



**DATE: 23 July 2013**

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

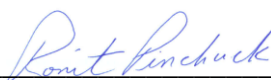
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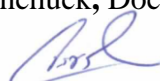
**AeroScout Ltd.**

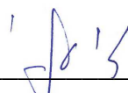
**Equipment under test:**

**Wi-Fi HUGS Tag**

**TAG-HGS-1000**

Written by:   
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Approved by:   
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Approved by:   
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This report relates only to items tested.



## Measurement/Technical Report for AeroScout Ltd.

Wi-Fi HUGS Tag

TAG-HGS-1000

**FCC ID: Q3HTAGHGS1000**

**IC: 5115A-TAGHGS1000**

23 July 2013

This report concerns:

Original Grant: X

Class I Change:

Class II Change:

Equipment type:

Spread Spectrum/Digital Device  
2400-2483.5 MH

Limits used:

47CFR15 Section 15.247

Measurement procedure used is ANSI C63.4-2003.

Application for Certification

prepared by:

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# 1. General Information

## 1.1 Administrative Information

Manufacturer:	AeroScout Ltd.
Manufacturer's Address:	3 Pekeris St. Einstein Entrance 4 <sup>th</sup> Floor Rehovot 76702 Tel: +972-8-9369393 Fax: +972-8-9365977
Manufacturer's Representative:	Dadi Matza
Equipment Under Test (E.U.T):	Wi-Fi HUGS Tag
Equipment Model No.:	TAG-HGS-1000
Equipment Serial No.:	Not designated
Date of Receipt of E.U.T:	05.06.2013
Start of Test:	05.06.2013
End of Test:	09.06.2013
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Part 15, Subpart C RSS-210, Issue 8, 2010



## **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.), Registration No. 90715.
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-1350, R-1285.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025B-1.
6. TUV Product Services, England, ASLLAS No. 97201.

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 AeroScout TAG-HGS-1000 Tag is a key component of the AeroScout Visibility System. The TAG-HGS-1000 Tag is a small Wi-Fi and active RFID device that enables the wireless network infrastructure to locate assets not connected to a wireless network. The tag can be attached to people. This enables tagged items to be accurately located in real-time and in any environment for indoor locations such as hospital.

AeroScout TAG-HGS-1000 Tags contain on-board motion sensors. The motion sensor can be configured to trigger alerts. It also enables different transmission intervals for tags when they are stationary or in motion – which reduces unnecessary network traffic and conserves battery life.

### **1.4 Test Methodology**

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.

### **1.5 Test Facility**

The radiated emissions tests were performed at I.T.L.'s testing facility at Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing September 3, 2009).

I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

### **1.6 Measurement Uncertainty**

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):

± 5.2 dB

Note: See ITL Procedure No. PM 198.

## 2. System Test Configuration

### 2.1 *Justification*

Radiated emission screening was performed in 3 orthogonal orientations. The worst case orientation was the vertical position.

### 2.2 *EUT Exercise Software*

No special exercise software was used.

### 2.3 *Special Accessories*

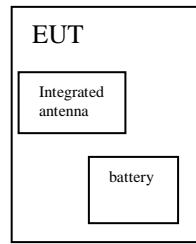
No special accessories were needed to achieve compliance.

### 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. Radiated Measurement Test Set-up Photo



Figure 2. Radiated Emission Test



Figure 3. Radiated Emission Test



**Figure 4. Radiated Emission Test**



**Figure 5. Radiated Emission Test**

## 4. 6 dB Minimum Bandwidth

### 4.1 Test procedure

The E.U.T operation mode and test set-up are as described in Section 3.

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

The E.U.T was tested at 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 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.

