

EMC Test Report

Project Number: 3161200

Report Number: 3161200EMC01 **Revision Level:** 2

Client: Aethon

Equipment Under Test: Autonomous Robot Remote door opener

Model Number: 29311203

Applicable Standards: § 15.231 Periodic operation in the band 40.66-40.7 MHz and above 70 MHz

ANSI C63.10: 2009

RSS 210 Issue 8

Report issued on: 20JAN2014

Test Result: Compliant

Tested by:



Brian Forster, EMC Engineer

Reviewed by:



David Schramm, EMC Manager

Remarks:

This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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1 Summary of Test Results

Test Description	Test Specification	Test Result
Field strength of fundamental	15.231(b) RSS 210, A2.9 (1)	Compliant
Field strength of spurious radiation	15.231 (b)(3) and 15.209 RSS 210 2.6, A2.9 (1)(2)	Compliant
20 dB bandwidth	15.231(c)	Compliant
99% Occupied bandwidth	RSS GEN 4.4.1	Report data only
Duty Cycle	--	Report data only

2 General Information

2.1 Client Information

Name: Aethon, Inc.
Address: 100 Business Center Drive
City, State, Zip, Country: Pittsburgh, PA 15205

2.2 Test Laboratory

Name: SGS North America, Inc.
Address: 620 Old Peachtree Road NW, Suite 100
City, State, Zip, Country: Suwanee, GA 30024, USA

2.3 General Information of EUT

Model Name: 29311203
Serial Number: AX2-041713-0827
Hardware Version: 4.13
Software Version: 7.5.5
Frequency Range: 418MHz
Antennas: ANT-418-CW-QW
Rated Voltage: 24.2V DC
Test Voltage: 24.2V DC

Sample Received Date: 17 MAY 2013
Dates of testing: 01-20 SEP 2013

2.4 Operating Modes and Conditions

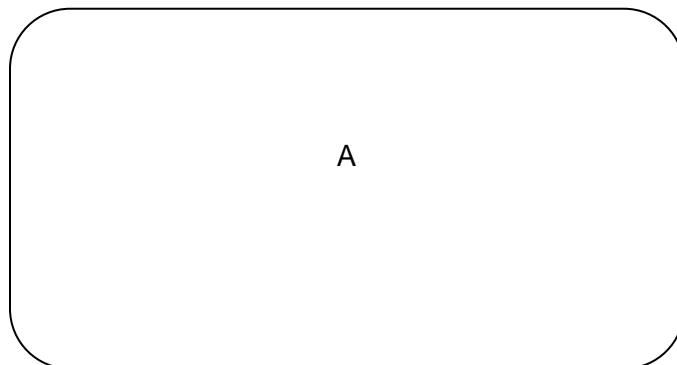
The EUT was configured in software to allow the EUT to transmit test data in a continuous mode.

2.5 Modification(s) required for compliance.

The EUT was modified to reduce output power using a 1.2kΩ resistor (connected to pin 1-“LADJ” of the 418MHz IC device) for R244 on the main board. The peak output power of the unit with the original component in place was 0dBm.

The Field Strength of Fundamental values are reported with this modification in place. Other measurements which did not rely on the absolute power out were made with the original 560Ω in place for R244. Spurious Emissions measurements were made with the 680Ω Resistor installed and reflect spurious emissions approximately 11dB higher than the compliant output power configuration.

2.6 EUT Connection Block Diagram



2.7 System Configurations

Device reference	Manufacturer	Description	Model Number	Serial Number
A	Aethon	Autonomous Robot	29311203	AX2-041713-0827

2.8 Cable List

Cable reference	Port Name	Start	End	Cable Length (m)	Ferrite installed?	Shielded?
--	--	--	--	--	--	--

3 Field Strength of Fundamental

3.1 Test Result

Test Description	Test Specification	Test Result
Field strength of fundamental	15.231(b) RSS 210, A2.9 (1)	Compliant

3.2 Test Method

The test data was measured using a Peak detector. Average measurements were made by correcting the peak value with the duty cycle correction factor. The receiver resolution bandwidth was set to 120 kHz for measurements taken in the 30MHz to 1GHz frequency range and 1MHz for measurements for 1GHz and higher. Measurements were made with the antenna positioned in both the horizontal and vertical planes of polarization. The antenna height was varied from 1 m to 4 m at a distance and the EUT was rotated 360° to find the maximum emitting point for each frequency. The radiated measurements were recorded and compared to the limits indicated in the table below.

