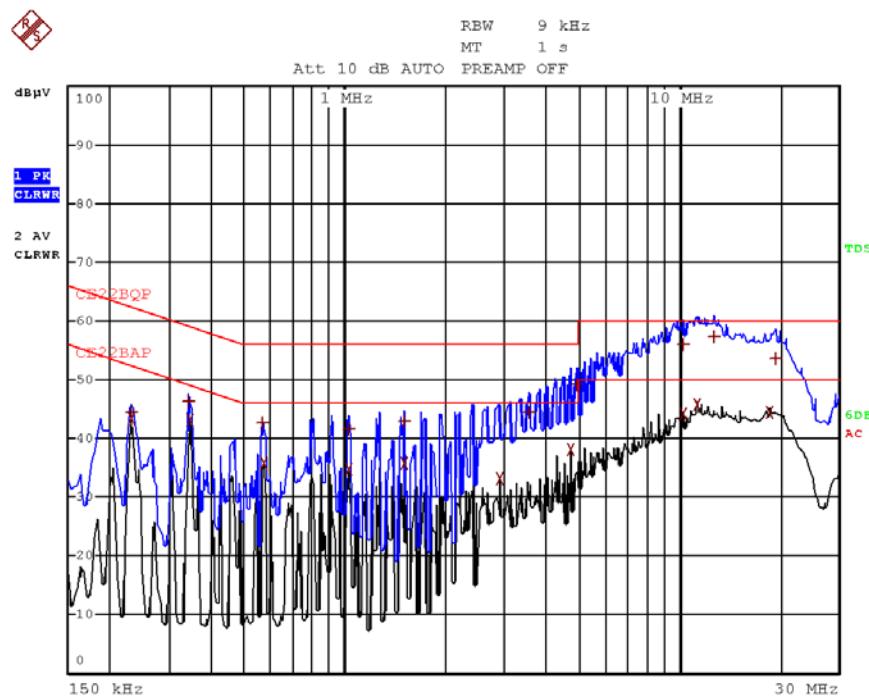
**Figure 8. Detectors: Peak, Quasi-peak, Average**

**Note:** *QP Delta/Av Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.*

# Conducted Emission

E.U.T Description Aquabot  
Type AQ21071W100  
Serial Number: Not designated

Specification: FCC Part 15, Subpart C  
Lead: Phase  
Detectors: Peak, Quasi-peak, Average



**Figure 9. Detectors: Peak, Quasi-peak, Average**



## Conducted Emission

E.U.T Description Aquabot  
Type AQ21071W100  
Serial Number: Not designated

Specification: FCC Part 15, Subpart C  
Lead: Neutral  
Detectors: Peak, Quasi-peak, Average

| EDIT PEAK LIST (Final Measurement Results) |            |                  |        |          |
|--|------------|------------------|--------|----------|
| Trace1:                                    | CE22BQP    |                  |        |          |
| Trace2:                                    | CE22BAP    |                  |        |          |
| Trace3:                                    | ---        |                  |        |          |
| TRACE                                      | FREQUENCY  | LEVEL dB $\mu$ V | DELTA  | LIMIT dB |
| 2 Average                                  | 230 kHz    | 43.20            | -9.24  |          |
| 1 Quasi Peak                               | 234 kHz    | 43.02            | -19.28 |          |
| 2 Average                                  | 346 kHz    | 45.78            | -3.27  |          |
| 1 Quasi Peak                               | 350 kHz    | 48.19            | -10.77 |          |
| 1 Quasi Peak                               | 578 kHz    | 45.66            | -10.33 |          |
| 2 Average                                  | 578 kHz    | 39.37            | -6.62  |          |
| 1 Quasi Peak                               | 802 kHz    | 44.15            | -11.84 |          |
| 2 Average                                  | 810 kHz    | 37.32            | -8.67  |          |
| 1 Quasi Peak                               | 1.51 MHz   | 46.24            | -9.75  |          |
| 2 Average                                  | 1.51 MHz   | 37.58            | -8.41  |          |
| 2 Average                                  | 2.902 MHz  | 34.72            | -11.27 |          |
| 1 Quasi Peak                               | 3.598 MHz  | 48.35            | -7.64  |          |
| 2 Average                                  | 4.758 MHz  | 38.45            | -7.54  |          |
| 1 Quasi Peak                               | 4.994 MHz  | 51.69            | -4.30  |          |
| 2 Average                                  | 8.71 MHz   | 43.49            | -6.50  |          |
| 1 Quasi Peak                               | 9.638 MHz  | 57.30            | -2.69  |          |
| 1 Quasi Peak                               | 11.258 MHz | 56.53            | -3.46  |          |
| 2 Average                                  | 11.726 MHz | 45.60            | -4.39  |          |
| 1 Quasi Peak                               | 19.098 MHz | 52.79            | -7.20  |          |
| 2 Average                                  | 19.23 MHz  | 43.45            | -6.54  |          |

Date: 9.OCT.2016 16:37:23

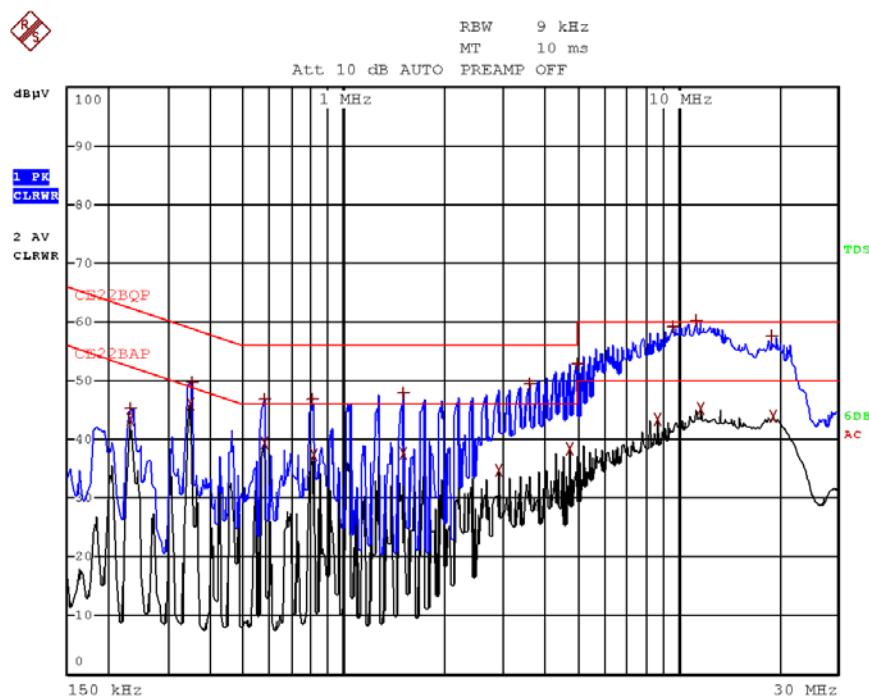
**Figure 10. Detectors: Peak, Quasi-peak, Average**

**Note:** *QP Delta/Av Delta refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.*

# Conducted Emission

E.U.T Description Aquabot  
Type AQ21071W100  
Serial Number: Not designated

Specification: FCC Part 15, Subpart C  
Lead: Neutral  
Detectors: Peak, Quasi-peak, Average



Date: 9.OCT.2016 16:35:45

**Figure 11 Detectors: Peak, Quasi-peak, Average**



#### 4.5 **Test Equipment Used; Conducted Emission**

| Instrument        | Manufacturer    | Model        | Serial No.        | Last Calibration Date | Next Calibration Due |
|-------------------|-----------------|--------------|-------------------|-----------------------|----------------------|
| LISN              | Fischer         | FCC-LISN-25A | 127               | 23. June 2016         | 23. June 2017        |
| Transient Limiter | HP              | 11947A       | 3107A03041        | 15. June 2016         | 15. June 2017        |
| EMI Receiver      | Rohde & Schwarz | ESCI7        | 100724            | 29. February 2016     | 01. March 2017       |
| Low Loss Cable    | Huber Suner     |              | 705A009301<br>EIM | 30. May 2016          | 30. May 2017         |

**Figure 12 Test Equipment Used**

## 5. 6 dB Minimum Bandwidth

### 5.1 Test Specification

FCC Part 15, Subpart C, Section 247(a)(2)

### 5.2 Test Procedure

(Temperature (22°C)/ Humidity (70%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was tested in the chamber, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The configuration tested is shown in *Figure 1*.

