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Report Template Version: V03

Report Template Revision Date: Mar.1st, 2017

RF Exposure Evaluation Report

Report No. : CQASZ20201200043EX-03
Applicant: Midmark RTLS Solutions, Inc.
Address of Applicant: 2600 Miller Creek Dr., Traverse City, MI 49684
Manufacturer: MOKO TECHNOLOGY LIMITED
Address of Manufacturer: 2F, Building1, No.37 Xiaxintang Xintang village, Fucheng Street, Longhua District, Shenzhen, Guangdong Province, China
Factory: MOKO TECHNOLOGY LIMITED
Address of Factory: 2F, Building1, No.37 Xiaxintang Xintang village, Fucheng Street, Longhua District, Shenzhen, Guangdong Province, China

Equipment Under Test (EUT):

Product: Plug-In BLE Sensor
Model No.: VER5800
Brand Name: N/A
FCC ID: OGUVER5800
Standards: 47 CFR Part 1.1307
47 CFR Part 1.1310
KDB447498D01 General RF Exposure Guidance v06

Date of Test: 2020-02-17 to 2020-02-28

Date of Issue: 2020-12-11

Test Result : PASS*

Tested By:

Tom Chen

(Tom chen)

Reviewed By:

Aaron Ma

(Aaron Ma)

Approved By:

Jack Ai

(Jack Ai)



* In the configuration tested, the EUT complied with the standards specified above.

The test report is effective only with both signature and specialized stamp, The result(s) shown in this report refer only to the sample(s) tested. Without written approval of CQA, this report can't be reproduced except in full.

1 Version

Revision History Of Report

Report No.	Version	Description	Issue Date
CQASZ20200200089E-03	Rev.01	Initial report	2020-03-02
CQASZ20201101383E-03	Rev.02	For specific changes, please refer to the note1	2020-11-20
CQASZ20201200043EX-03	Rev.03	For specific changes, please refer to the note2	2020-12-11

Note1:

	Before change	After change
Item number	CQASZ20200200089E-03	CQASZ20201101383E-03
Applicant:	MOKO TECHNOLOGY LIMITED	Royal Hydroponics LLC
Address of Applicant:	2F, Building1, No.37 Xiixintang Xintang village, Fucheng Street, Longhua District, Shenzhen, Guangdong Province, China	121 Leavitt Road Suite 148 Amherst, OH 44001
EUT Name:	Bluetooth Gateway Plug Mini	HydroMesh Smart Plug
Model No.	MK110	HSP110
Brand Name:	N/A	by Royal Hydroponics

Note2:

	Before change	After change
Item number	CQASZ20201101383E-03	CQASZ20201200043EX-03
Applicant:	Royal Hydroponics LLC	Midmark RTLS Solutions, Inc.
Address of Applicant:	121 Leavitt Road Suite 148 Amherst, OH 44001	2600 Miller Creek Dr., Traverse City, MI 49684
EUT Name:	HydroMesh Smart Plug	Plug-In BLE Sensor
Model No.	HSP110	VER5800
Brand Name:	by Royal Hydroponics	N/A

This test report (Ref. No.: CQASZ20201200043EX-03) All test data comes from source test reports (Ref. No.: CQASZ20200200089E-03). Only on the basis of the original report change Applicant and Address of Applicant. The tested samples have not been changed, it's just a different model name.

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3 General Information

3.1 Client Information

Applicant:	Midmark RTLS Solutions, Inc.
Address of Applicant:	2600 Miller Creek Dr., Traverse City, MI 49684
Manufacturer:	MOKO TECHNOLOGY LIMITED
Address of Manufacturer:	2F, Building1, No.37 Xiaxintang Xintang village, Fucheng Street, Longhua District, Shenzhen, Guangdong Province, China

3.2 General Description of EUT

Product Name:	Plug-In BLE Sensor					
Model No.:	VER5800					
Trade Mark:	N/A					
Type of Modulation:	IEEE 802.11b mode: DSSS(CCK,QPSK, BPSK) IEEE 802.11g mode: OFDM (BPSK/QPSK/16QAM/64QAM) IEEE 802.11n HT20 MHz mode: OFDM (BPSK/QPSK/16QAM/64QAM) IEEE 802.11n HT40 MHz mode: OFDM (BPSK/QPSK/16QAM/64QAM) BLE(GFSK)					
Channel Spacing:	IEEE 802.11b/g/n(HT20):20MHz IEEE 802.11n(HT40):40MHz BLE:2MHz					
Operation Frequency:	IEEE 802.11b;IEEE 802.11g;IEEE 802.11n HT20					
	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
	1	2412	6	2437	11	2462
	2	2417	7	2442		
	3	2422	8	2447		
	4	2427	9	2452		
	5	2432	10	2457		
	IEEE 802.11n HT40					
	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
	1	2422	4	2437	7	2452
	2	2427	5	2442		
	3	2432	6	2447		
	BLE					