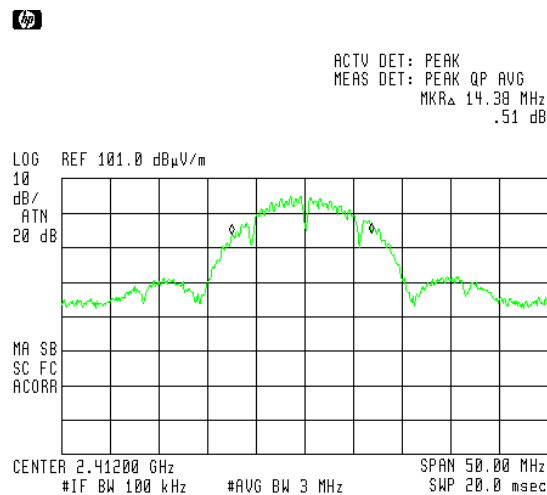


Figure 6 — Low Channel



ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR $\Delta$  9.88 MHz  
-.66 dB

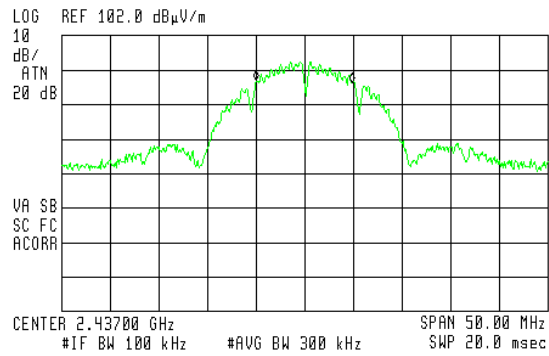


Figure 7 — Mid Channel



ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR $\Delta$  11.38 MHz  
-.32 dB

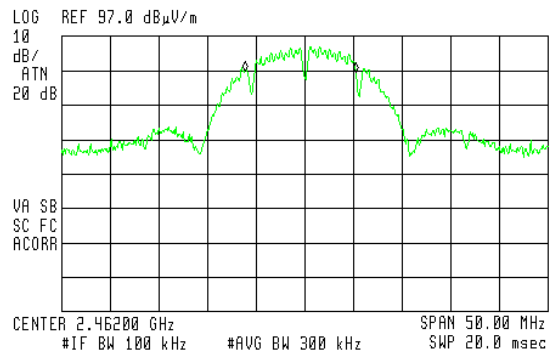


Figure 8 — High Channel

## 4.2 Results table

E.U.T Description: Wi-Fi HUGS Tag

Model No.: TAG-HGS-1000

Serial Number: Not designated


Specification: F.C.C. Part 15, Subpart C: (15.247-a2)

Operation Frequency (MHz)	Modulation Mbps	Reading (MHz)	Specification (MHz)
2412.00	6	14.38	0.5
2437.00	6	9.88	0.5
2462.00	6	11.38	0.5

**Figure 9 6 dB Minimum Bandwidth**

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 23.07.13

Typed/Printed Name: A. Sharabi

### 4.3 Test Equipment Used.

6 dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 Year
RF Filter Section	HP	85420E	3705A00248	February 26, 2013	1 Year
Antenna Biconical	EMCO	3104	2606	August 30, 2012	1 Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	1 Year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 Years
Horn Antenna	ARA	SWH-28	1007	January 26, 2011	3 Years
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	August 21, 2012	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 28, 2012	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 Year
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	1 Year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

Figure 10 Test Equipment Used

## 5. 26 dB Minimum Bandwidth

### 5.1 Test procedure

The E.U.T operation mode and test set-up are as described in Section 3.

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

The E.U.T was tested at 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 configuration tested is shown in *Figure 1*.

The spectrum bandwidth of the E.U.T. at the point of 26 dB below maximum peak power was measured and recorded.