Fundamental Frequency	Average Limits			Peak Limits dBuV/m
	Millivolts/meter	Microvolts/m	dBuV/m	
418 MHz	10.3	10333	80.3	100.3

3.3 Test Site

10m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions

Temperature: 24.5°C
Relative Humidity: 47.3 %
Atmospheric Pressure: 97.8 kPa

3.4 Test Equipment

Test Start Date: 9/19/2013

Tested By: BKF

Test End Date: 9/19/2013

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Bilog Antenna	JB6	Sunol	B079689	22-Aug-14
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079661	6-Aug-14
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079713	7-Aug-14
Coaxial Cable	Sucoflex 106	Huber+Suhner	B085892	23-Oct-13
EMI Test Receiver	ESU40	R&S	B079629	24-Sep-13

3.5 Test Setup Photographs

Test setup photographs are located in a separate exhibit.

3.6 **Test Data**

Test Data

Frequency MHz	Peak Field Strength dB μ V	Duty Cycle Correction Factor	Calculated Average dB μ V	Average Limit dB μ V	Margin dB
418.00	84.0	-6.5	77.6	80.285	-2.7

4 Field Strength of Spurious Radiation

4.1 Test Result

Test Description	Test Specification	Test Result
Field strength of spurious radiation	15.231 (b) and 15.205 RSS 210 2.6, A2.9 (1)(2)	Compliant

4.2 Test Method

Spurious Emissions measurements were made with the 680Ω Resistor installed and reflect spurious emissions approximately 11dB higher than the compliant output power configuration.

The initial preliminary exploratory scans were performed over the frequency range as indicated in the tables below using the max hold function and incorporating a Peak detector and using TILE! software. The final test data was measured using a Peak detector. For harmonics of the fundamental, Average measurements were made by correcting the peak value with the duty cycle correction factor. For emissions other than harmonics of the fundamental, the Average measurements were made using the Average detector. The receivers resolution bandwidth was set to 120 kHz for measurements taken in the 30MHz to 1GHz frequency range and 1MHz for measurements for 1GHz and higher. Measurements were made with the antenna positioned in both the horizontal and vertical planes of polarization. The antenna height was varied from 1 m to 4 m at a distance of 3 meters and the EUT was rotated 360° to find the maximum emitting point for each frequency. The radiated measurements were recorded and compared to the limits indicated in the table below.

Frequency (MHz)	Limits ²		Peak Limits dBuV/m
	Microvolts/m	dBuV/m	
40.66-40.7	225	47	--
70-130	125	42	--
130-174	125-375 ¹	42-51.5	--
174-260	375	51.5	--
260-470	375-1250 ¹	51.5-62	--
470 - 960	1250	62	
Above 960 ³	1250	62	82

(1) Linear Interpolation

(2) Spurious emission shall meet the limits in 15.231(b) or the general limits of 15.209; whichever permits a higher field strength.

(3) Average limits instead of quasi-peak

4.3 **Test Site**

10m Absorber Lined Shielded Enclosure (ALSE), Suwanee, GA

Environmental Conditions

Temperature: 24.5°C
Relative Humidity: 47.3 %
Atmospheric Pressure: 97.8 kPa

4.4 **Test Equipment**

Test Start Date: 9/19/2013

Tested By: BKF

Test End Date: 9/19/2013

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Bilog Antenna	JB6	Sunol	B079689	22-Aug-14
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Coaxial Cable	Sucoflex 106	Huber+Suhner	B085892	23-Oct-13
EMI Test Receiver	ESU40	R&S	B079629	24-Sep-13