	<table><tr><th>Channel No .</th><th>Frequency (MHz)</th><th>Channel No .</th><th>Frequency (MHz)</th></tr><tr><td>1</td><td>2402</td><td>2</td><td>2404</td></tr><tr><td>3</td><td>2406</td><td>4</td><td>2408</td></tr><tr><td>5</td><td>2410</td><td>6</td><td>2412</td></tr><tr><td>7</td><td>2414</td><td>8</td><td>2416</td></tr><tr><td>9</td><td>2418</td><td>10</td><td>2420</td></tr><tr><td>11</td><td>2422</td><td>12</td><td>2424</td></tr><tr><td>13</td><td>2426</td><td>14</td><td>2428</td></tr><tr><td>15</td><td>2430</td><td>16</td><td>2432</td></tr><tr><td>17</td><td>2434</td><td>18</td><td>2436</td></tr><tr><td>19</td><td>2438</td><td>20</td><td>2440</td></tr><tr><td>21</td><td>2442</td><td>22</td><td>2444</td></tr><tr><td>23</td><td>2446</td><td>24</td><td>2448</td></tr><tr><td>25</td><td>2450</td><td>26</td><td>2452</td></tr><tr><td>27</td><td>2454</td><td>28</td><td>2456</td></tr><tr><td>29</td><td>2458</td><td>30</td><td>2460</td></tr><tr><td>31</td><td>2462</td><td>32</td><td>2464</td></tr><tr><td>33</td><td>2466</td><td>34</td><td>2468</td></tr><tr><td>35</td><td>2470</td><td>36</td><td>2472</td></tr><tr><td>37</td><td>2474</td><td>38</td><td>2476</td></tr><tr><td>39</td><td>2478</td><td>40</td><td>2480</td></tr></table>	Channel No .	Frequency (MHz)	Channel No .	Frequency (MHz)	1	2402	2	2404	3	2406	4	2408	5	2410	6	2412	7	2414	8	2416	9	2418	10	2420	11	2422	12	2424	13	2426	14	2428	15	2430	16	2432	17	2434	18	2436	19	2438	20	2440	21	2442	22	2444	23	2446	24	2448	25	2450	26	2452	27	2454	28	2456	29	2458	30	2460	31	2462	32	2464	33	2466	34	2468	35	2470	36	2472	37	2474	38	2476	39	2478	40	2480
	Channel No .	Frequency (MHz)	Channel No .	Frequency (MHz)																																																																																	
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37	2474	38	2476																																																																																		
39	2478	40	2480																																																																																		
Antenna Type:	PCB antenna																																																																																				
Antenna:	0 dBi gain																																																																																				
Power Supply:	AC 120V/60Hz																																																																																				

4 SAR Evaluation

4.1 RF Exposure Compliance Requirement

4.1.1 Limits

According to FCC Part1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in part1.1307(b)

TABLE 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)
(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

Friis Formula

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

π = 3.1416

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

P_d is the limit of MPE, 1 mW/cm². If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

4.1.2 Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

4.1.3 EUT RF Exposure

1) For BLE

Measurement Data

GFSK mode				
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2402MHz)	2.04	2.0±1	3	1.995
Middle(2440MHz)	3.01	3.0±1	4	2.512
Highest(2480MHz)	4.52	4.0±1	5	3.162

The worst case:

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
3.162	0	0.00063	1.0	PASS

Remark: The Max Conducted Peak Output Power data refer to report Report No.: CQASZ20201200043EX-02

2) For WIFI

Measurement Data

IEEE for 802.11b mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2412MHz)	13.72	13.5±1	14.5	28.184
Middle(2437MHz)	13.85	13.5±1	14.5	28.184
Highest(2462MHz)	13.16	13.5±1	14.5	28.184
IEEE for 802.11g mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2412MHz)	10.81	10.5±1	11.5	14.125
Middle(2437MHz)	10.12	10.5±1	11.5	14.125
Highest(2462MHz)	10.46	10.5±1	11.5	14.125
IEEE for 802.11n(HT20) mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2412MHz)	9.63	10.0±1	11	12.589
Middle(2437MHz)	9.83	10.0±1	11	12.589
Highest(2462MHz)	9.76	10.0±1	11	12.589
IEEE for 802.11n(HT40) mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2422MHz)	6.71	7.0±1	8	6.310
Middle(2437MHz)	7.42	7.0±1	8	6.310
Highest(2452MHz)	7.60	7.0±1	8	6.310

The worst case:

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
28.184	0	0.006	1.0	PASS

Remark:

The Max Conducted Average Output Power data refer to report Report No.:CQASZ20201200043EX-01

WIFI and BLE can not simultaneous transmitting at same time.