The spectrum bandwidth of the E.U.T. at the point of 6 dB below maximum peak power was measured and recorded. The RBW was set to 100 kHz.

### 5.3 Test Limit

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

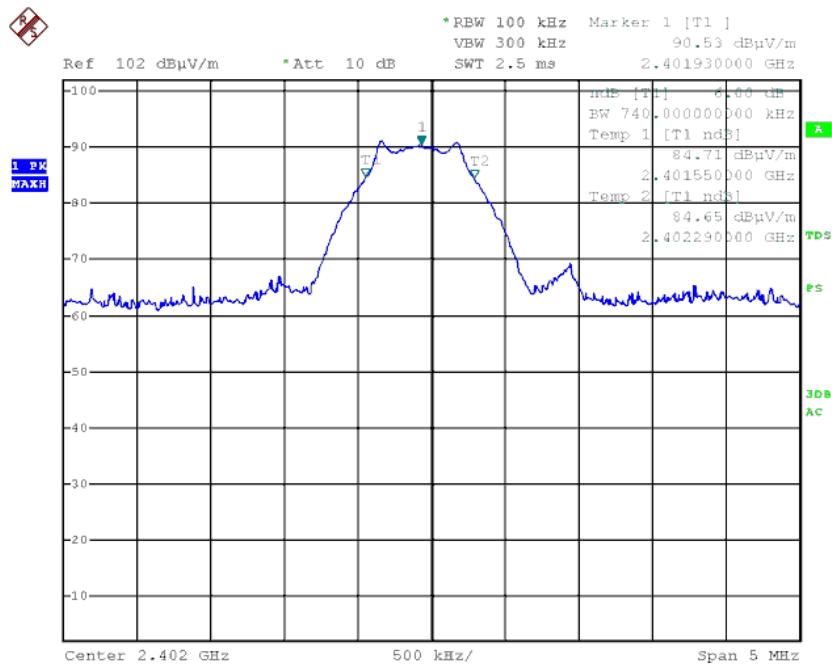
### 5.4 Test Results

| Operation Frequency<br>(MHz) | Reading<br>(MHz) | Specification<br>(MHz) |
|------------------------------|------------------|------------------------|
| 2402.0                       | 0.7              | ≥0.5                   |
| 2440.0                       | 0.7              | ≥0.5                   |
| 2480.0                       | 0.7              | ≥0.5                   |

**Figure 13 6 dB Minimum Bandwidth**

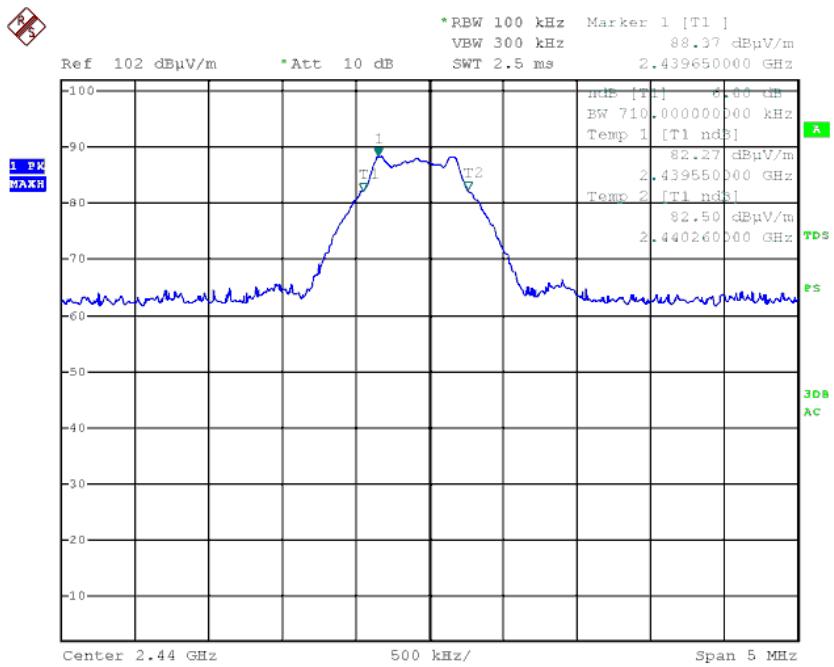
JUDGEMENT: Passed

For additional information see *Figure 14* to *Figure 16*.



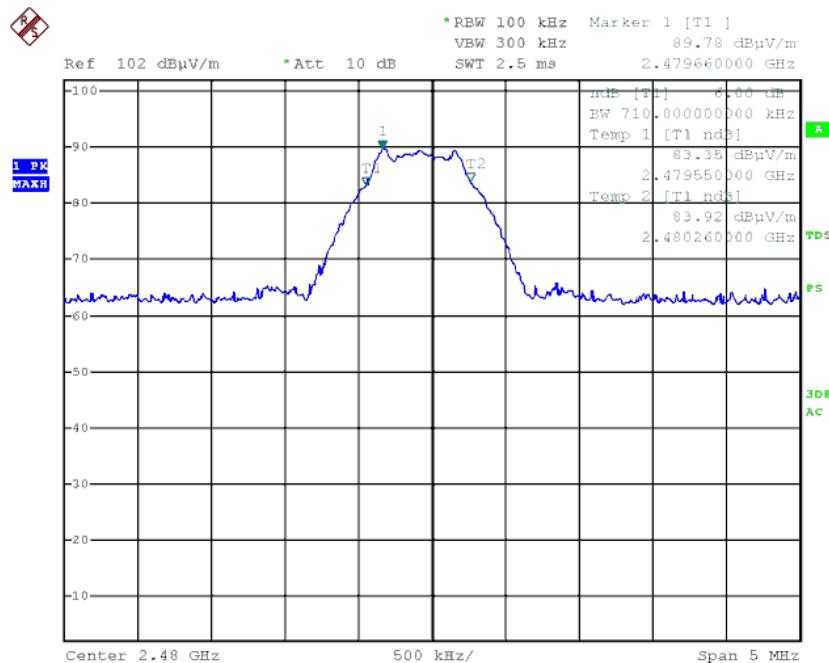
Date: 15.NOV.2016 14:27:33

**Figure 14. 2402.0 MHz**



Date: 15.NOV.2016 10:24:45

**Figure 15. 2440.0 MHz**



Date: 15.NOV.2016 10:02:46

**Figure 16. 2480.0 MHz**

## 5.5 *Test Equipment Used; 6dB Bandwidth*

| Instrument                  | Manufacturer | Model | Serial No. | Last Calibration Date | Next Calibration Due |
|-----------------------------|--------------|-------|------------|-----------------------|----------------------|
| Spectrum Analyzer           | R&S          | ESCI7 |            | 29. February 2016     | 01 March 2017        |
| Horn Antenna                | ETS          | 3115  | 6142       | 19. May 2015          | 19. May 2018         |
| Semi Anechoic Civil Chamber | ETS          | S81   | SL 11643   | NCR                   | NCR                  |

### Figure 17 Test Equipment Used



## 6. Maximum Transmitted Peak Power Output

### 6.1 Test Specification

FCC, Part 15, Subpart C, Section 247(b)(3)

### 6.2 Test Procedure

(Temperature (22°C)/ Humidity (70%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was tested in the chamber, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The configuration tested is shown in *Figure 2*.