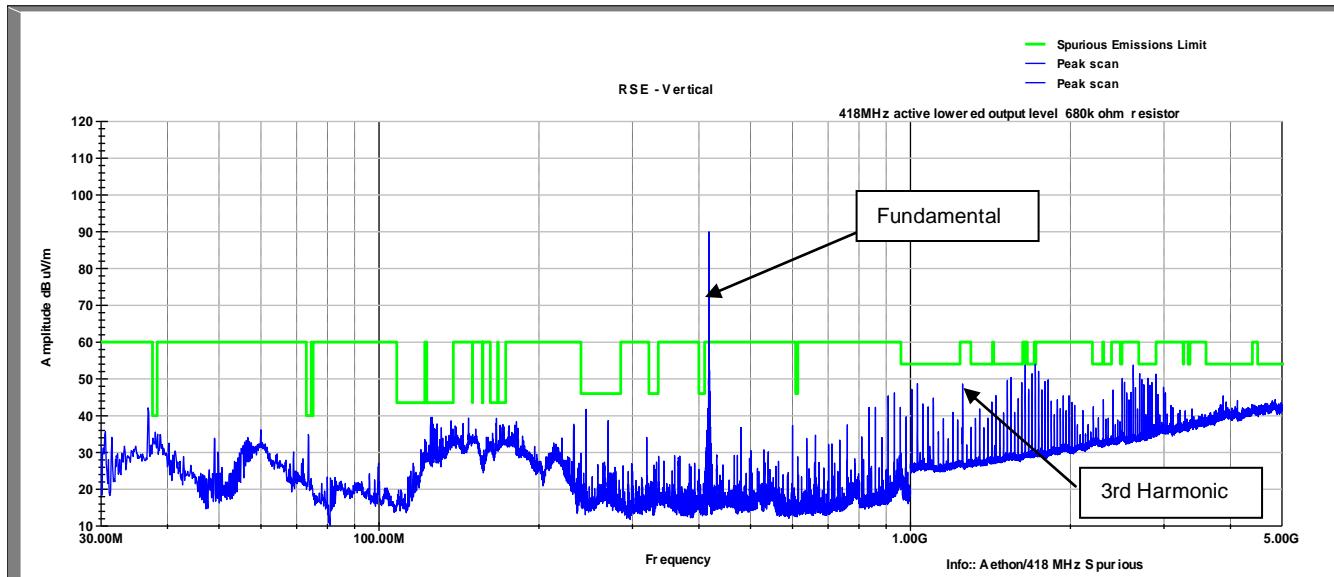
Note: The calibration period equipment is 1 year.

4.5 **Test Setup Photographs**

Test setup photographs are located in a separate exhibit.

4.6 Test Data

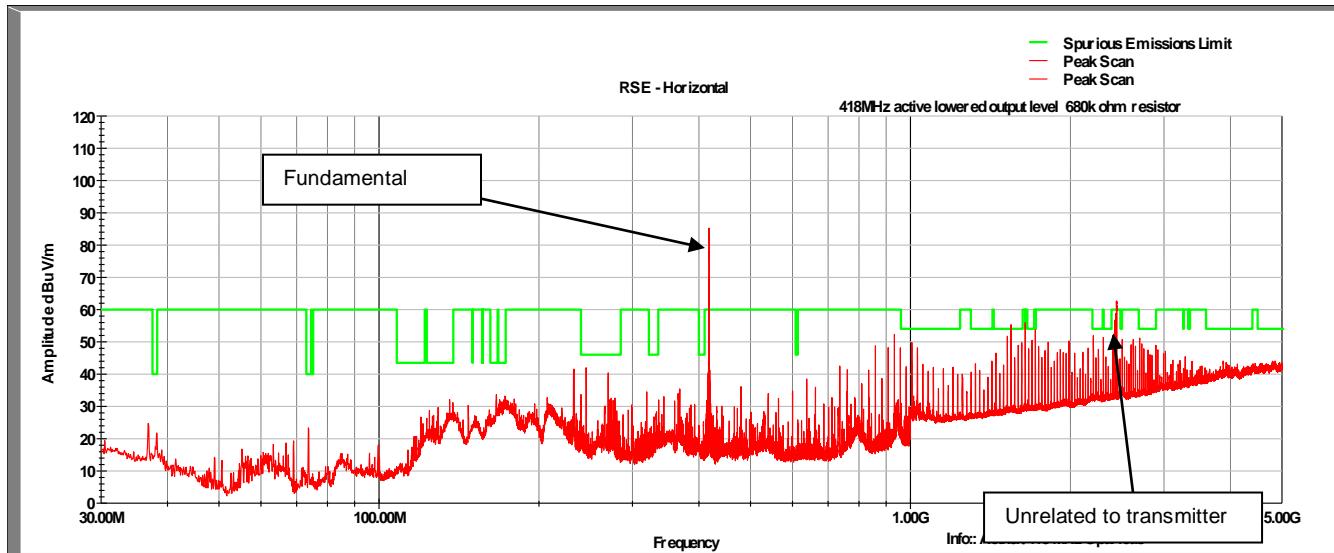
Test Data Vertical



Note: No intentional radiator peak emissions above the average/QP limits. Emissions other than the intentional radiator are produced by test power supply, not incorporated in final product.

Frequency MHz	Field Strength dB μ V	Limit dB μ V	Margin dB
1254.00	48.6	60.000	-11.4

Horizontal



Note: No intentional radiator peak emissions above the average/QP limits. Emissions other than the intentional radiator are produced by test power supply, not incorporated in final product.

5 20 dB Bandwidth

5.1 Test Result

Test Description	Basic Standards	Test Result
20 dB bandwidth	15.231(c)	Compliant

5.2 Test Method

The procedures from ANSI C63.10 (2009) clause 6.9 were used to determine the 20 dB bandwidth.

