



RF Exposure Evaluation Report

FOR

Manufacturer:
HAP Innovations

Model Number:
sp.01

FCC ID: 2AIA7-SPN01

FCC CFR 47 Part 1.1307, 1.1310, 2.1091

TEST REPORT #: EMC_HAPIN-001-16501_FCC_MPE_rev3
DATE: 2016-09-01



IC recognized #
3462B-1

CETECOM Inc.

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1 Assessment

The following equipment, as detailed in section 3 of this test report, meets the RF exposure limits and/or the conditions for exemption from routine evaluation as defined in the following standards.

Standard	Version
FCC CFR 47 Part 1.1310	Current as of 2016-08-01
FCC CFR 47 Part 2.1091	Current as of 2016-08-01
FCC KDB 447498	v05r02
OET Bulletin 65	Edition 97-01, August 1997

Responsible for Testing Laboratory:

2016-09-01 Compliance Franz Engert
 (Compliance Manager)

Date	Section	Name	Signature
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Responsible for the Report:

2016-09-01 Compliance Douglas Antioco
 (EMC Engineer)

Date	Section	Name	Signature
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The test results of this test report relate exclusively to the test item specified in Section 3. CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the Test Report

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Manager Compliance Services:	Franz Engert
Project Engineer:	Douglas Antioco

2.2 Identification of the Client

Clients Name:	Device Solutions
Clients Address:	1004 Copeland Oaks Dr.
City/Zip Code	Morrisville, NC 27560
Country	USA

2.3 Identification of the Manufacturer

Manufacturer's Name:	HAP Innovations
Manufacturers Address:	4220 Apex Highway, Suite 200
City/Zip Code	Durham, NC 27713
Country	USA

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Model Number	sp.01
Hardware Version	1.0
Software Version	1.0
FCC ID	2AIA7-SPN01
Technical Product Description	<p>The HAP Innovations spencer™ is a smart in-home medication dispenser. It is designed to provide machine-to-machine (M2M) connectivity via the 4G LTE wireless network. The device communicates periodically with back-end servers for status/usage information, and on demand for audio/video interaction between patients and providers.</p> <p>For situations where LTE services are not available, the device will connect over an 802.11a/b/g/n wireless LAN. In addition, the device provides short-range RF connectivity to Bluetooth and Bluetooth Smart products, such as home health monitors.</p> <p>The device includes a touchscreen display, camera, speakers, and microphone for the user interface, and integrated cameras and motors for tracking and dispensing the medication.</p>
Radios Included	802.11b/g/n BTLE 4.0 Bluetooth EDR/BDR LTE (Band 4 and 13)
Module Information:	<p>LTE Module Manufacturer: Gemalto M2M GmbH Module: Cinterion ELS31-V FCC-ID: QIPELS31-V</p> <p>802.11b/g/n/BT 4.0 (LE)/ Bluetooth EDR/BDR Module Manufacturer: TI Module: WL1835MOD FCC-ID: Z64-WL18SBMOD</p>
Antenna Information	<p>Internal antennas Documented max antenna gains: 802.11b/g/n/BT 4.0 (LE)/Bluetooth EDR/BDR (2.4GHz Band) = 3.6 dBi LTE Band 4 = 4 dBi LTE Band 13 = 1.5 dBi</p>
Co-located Transmitters/ Antennas	<p>LTE & 802.11b/g/n LTE & BT EDR/BDR LTE & BT 4.0 (LE)</p>
Rated Operating Voltage Range	Vmin: 11.5V dc / Vnom: 12.0V dc / Vmax: 16.8V dc
Rated Operating Temperature Range	Tlow: 5° C / Tnom: 25° C / Tmax: 40° C
Prototype / Production Unit	Prototype
Device Category	<input type="checkbox"/> Fixed Installation <input checked="" type="checkbox"/> Mobile <input type="checkbox"/> Portable
Exposure Category	<input type="checkbox"/> Occupational/ Controlled <input checked="" type="checkbox"/> General Population/ Uncontrolled

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3.2 Identification of the Equipment Under Test (EUT)

EUT #	Serial Number	HW Version	SW Version	Note
1	010C0319160300002E	1.0	1.0	Radiated Sample

3.3 Identification of Accessory Equipment

AE #	Type	Serial Number	HW Version	SW Version	Note
1	N/A	N/A	N/A	N/A	N/A

4 RF Exposure Evaluation Requirements

4.1 FCC:

Calculations can be made to predict RF field strength and power density levels around typical RF sources using the general equations (3) and (4) on page 19 of the following FCC document:

“OET Bulletin 65, Edition 97-01 - Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields”.