The E.U.T was evaluated in 3 channels: low (2402.0 MHz), mid (2440.0 MHz) and high (2480 MHz).

Radiated output power levels were measured at selected operation frequencies and the results were converted to power level according to the formula as shown below:

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} \quad [W]$$

E - Field Strength (V/m)

d – Distance from transmitter (m)

G – Antenna gain

P – Peak power (W)

### 6.3 Test Limit

The maximum peak conducted output power of the intentional radiator for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.



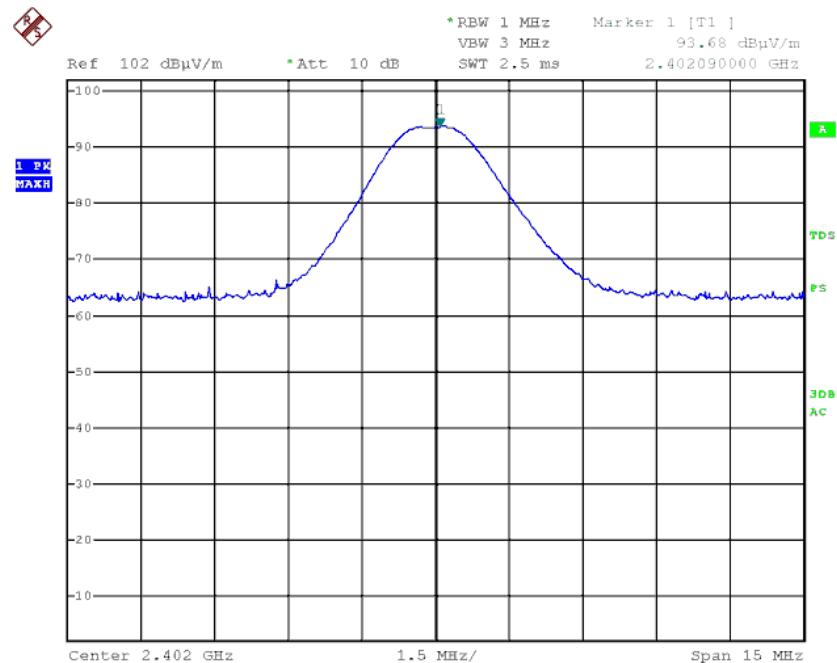
## 6.4 **Test Results**

| Operation Frequency<br>(MHz) | Polarization<br>(V/H) | Power<br>(dBuV/m) | Power<br>(dBm) | Power<br>(mW) | Specification<br>(mW) | Margin   |
|------------------------------|-----------------------|-------------------|----------------|---------------|-----------------------|----------|
| 2402.0                       | V                     | 93.7              | -1.5           | 0.708         | 1000.0                | -999.292 |
|                              | H                     | 89.3              | -5.9           | 0.257         | 1000.0                | -999.743 |
| 2440.0                       | V                     | 93.8              | -1.4           | 0.724         | 1000.0                | -999.276 |
|                              | H                     | 88.1              | -7.1           | 0.195         | 1000.0                | -999.805 |
| 2480.0                       | V                     | 91.4              | -3.8           | 0.417         | 1000.0                | -999.583 |
|                              | H                     | 88.1              | -7.1           | 0.195         | 1000.0                | -999.805 |

**Figure 18 Maximum Peak Power Output**

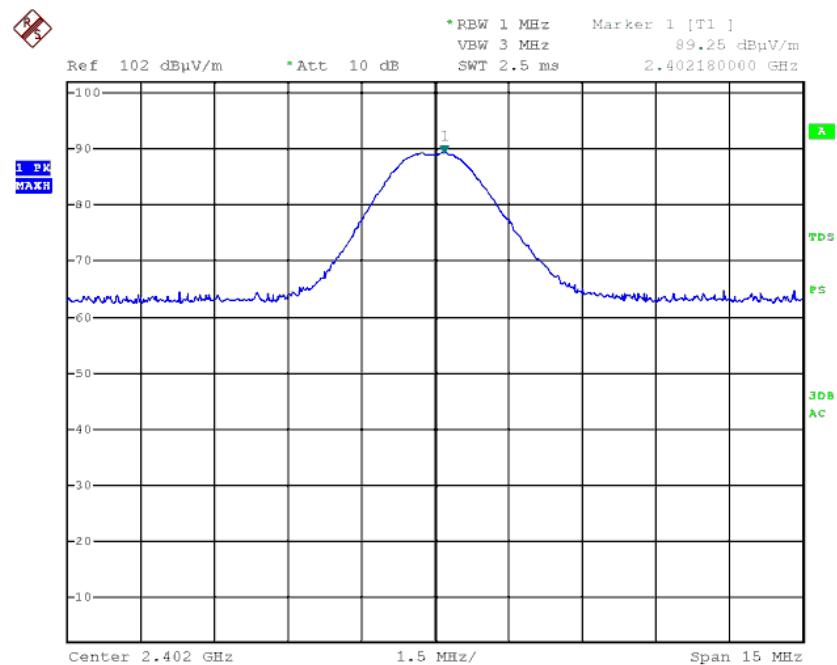
JUDGEMENT: Passed by 999.276 mW

For additional information see *Figure 19* to *Figure 24*.