The limit on the bandwidth of the emission is <0.<.25% of the center frequency for devices operating above 70 MHz and below 900MHz

$BW_{limit} : .0025 * 418 \text{ MHz} = 1.045 \text{ MHz}$

The measured BW is 8.804 kHz

5.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24..5°C

Relative Humidity: 47.3 %

Atmospheric Pressure: 97.8 kPa

5.4 Test Equipment

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Receiver	ESU40	R & S	B079629	24 SEP 2013
Coaxial Cable	--	--	B092135	17JUL2014

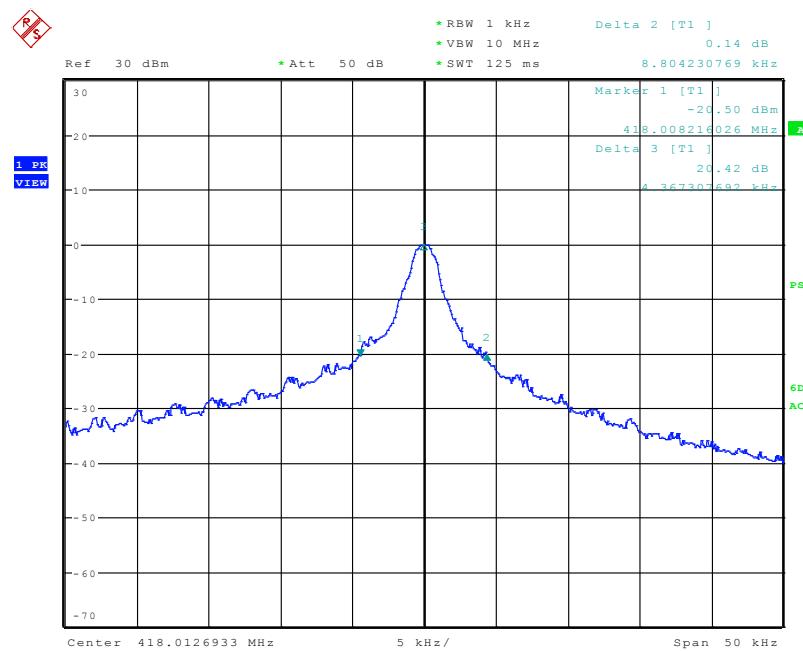
Note: The calibration period equipment is 1 year.

5.5 Test Setup Photographs

Test setup photographs are located in a separate exhibit.

5.6 Test Data

20 dB Bandwidth Plot



Date: 10.SEP.2013 10:53:30

6 99% Bandwidth

6.1 Test Result

Test Description	Basic Standards	Test Result
99% Occupied bandwidth	RSS GEN 4.4.1	Report data only

6.2 Test Method

The 99% bandwidth function of the receiver was used.

6.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24..5°C

Relative Humidity: 47.3 %

Atmospheric Pressure: 97.8 kPa

6.4 Test Equipment

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Receiver	ESU40	R & S	B079629	24 SEP 2013
Coaxial Cable	--	--	B092135	17JUL2014

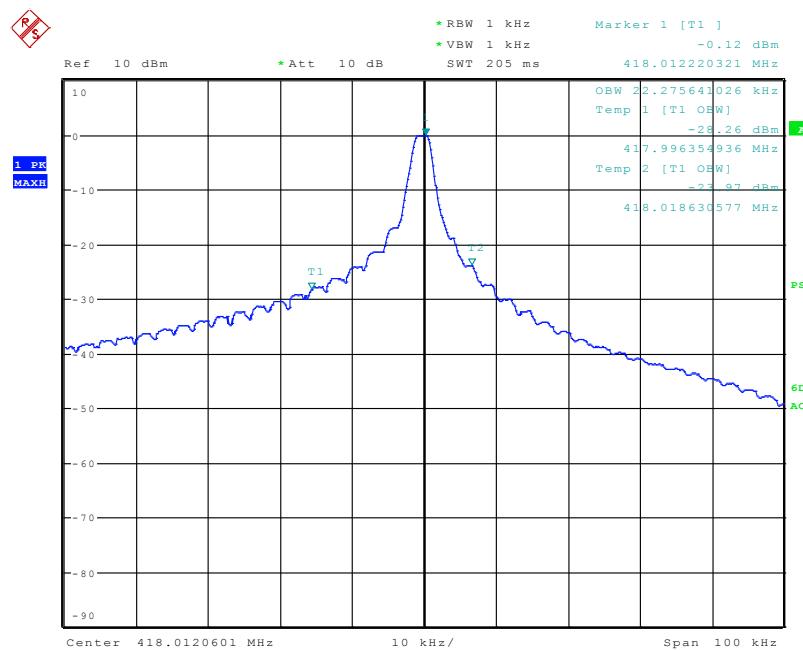
Note: The calibration period equipment is 1 year.