The table below is excerpted from Table 1B of CFR 47 1.1310 titled Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure:

Frequency Range (MHz)	E-field strength (V/m)	H-field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
300 – 1500	---	---	f (MHz) /1500	30
1500 – 100.000	---	---	1.0	30

* Plane-wave equivalent power density

Using the equation from page 19 of OET Bulletin 65, Edition 97-01:

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

where: S = power density (in appropriate units, e.g. mW/cm²)

P = power input to the antenna (in appropriate units, e.g., mW)

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

Additionally, according to § 2.1091:

The limit for <1.5 GHz mobile operations where no routine evaluation is required is: 1.5W ERP

The limit for >1.5 GHz mobile operations where no routine evaluation is required is: 3W ERP

Note:

1. This device is to be used only for fixed and mobile applications.
2. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons.

5 Measurement Summary

5.1 Analysis to Exclude Routine RF Exposure Evaluation for Stand Alone Operation

Radiated power is calculated as

Maximum EIRP (dBm) = Maximum average output power (including tune-up tolerance) (dBm) + Antenna Gain (dBi)

Time-Averaged EIRP (dBm) = Maximum EIRP (dBm) + 10 * log (Maximum Duty Cycle)

Time-Averaged ERP (dBm) = Time-Averaged EIRP (dBm) – 2.15

Tune-up tolerance is taken from:

LTE Module (FCC ID: QIPELS31-V)

Tune up tolerance was taken from the document provided by the module manufacturer Gemalto "Tune-up Procedure of Cinterion Wireless Module ELS31-V" dated November 13, 2015.

802.11 b/g/n, BT EDR/BDR, BT 4.0 (LE) Module (FCC ID: Z64-WL18SBMOD)

Tune up tolerance was taken from the document provided by the Client, Device Solutions "More_WiFi_Tune_up" dated August 29, 2016.

Antenna gain is taken from the manufacturer's written declaration (Gain values noted in Section 3.1).

Analysis to Exclude Routine RF Exposure Evaluation for Stand Alone Operation							
Band of Operation	Max Duty Cycle	Maximum EIRP	Time-Averaged EIRP		Time- Averaged ERP		FCC Limit
MHz	%	dBm	dBm	W	dBm	W	W
LTE Band 4 1710 to 1755	100	27.5	27.5	0.562	N/A	N/A	3
LTE Band 13 777 to 787	100	25.0	N/A	N/A	22.85	0.193	1.5
802.11 b/g/n 2400 to 2483.5	100	23.4	23.4	0.219	N/A	N/A	3
BT EDR/BDR 2400 to 2483.5	100	17.8	17.8	0.060	N/A	N/A	3
BT 4.0 (LE) 2400 to 2483.5	100	13.1	13.1	0.020	N/A	N/A	3

5.2 Compliance with MPE (Power Density) limits for simultaneous transmitter operation

The combination of radios that can simultaneously transmit are:

LTE & 802.11b/g/n
 LTE & BT EDR/BDR
 LTE & BT 4.0 (LE)

Power Density Calculation for a distance between the transmitter and the human body of 20cm						
Band of Operation (MHz) A	Power Density @ 20cm (mW/cm ²) B	FCC Limit worst case (mW/cm ²) C	Single transmitter MPE ratio D	simultaneous transmitter MPE ratio for the radio in column one combined with worst case radio E	FCC Limit (ratio) F	Verdict
LTE Band 4	0.112	1	0.112	0.156	1.00	Pass
LTE Band 13	0.063	0.518	0.121	0.165	1.00	Pass
802.11b/g/n	0.044	1	0.044	0.165	1.00	Pass
BT EDR/BDR	0.012	1	0.012	0.133	1.00	Pass
BT 4.0 (LE)	0.004	1	0.004	0.125	1.00	Pass

Note: The simultaneous transmission in Column 5 (E) has been calculated as:

$$E = (D_{\text{LTE Band 13}}) + D_{\text{2.4GHz Technology}}$$

or

$$E = (D_{\text{802.11b/g/n}}) + D_{\text{LTE Band}}$$

Simultaneous Transmitter MPE Ratio Matrix

	802.11b/g/n	BT EDR/BDR	BT 4.0 (LE)
LTE Band 4	0.156	0.124	0.116
LTE Band 13	0.165	0.133	0.125

FCC Limit= 1

Conclusion:

- The equipment fulfills the FCC limits for the minimum distance between the antennas of the 2 active transmitters and the human body of 20 cm and more.

6 Revision History

Date	Report Number – Changes to Report	Report prepared by
2016-08-01	1. EMC_HAPIN-001-16501_FCC_MPE a. First Version	Douglas Antioco
2016-08-18	1. EMC_HAPIN-001-16501_FCC_MPE_rev1 a. Second Version b. Updated Power values and identified sources in section 5.1	Douglas Antioco
2016-08-30	1. EMC_HAPIN-001-16501_FCC_MPE_rev2 a. Third Version b. Replaces Previous Versions c. Updated Power values and identified sources in section 5.1	Douglas Antioco
2016-09-01	1. EMC_HAPIN-001-16501_FCC_MPE_rev3 a. Fourth Version b. Replaces Previous Versions c. Added Simultaneous Transmitter MPE Ratio Matrix in section 5.2	Douglas Antioco