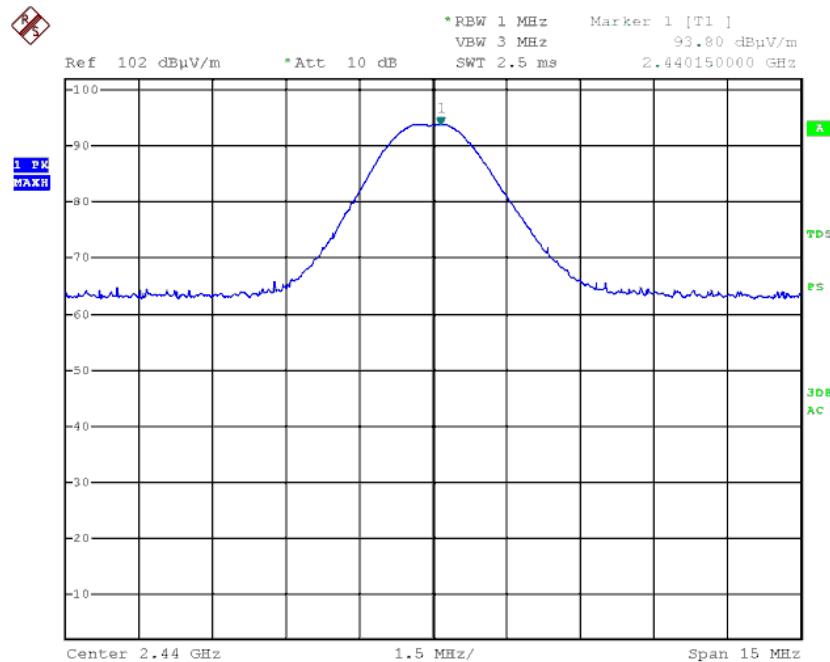
Date: 15.NOV.2016 14:23:38

**Figure 19 2402.0 MHz – Vertical**



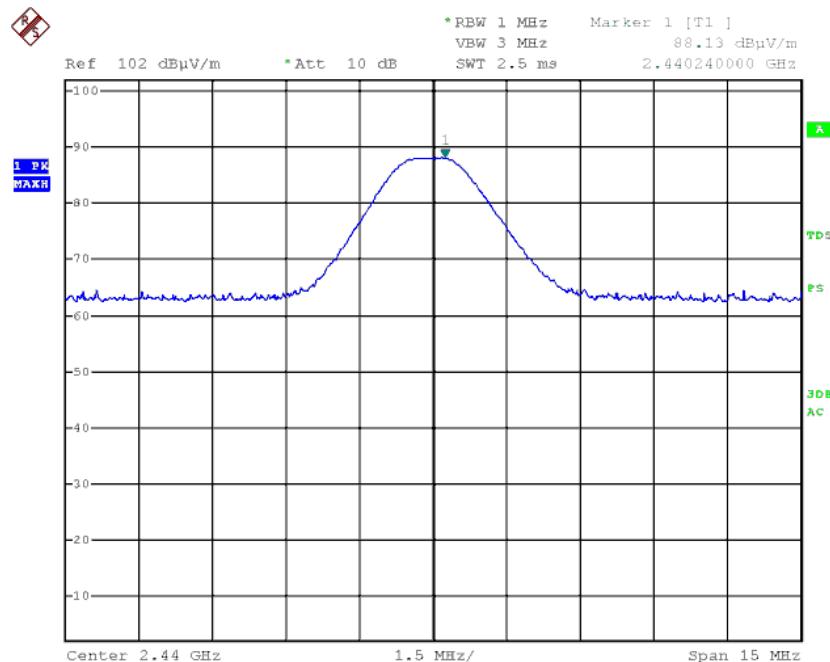
Date: 15.NOV.2016 14:19:08

**Figure 20 2402.0 MHz – Horizontal**



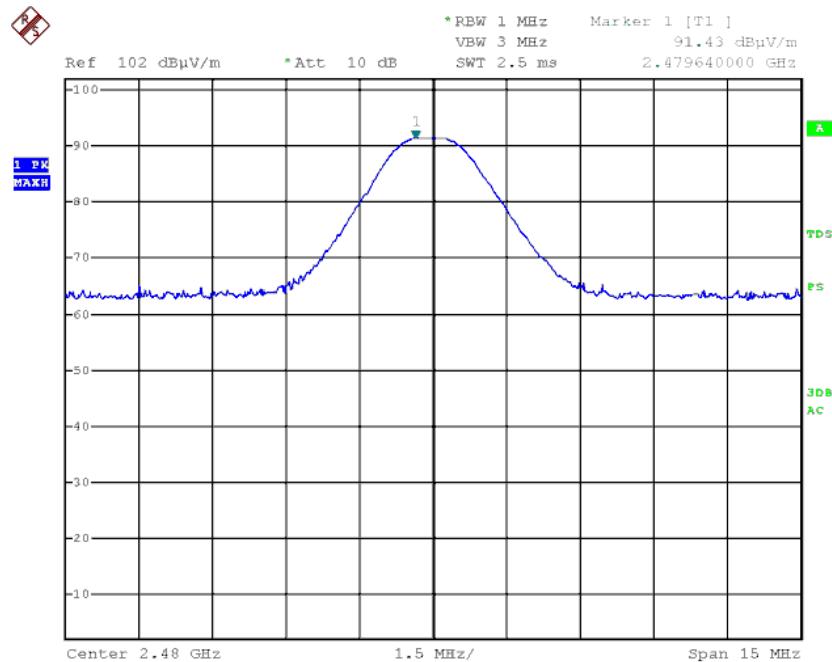
Date: 15.NOV.2016 10:23:22

**Figure 21 2440.0 MHz – Vertical**



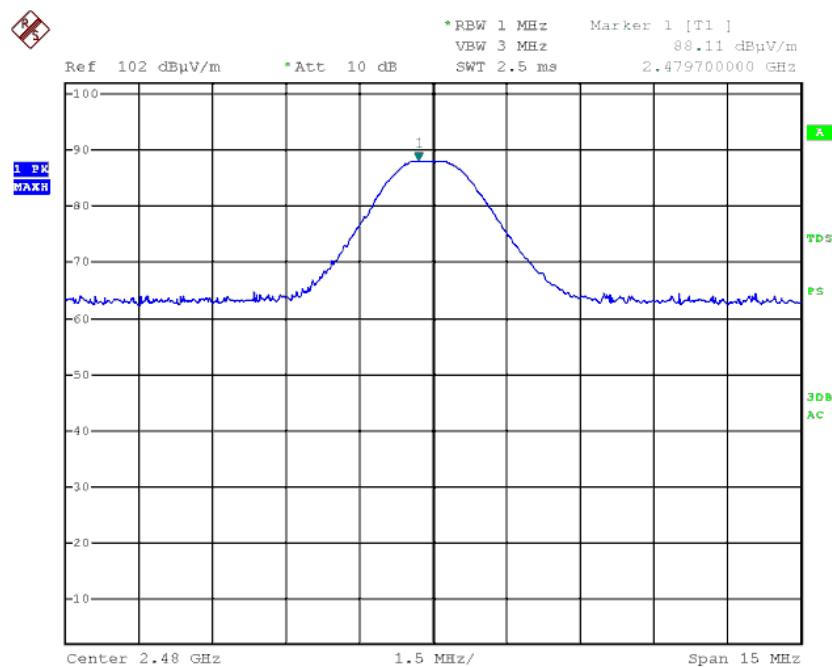
Date: 15.NOV.2016 10:43:08

**Figure 22 2440.0 MHz – Horizontal**



Date: 15.NOV.2016 09:41:35

**Figure 23 2480.0 MHz – Vertical**



Date: 15.NOV.2016 09:45:21

**Figure 24 2480.0 MHz – Horizontal**



## 6.5 ***Test Equipment Used; Maximum Peak Power Output***

| Instrument                  | Manufacturer | Model | Serial No. | Last Calibration Date | Next Calibration Due |
|-----------------------------|--------------|-------|------------|-----------------------|----------------------|
| EMI Receiver                | R&S          | ESCI7 | 100724     | 29. February 2016     | 01. March 2017       |
| Horn Antenna                | ETS          | 3115  | 6142       | 19. May 2015          | 19. May 2018         |
| Semi Anechoic Civil Chamber | ETS          | S81   | SL 11643   | NCR                   | NCR                  |

**Figure 25 Test Equipment Used**

## 7. Band Edge Spectrum

### 7.1 ***Test Specification***

FCC, Part 15, Subpart C, Section 247(d)

### 7.2 ***Test Procedure***

(Temperature (22°C)/ Humidity (70%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was tested in the chamber, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The configuration tested is shown in *Figure 1*.

The RBW was set to 100 kHz.

### 7.3 ***Test Limit***

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power

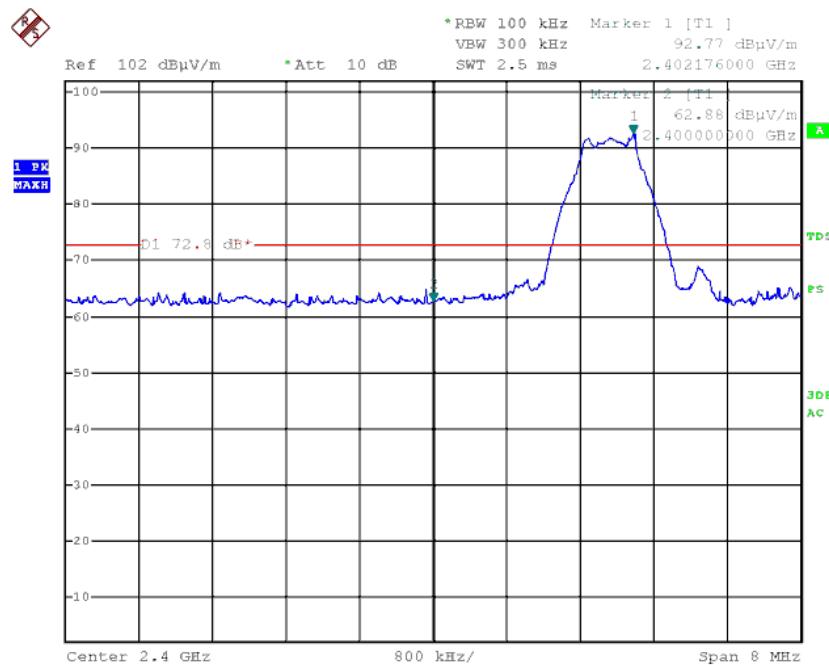
### 7.4 ***Test Results***

| Operation Frequency<br>(MHz) | Band Edge Frequency<br>(MHz) | Spectrum Level<br>(dBuV/m) | Specification<br>(dBuV/m) | Margin<br>(dB) |
|------------------------------|------------------------------|----------------------------|---------------------------|----------------|
| Low                          | 2400.0                       | 62.9                       | 72.8                      | -9.9           |
| High                         | 2483.5                       | 53.2                       | 69.7                      | -16.5          |