6.5 Test Setup Photographs

Test setup photographs are located in a separate exhibit.

6.6 Test Data

99% Bandwidth Plot



7 Duty Cycle

7.1 Test Result

Test Description	Basic Standards	Test Result
Duty Cycle	--	--

7.2 Test Method

Clause 7.5 of ANSI C63.10 (2009) was used.
The duty cycle was determined to be 47.41%

7.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24..5°C
Relative Humidity: 47.3 %
Atmospheric Pressure: 97.8 kPa

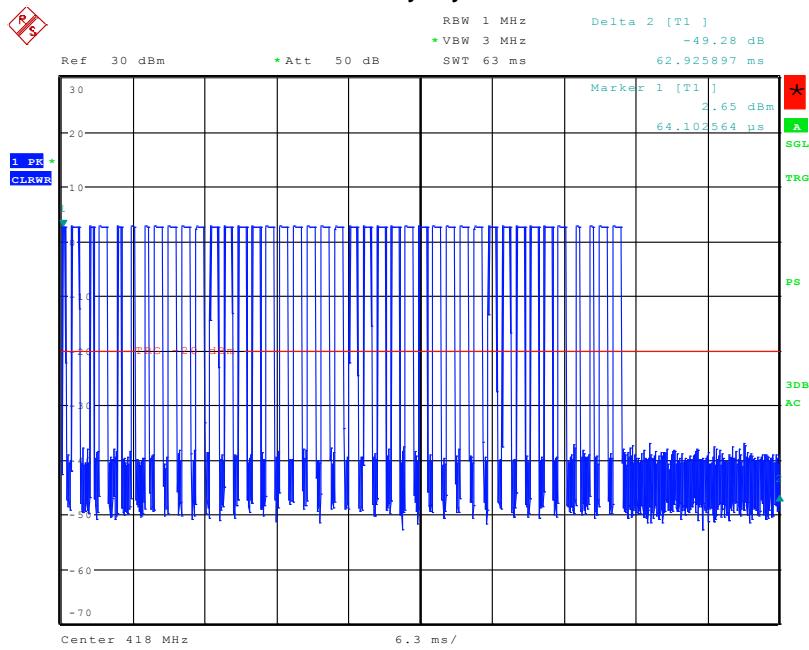
7.4 Test Equipment

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Receiver	ESU40	R & S	B079629	24 SEP 2013
Coaxial Cable	--	--	B092135	17JUL2014

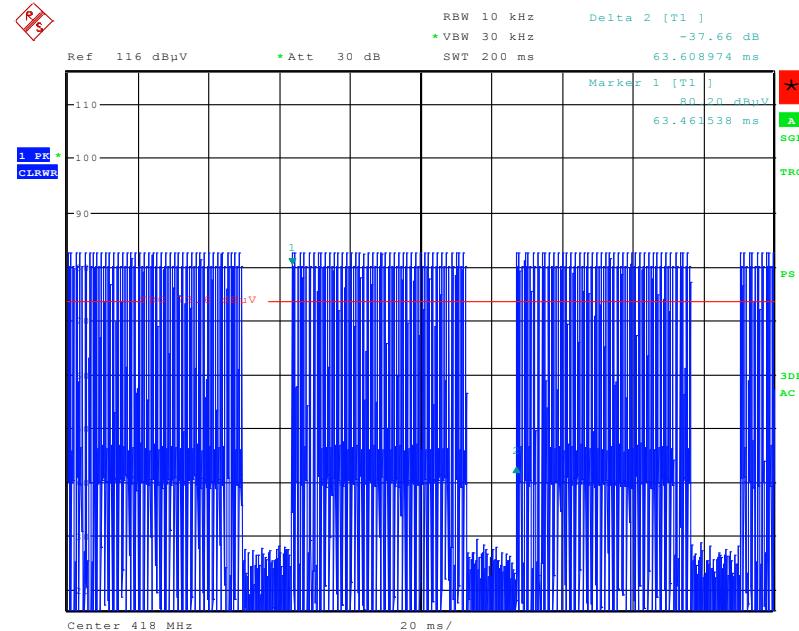
Note: The calibration period equipment is 1 year.

7.5 Test Data

Duty Cycle Data



Date: 10.SEP.2013 10:26:00



Date: 18.OCT.2013 16:41:05

8 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	18 OCT 2013
1	Updated model number	10JAN2014
2	Updated Spurious emissions plots clarified test methods wrt test distance	20JAN2014