**Figure 26 Band Edge Spectrum**

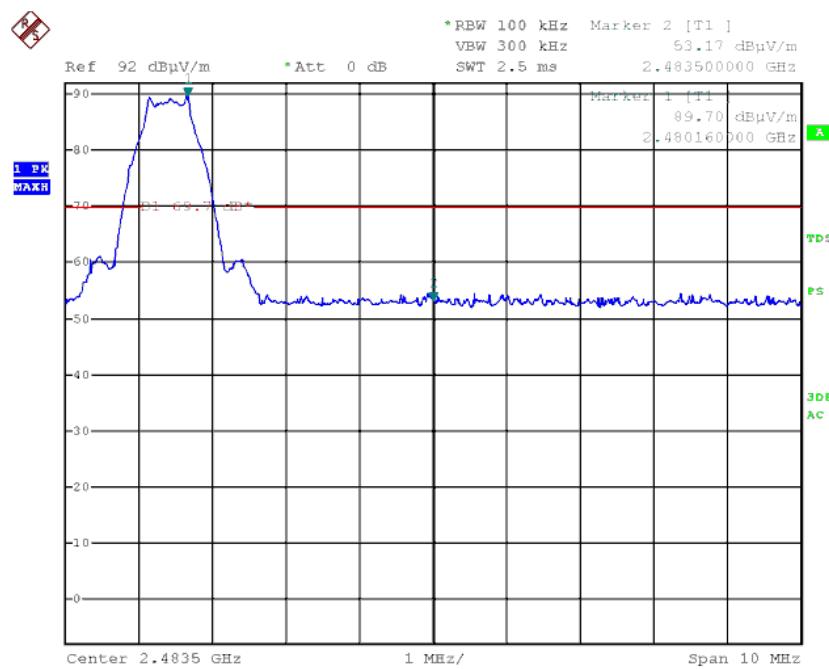
JUDGEMENT: Passed by 9.9dB

For additional information see *Figure 27* and *Figure 28*.



Date: 15.NOV.2016 14:33:48

**Figure 27 —Lower Band Edge**



Date: 15.NOV.2016 09:58:56

**Figure 28 —Upper Band Edge**



## 7.5 **Test Equipment Used; Band Edge Spectrum**

| Instrument                  | Manufacturer | Model | Serial No. | Last Calibration Date | Next Calibration Due |
|-----------------------------|--------------|-------|------------|-----------------------|----------------------|
| EMI Receiver                | R&S          | ESCI7 | 100724     | 29. February 2016     | 01. March 2017       |
| Horn Antenna                | ETS          | 3115  | 6142       | 19. May 2015          | 19. May 2018         |
| Semi Anechoic Civil Chamber | ETS          | S81   | SL 11643   | NCR                   | NCR                  |

**Figure 29 Test Equipment Used**

## 8. Emissions in Non-Restricted Frequency Bands

### 8.1 ***Test Specification***

FCC, Part 15, Subpart C, Section 247(d)

### 8.2 ***Test Procedure***

(Temperature (22°C)/ Humidity (70%RH))

The E.U.T. operation mode and test set-up are as described in Section 2 of this report.

#### **For measurements between 0.009MHz-30MHz:**

The E.U.T was tested inside the shielded room at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The frequency range 0.009MHz-30MHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The emissions were measured at a distance of 3 meters.

#### **For measurements between 30.0MHz-1.0GHz:**

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The frequency range 30.0MHz -1.0GHz was scanned and the list of the highest emissions was verified and updated accordingly.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization. The emissions were measured at a distance of 3 meters.

#### **For measurements between 1.0GHz-25.0GHz:**

The E.U.T was tested inside the shielded room and placed on a non-metallic table, 1.5 meters above the ground. The frequency range 1.0GHz -25.0GHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The emissions were measured at a distance of 3 meters.

RBW was set to 100kHz

The E.U.T. was operated at the low (2402.0 MHz), mid (2440 MHz) and high channels (2480.0 MHz).

### 8.3 ***Test Limit***

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power



#### 8.4 ***Test Results***

JUDGEMENT: Passed

All detected emissions were greater than 20dBc below the fundamental level.

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 247(d) specification.



## 8.5 **Test Instrumentation Used, Emission in Non Restricted Frequency Bands**

| Instrument                  | Manufacturer    | Model        | Serial No.    | Last Calibration Date | Next Calibration Due |
|-----------------------------|-----------------|--------------|---------------|-----------------------|----------------------|
| EMI Receiver                | R&S             | ESCI7        | 100724        | 29. February 2016     | 01. March 2017       |
| Spectrum Analyzer           | HP              | 8592L        | 3826A01204    | 13. March 2016        | 13. March 2017       |
| EMI Receiver                | HP              | 8542E        | 3906A00276    | 03. March 2016        | 03. March 2017       |
| RF Filter Section           | HP              | 85420E       | 3705A00248    | 03. March 2016        | 03. March 2017       |
| Spectrum Analyzer           | HP              | 8564E        | 3442A00275    | 10. March 2016        | 10. March 2017       |
| Biconical Antenna           | EMCO            | 3104         | 2606          | 24. March 2016        | 24. March 2017       |
| Active Loop Antenna         | EMCO            | 6502         | 9506-2950     | 12 September 2016     | 12 September 2017    |
| Log Periodic Antenna        | EMCO            | 3146         | 9505-4081     | 23. April 2016        | 23. April 2017       |
| Horn Antenna                | ETS             | 3115         | 29845         | 19. May 2015          | 19. May 2018         |
| Horn Antenna                | ARA             | SWH-28       | 1007          | 30. March 2014        | 30. March 2017       |
| Low Noise Amplifier         | Narda           | DBS-0411N313 | 13            | 08. August 2016       | 08. August 2017      |
| Low Noise Amplifier         | Sophia Wireless | LNA28-B      | 232           | 08. August 2016       | 08. August 2017      |
| Spectrum Analyzer           | HP              | 8593EM       | 3536A00120ADI | 10. March 2016        | 10. March 2017       |
| Semi Anechoic Civil Chamber | ETS             | S81          | SL 11643      | NCR                   | NCR                  |

**Figure 30 Test Equipment Used**



## 8.6 **Field Strength Calculation**

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors", using the following equation:

$$FS = RA + AF + CF$$

FS: Field Strength [dB $\mu$ V/m]

RA: Receiver Amplitude [dB $\mu$ V]

AF: Receiving Antenna Correction Factor [dB/m]

CF: Cable Attenuation Factor [dB]

Example:  $FS = 30.7 \text{ dB}\mu\text{V (RA)} + 14.0 \text{ dB (AF)} + 0.9 \text{ dB (CF)} = 45.6 \text{ dB}\mu\text{V}$

No external pre-amplifiers are used.

## 9. Emissions in Restricted Frequency Bands

### 9.1 ***Test Specification***

FCC, Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d)

### 9.2 ***Test Procedure***

(Temperature (22°C)/ Humidity (70%RH))

#### **For measurements between 0.009MHz-30MHz:**

The E.U.T was tested inside the shielded room at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The frequency range 0.009MHz-30MHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The emissions were measured at a distance of 3 meters.

#### **For measurements between 30.0MHz-1.0GHz:**

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The frequency range 30.0MHz -1.0GHz was scanned and the list of the highest emissions was verified and updated accordingly.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

The emissions were measured at a distance of 3 meters.

#### **For measurements between 1.0GHz-25.0GHz:**

The E.U.T was tested inside the shielded room and was placed on a non-metallic table, 1.5 meters above the ground. The frequency range 1.0GHz -25.0GHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The emissions were measured at a distance of 3 meters.

The E.U.T. was operated at the low (2402 MHz), mid (2440 MHz) and high channels (2480 MHz).

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.



### 9.3 **Test Limit**

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

| Frequency (MHz) | Field strength (microvolts/meter) | Measurement distance (meters) | Field strength (dB $\mu$ V/m) | Field strength* (dB $\mu$ V/m)@3m |
|-----------------|-----------------------------------|-------------------------------|-------------------------------|-----------------------------------|
| 0.009-0.490     | 2400/F(kHz)                       | 300                           | 48.5-13.8                     | 128.5-73.8                        |
| 0.490-1.705     | 24000/F(kHz)                      | 30                            | 33.8-23.0                     | 73.8-63.0                         |
| 1.705-30.0      | 30                                | 30                            | 29.5                          | 69.5                              |
| 30-88           | 100                               | 3                             | 40.0                          | 40.0                              |
| 88-216          | 150                               | 3                             | 43.5                          | 43.5                              |
| 216-960         | 200                               | 3                             | 46.0                          | 46.0                              |
| Above 960       | 500                               | 3                             | 54.0                          | 54.0                              |

\*The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector. For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

**Figure 31 Table of Limits**

### 9.4 **Test Results**

JUDGEMENT: Passed by 1.2dB

For the operation frequency of 2402 MHz, the margin between the emission level and the specification limit is in the worst case 3.2dB at the frequency of 2390.0 MHz, vertical polarization.

For the operation frequency of 2440 MHz, the margin between the emission level and the specification limit is in the worst case 8.3dB at the frequency of 4880.0 MHz, horizontal polarization.

For the operation frequency of 2480 MHz, the margin between the emission level and the specification limit is in the worst case 2.7dB at the frequency of 2483.5 MHz, vertical polarization.

The EUT met the requirements of the F.C.C. Part 15, Subpart C specification.

The details of the highest emissions are given in *Figure 32* to *Figure 33*.



## Radiated Emission

E.U.T Description Aquabot  
Type AQ21071W100  
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical      Frequency range: 0.009MHz to 25.0 GHz  
Test Distance: 3 meters      Detector: Peak

| Operation Frequency<br>(MHz) | Frequency<br>(MHz) | Polarity<br>(H/V) | Peak Reading<br>(dB $\mu$ V/m) | Peak Specification<br>(dB $\mu$ V/m) | Peak Margin<br>(dB) |
|------------------------------|--------------------|-------------------|--------------------------------|--------------------------------------|---------------------|
| 2402.0                       | 2390.0             | H                 | 64.3                           | 74.0                                 | -9.7                |
| 2402.0                       | 2390.0             | V                 | 62.0                           | 74.0                                 | -12.0               |
| 2402.0                       | 4804.0             | H                 | 39.3                           | 74.0                                 | -34.7               |
| 2402.0                       | 4804.0             | V                 | 41.0                           | 74.0                                 | -33.0               |
| 2440.0                       | 4880.0             | H                 | 42.3                           | 74.0                                 | -31.7               |
| 2440.0                       | 4880.0             | V                 | 41.1                           | 74.0                                 | -32.9               |
| 2480.0                       | 4960.0             | H                 | 43.2                           | 74.0                                 | -30.8               |
| 2480.0                       | 4960.0             | V                 | 43.1                           | 74.0                                 | -30.9               |
| 2480.0                       | 2483.5             | H                 | 53.6                           | 74.0                                 | -20.4               |
| 2480.0                       | 2483.5             | V                 | 59.8                           | 74.0                                 | -14.2               |

**Figure 32. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.  
Detector: Peak**

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Reading” includes correction factor.

“Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain



## Radiated Emission

E.U.T Description Aquabot  
Type AQ21071W100  
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical  
Test Distance: 3 meters

Frequency range: 0.009MHz to 25.0 GHz  
Detector: Average

| Operation Frequency | Frequency | Polarity | Average Reading | Average Specification | Average Margin |
|---------------------|-----------|----------|-----------------|-----------------------|----------------|
| (MHz)               | (MHz)     | (H/V)    | (dB $\mu$ V/m)  | (dB $\mu$ V/m)        | (dB)           |
| 2402.0              | 2390.0    | H        | 51.4            | 54.0                  | -2.6           |
| 2402.0              | 2390.0    | V        | 50.6            | 54.0                  | -3.4           |
| 2402.0              | 4804.0    | H        | -               | 54.0                  | -              |
| 2402.0              | 4804.0    | V        | -               | 54.0                  | -              |
| 2440.0              | 4880.0    | H        | -               | 54.0                  | -              |
| 2440.0              | 4880.0    | V        | -               | 54.0                  | -              |
| 2480.0              | 4960.0    | H        | -               | 54.0                  | -              |
| 2480.0              | 4960.0    | V        | -               | 54.0                  | -              |
| 2480.0              | 2483.5    | H        | 48.5            | 54.0                  | -5.5           |
| 2480.0              | 2483.5    | V        | 52.8            | 54.0                  | -1.2           |

**Figure 33. Radiated Emission. Antenna Polarization: HORIZONTAL / VERTICAL.  
Detector: Average**

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Average Reading” includes correction factor.

Correction Factor = Antenna Factor + Cable Loss- Low Noise Amplifier Gain



### 9.5 Test Instrumentation Used; Emissions in Restricted Frequency Bands

| Instrument                  | Manufacturer    | Model        | Serial No.    | Last Calibration Date | Next Calibration Due |
|-----------------------------|-----------------|--------------|---------------|-----------------------|----------------------|
| EMI Receiver                | R&S             | ESCI7        | 100724        | 29. February 2016     | 01. March 2017       |
| Spectrum Analyzer           | HP              | 8592L        | 3826A01204    | 13. March 2016        | 13. March 2017       |
| EMI Receiver                | HP              | 8542E        | 3906A00276    | 03. March 2016        | 03. March 2017       |
| RF Filter Section           | HP              | 85420E       | 3705A00248    | 03. March 2016        | 03. March 2017       |
| Spectrum Analyzer           | HP              | 8564E        | 3442A00275    | 10. March 2016        | 10. March 2017       |
| Biconical Antenna           | EMCO            | 3104         | 2606          | 24. March 2016        | 24. March 2017       |
| Active Loop Antenna         | EMCO            | 6502         | 9506-2950     | 12 September 2016     | 12 September 2017    |
| Log Periodic Antenna        | EMCO            | 3146         | 9505-4081     | 23. April 2016        | 23. April 2017       |
| Horn Antenna                | ETS             | 3115         | 29845         | 19. May 2015          | 19. May 2018         |
| Horn Antenna                | ARA             | SWH-28       | 1007          | 30. March 2014        | 30. March 2017       |
| Low Noise Amplifier         | Narda           | DBS-0411N313 | 13            | 08. August 2016       | 08. August 2017      |
| Low Noise Amplifier         | Sophia Wireless | LNA28-B      | 232           | 08. August 2016       | 08. August 2017      |
| Spectrum Analyzer           | HP              | 8593EM       | 3536A00120ADI | 10. March 2016        | 10. March 2017       |
| Semi Anechoic Civil Chamber | ETS             | S81          | SL 11643      | NCR                   | NCR                  |

Figure 34 Test Equipment Used



## 10. Transmitted Power Density

### 10.1 ***Test Specification***

FCC, Part 15, Subpart C, Section 247(e)

### 10.2 ***Test Procedure***

(Temperature (22°C)/ Humidity (70%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T was tested in the chamber, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The configuration tested is shown in *Figure 2*.

The spectrum analyzer was set to 3 kHz RBW and VBW to 10 kHz.

The E.U.T was evaluated in 3 channels: low (2402MHz), mid (2440MHz) and high (2480MHz).

Radiated output power levels were measured at selected operation frequencies and the results were converted to power level according to the formula as shown below:

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} \quad [W]$$

E - Field Strength (V/m)

d – Distance from transmitter (m)

G – Antenna gain

P – Peak power (W)

### 10.3 ***Test Limit***

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission



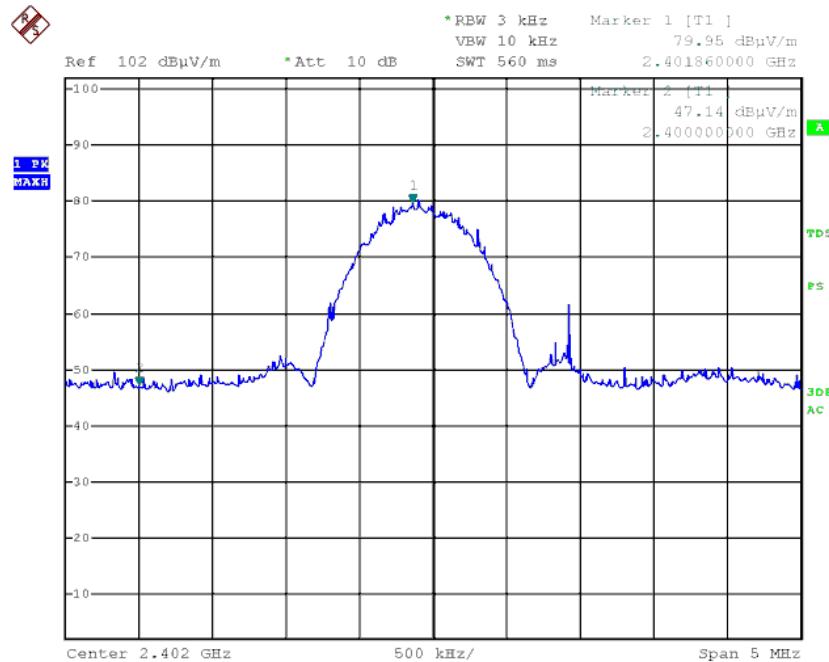
#### 10.4 Test Results

| Operation Frequency<br>(MHz) | Reading Spectrum Analyzer<br>(dB $\mu$ V/m) | Reading Spectrum Analyzer<br>(dBm) | Specification<br>(dBm) | Margin<br>(dB) |
|------------------------------|---|------------------------------------|------------------------|----------------|
| 2402.0                       | 80.0  | -15.2                              | 8.0                    | -23.2          |
| 2440.0                       | 79.6  | -15.6                              | 8.0                    | -23.6          |
| 2480.0                       | 77.5  | -17.7                              | 8.0                    | -25.7          |

Figure 35 Test Results

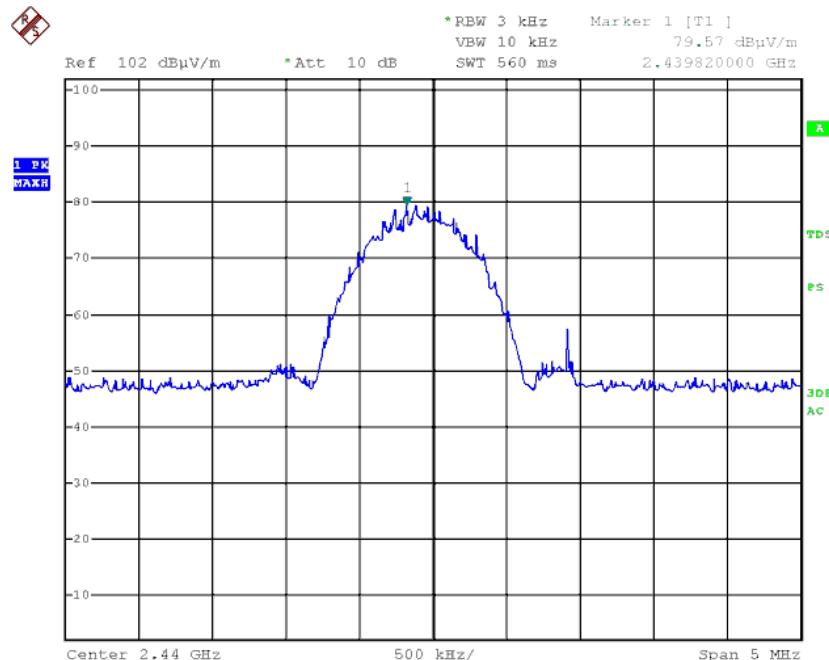
JUDGEMENT: Passed by 23.2dB

For additional information see *Figure 35*.



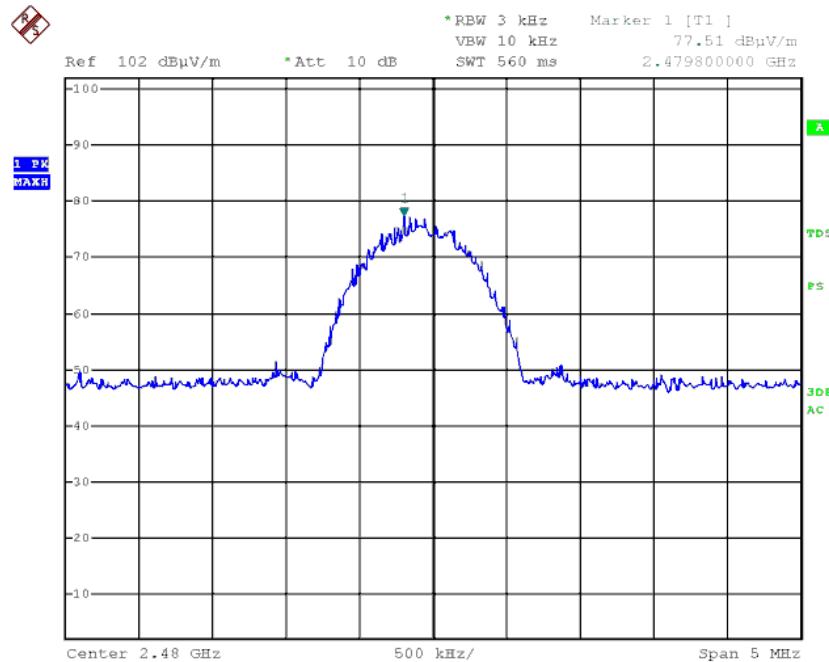
Date: 15.NOV.2016 14:38:51

**Figure 36 — 2402.0 MHz**



Date: 15.NOV.2016 10:28:03

**Figure 37 — 2440.0 MHz**



Date: 15.NOV.2016 09:51:21

**Figure 38 — 2480.0 MHz**

### 10.5 Test Equipment Used; Transmitted Power Density

| Instrument                  | Manufacturer | Model | Serial No. | Last Calibration Date | Next Calibration Due |
|-----------------------------|--------------|-------|------------|-----------------------|----------------------|
| EMI Receiver                | R&S          | ESCI7 | 100120     | 29. February 2016     | 01. March 2017       |
| Horn Antenna                | ETS          | 3115  | 29845      | 19. May 2015          | 19. May 2018         |
| Semi Anechoic Civil Chamber | ETS          | S81   | SL 11643   | NCR                   | NCR                  |

**Figure 39 Test Equipment Used**



## 11. Antenna Gain/Information

The antenna gain is 5.3 dBi, integral.



## 12. R.F Exposure/Safety

Typical use of the E.U.T. is as a power and control unit for robotic pool cleaner.

The typical placement of the E.U.T.: Place the power and control unit at least 3.6 meters/11.8 feet from the pool and at least 12 cm/4 inches above the surface.

The typical distance between the E.U.T. and the user is 20 cm.

### Calculation of Maximum Permissible Exposure (MPE)

Based on Section 1.1310 Requirements

(a) FCC limits at 2440 MHz is:

$$1 \frac{mW}{cm^2}$$

Using table 1 of Section 1.1310 limit for general population/uncontrolled exposures, the above level is an average over 30 minutes.

(b) The power density produced by the E.U.T. is

$$S = \frac{P_t G_t}{4\pi R^2}$$

P<sub>t</sub>- Transmitted Power 93.8 dBuV/m (Peak) = -1.4dBm = 0.724 mW (testing performed radiated; power results include antenna gain)

G<sub>T</sub>- Antenna Gain, 5.3 dBi

R- Distance from Transmitter using 20cm worst case

(c) The peak power density is:

$$S = \frac{(0.724)}{4\pi(20)^2} = 1.44 \times 10^{-4} \frac{mW}{cm^2}$$

(d) This is below the FCC limit.



## 13. APPENDIX A - CORRECTION FACTORS

### 13.1 *Correction factors for RF OATS Cable 35m*

ITL #1784

| Frequency ( MHz) | Cable loss (dB) |
|------------------|-----------------|
| 10.0             | 0.3             |
| 20.0             | 0.2             |
| 50.0             | -0.1            |
| 100.0            | -0.6            |
| 200.0            | -1.2            |
| 500.0            | -2.3            |
| 1000.0           | -3.6            |

### 13.2 *Correction factors for RF OATS Cable 10m*

ITL #1794

| Frequency(MHz) | Cable loss(dB) |
|----------------|----------------|
| 10.0           | -0.3           |
| 20.0           | -0.3           |
| 50.0           | -0.5           |
| 100.0          | -0.7           |
| 200.0          | -1.1           |
| 500.0          | -1.8           |
| 1000.0         | -2.7           |



13.3 **Correction factors for ACTIVE LOOP ANTENNA ITL**  
**# 1075:**  
**Model 6502 S/N 9506-2950**

| f(MHz) | MAF(dBs/m) | AF(dB/m) |
|--------|------------|----------|
| 0.01   | -33.1      | 18.4     |
| 0.02   | -37.2      | 14.3     |
| 0.03   | -38.2      | 13.3     |
| 0.05   | -39.8      | 11.7     |
| 0.1    | -40.1      | 11.4     |
| 0.2    | -40.3      | 11.2     |
| 0.3    | -40.3      | 11.2     |
| 0.5    | -40.3      | 11.2     |
| 0.7    | -40.3      | 11.2     |
| 1      | -40.1      | 11.4     |
| 2      | -40        | 11.5     |
| 3      | -40        | 11.5     |
| 4      | -40.1      | 11.4     |
| 5      | -40.2      | 11.3     |
| 6      | -40.4      | 11.1     |
| 7      | -40.4      | 11.1     |
| 8      | -40.4      | 11.1     |
| 9      | -40.5      | 11       |
| 10     | -40.5      | 11       |
| 20     | -41.5      | 10       |
| 30     | -43.5      | 8        |



**13.4 Correction factors for biconical antenna – ITL #  
1356**

**Model: EMCO 3110B  
Serial No.:9912-3337**

| Frequency [MHz] | AF [dB/m] |
|-----------------|-----------|
| 30.0            | 14.18     |
| 35.0            | 13.95     |
| 40.0            | 12.84     |
| 45.0            | 11.23     |
| 50.0            | 11.10     |
| 60.0            | 10.39     |
| 70.0            | 9.34      |
| 80.0            | 9.02      |
| 90.0            | 9.31      |
| 100.0           | 8.95      |
| 120.0           | 11.53     |
| 140.0           | 12.20     |
| 160.0           | 12.56     |
| 180.0           | 13.49     |
| 200.0           | 15.27     |



**13.5 Correction factors for log periodic antenna – ITL #  
1349**

**Model: EMCO 3146  
Serial No.:9505-4081**

| Frequency [MHz] | AF [dB/m] |
|-----------------|-----------|
| 200.0           | 11.47     |
| 250.0           | 12.06     |
| 300.0           | 14.77     |
| 400.0           | 15.77     |
| 500.0           | 18.01     |
| 600.0           | 18.84     |
| 700.0           | 20.93     |
| 800.0           | 21.27     |
| 900.0           | 22.44     |
| 1000.0          | 24.10     |



### 13.6 Correction factors for

#### *Horn ANTENNA*

**Model: 3115      ITL # 1352**  
**Antenna serial number: 6142**  
**3 meter range**

| f(GHz) | AF(dB/m) | GA(dB) |
|--------|----------|--------|
| 0.75   | 25       | 3      |
| 1G     | 23.5     | 7      |
| 1.5G   | 26       | 8      |
| 2G     | 29       | 7      |
| 2.5G   | 27.5     | 10     |
| 3G     | 30       | 10     |
| 3.5G   | 31.5     | 10     |
| 4G     | 32.5     | 9.5    |
| 4.5G   | 32.5     | 10.5   |
| 5G     | 33       | 10.5   |
| 5.5G   | 35       | 10.5   |
| 6G     | 36.5     | 9.5    |
| 6.5G   | 36.5     | 10     |
| 7G     | 37.5     | 10     |
| 7.5G   | 37.5     | 10     |
| 8G     | 37.5     | 11     |
| 8.5G   | 38       | 11     |
| 9G     | 37.5     | 11.5   |
| 9.5G   | 38       | 11.5   |
| 10G    | 38.5     | 11.5   |
| 10.5G  | 38.5     | 12     |
| 11G    | 38.5     | 12.5   |
| 11.5G  | 38.5     | 13     |
| 12G    | 38       | 13.5   |
| 12.5G  | 38.5     | 13     |
| 13G    | 40       | 12     |
| 13.5G  | 41       | 12     |
| 14G    | 40       | 13     |
| 14.5G  | 39       | 14     |
| 15G    | 38       | 15.5   |
| 15.5G  | 37.5     | 16     |
| 16G    | 37.5     | 16     |
| 16.5G  | 39       | 15     |
| 17G    | 40       | 15     |
| 17.5G  | 42       | 13.5   |
| 18G    | 42.5     | 13     |



13.7 **Correction factors for**

**Horn Antenna**  
**Model: SWH-28**  
**at 1 meter range.**

| Frequency, MHz | Measured antenna factor, dB/m 1) |
|----------------|----------------------------------|
| 18000          | 33.0                             |
| 18500          | 32.9                             |
| 19000          | 33.1                             |
| 19500          | 33.3                             |
| 20000          | 33.6                             |
| 20500          | 33.6                             |
| 21000          | 33.4                             |
| 21500          | 33.8                             |
| 22000          | 33.7                             |
| 22500          | 33.9                             |
| 23000          | 34.8                             |
| 23500          | 34.5                             |
| 24000          | 34.2                             |
| 24500          | 34.8                             |
| 25000          | 34.4                             |
| 25500          | 35.2                             |
| 26000          | 35.9                             |
| 26500          | 36.0                             |



### 13.8 ***Correction factor for RF CABLE for Semi Anechoic Chamber***

ITL # 1841

| FREQ<br>(MHz) | LOSS<br>(dB) |
|---------------|--------------|
| 1000.0        | 1.5          |
| 2000.0        | 2.1          |
| 3000.0        | 2.7          |
| 4000.0        | 3.1          |
| 5000.0        | 3.5          |
| 6000.0        | 4.1          |
| 7000.0        | 4.6          |
| 8000.0        | 4.9          |
| 9000.0        | 5.7          |
| 10000.0       | 5.7          |
| 11000.0       | 6.1          |
| 12000.0       | 6.1          |
| 13000.0       | 6.2          |
| 14000.0       | 6.7          |
| 15000.0       | 7.4          |
| 16000.0       | 7.5          |
| 17000.0       | 7.9          |
| 18000.0       | 8.1          |
| 19000.0       | 8.8          |
| 20000.0       | 9.1          |

#### *NOTES:*

1. The cable is manufactured by Commscope
2. The cable type is 0623 WBC-400, serial # G020132 and 10m long