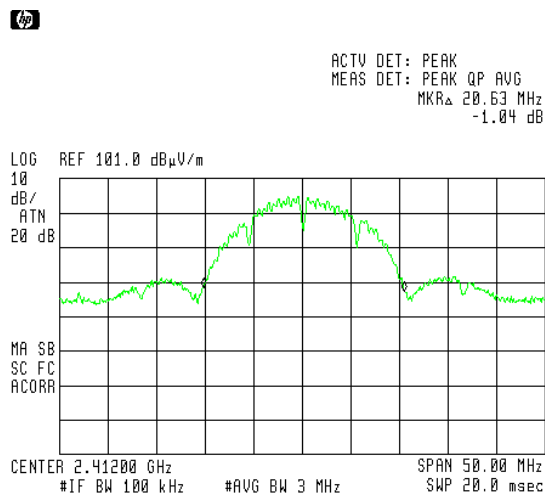


Figure 11 — Low Channel

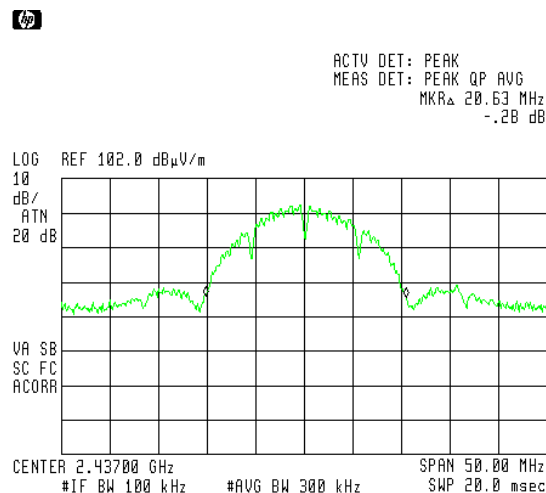


Figure 12 — Mid Channel





ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKRΔ 20.75 MHz  
-14 dB

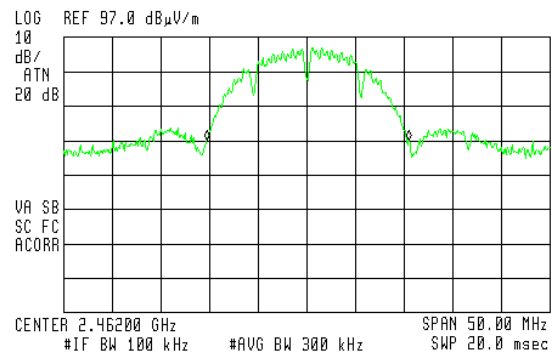


Figure 13 — High Channel

## 5.2 Results table

E.U.T Description: Wi-Fi HUGS Tag

Model No.: TAG-HGS-1000

Serial Number: Not designated

Specification: F.C.C. Part 15, Subpart C: (15.247-a2)

Operation Frequency (MHz)	Modulation  Mbps	Reading  (MHz)	Specification  (MHz)
2412.00	6	20.63	N/A
2437.00	6	20.63	N/A
2462.00	6	20.75	N/A

**Figure 14 26 dB Minimum Bandwidth**

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 23.07.13

Typed/Printed Name: A. Sharabi

### 5.3 Test Equipment Used.

#### 26 dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 Year
RF Filter Section	HP	85420E	3705A00248	February 26, 2013	1 Year
Antenna Biconical	EMCO	3104	2606	August 30, 2012	1 Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	1 Year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 Years
Horn Antenna	ARA	SWH-28	1007	January 26, 2011	3 Years
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	August 21, 2012	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 28, 2012	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 Year
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	1 Year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

Figure 15 Test Equipment Used

## 6. Maximum Transmitted Peak Power Output

### 6.1 Test procedure

The E.U.T operation mode and test set-up are as described in Section 3.

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

The E.U.T was tested at 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 configuration tested is shown in Figure 1.

The E.U.T. was tested at low, mid and high channels at 20MHz with the following modulations: BPSK (6Mbps).

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:

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

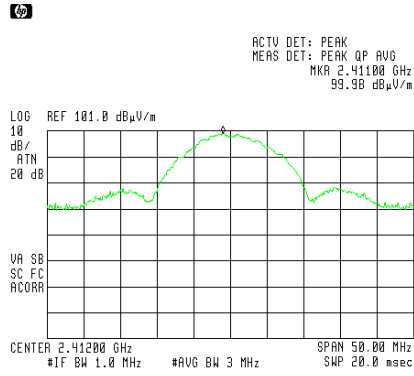


Figure 16 , Low channel

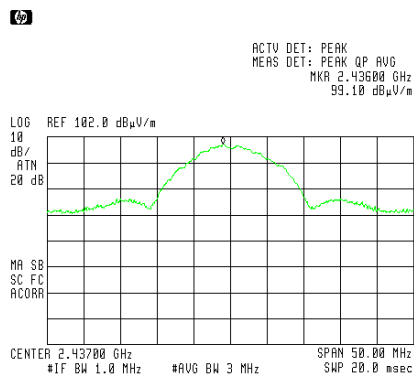


Figure 17, Mid channel

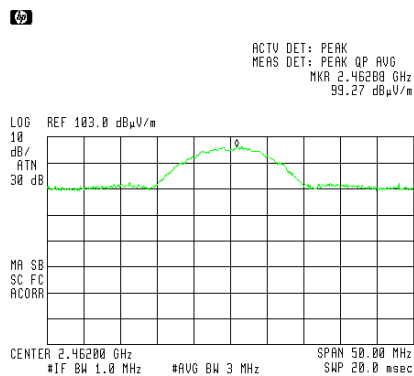


Figure 18 , High Channel



## 6.2 Results table

E.U.T. Description: Wi-Fi HUGS Tag

Model No.: TAG-HGS-1000

Serial Number: Not designated


Specification: F.C.C. Part 15, Subpart C Section 15.247(b)

Operation Frequency (MHz)	Modulation Mbps	Power (dBuV/m)	Power (mW)	Specification (mW)	Margin (dB)
2412.00	6	99.98	3.0	1000	-997.0
2437.00	6	99.10	2.4	1000	-997.6
2462.00	6	99.27	2.4	1000	-997.6

**Figure 19 Maximum Peak Power Output**

JUDGEMENT: Passed by 997.0 dB

TEST PERSONNEL:

Tester Signature: 

Date: 23 07.13

Typed/Printed Name: A. Sharabi

### 6.3 Test Equipment Used.

#### Peak Power Output

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 Year
RF Filter Section	HP	85420E	3705A00248	February 26, 2013	1 Year
Antenna Biconical	EMCO	3104	2606	August 30, 2012	1 Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	1 Year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 Years
Horn Antenna	ARA	SWH-28	1007	January 26, 2011	3 Years
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	August 21, 2012	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 28, 2012	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 Year
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	1 Year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

**Figure 20 Test Equipment Used**

## 7. Band Edge Spectrum

[In Accordance with section 15.247(c)]

### 7.1 Test procedure

The E.U.T operation mode and test set-up are as described in Section 3.

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

The E.U.T was tested at 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 configuration tested is shown in Figure 1.

The E.U.T. was tested at low, mid and high channels at 20MHz with the following modulations: BPSK (6Mbps).

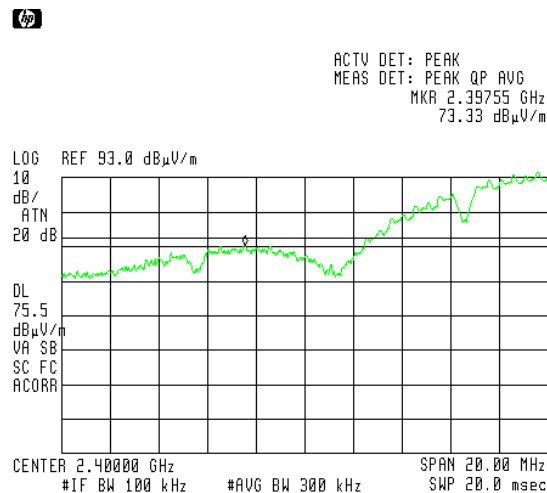


Figure 21 —Lower Band Edge



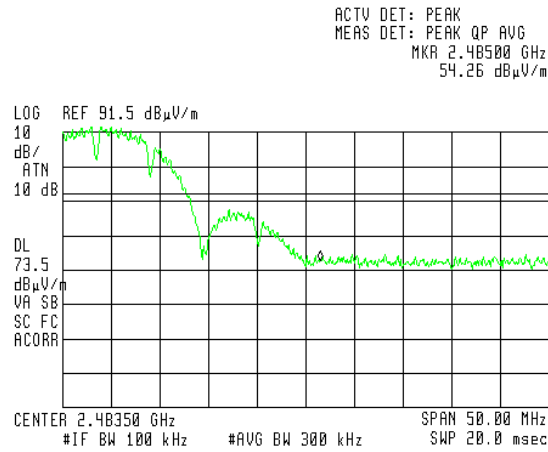


Figure 22 —Upper Band Edge

## 7.2 Results table

E.U.T. Description: Wi-Fi HUGS Tag  
Model No.: TAG-HGS-1000  
Serial Number: Not designated  
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Modulation Mbps	Band Edge Frequency (MHz)	Spectrum Level (dBc)	Specification (dBc)	Margin (dB)
2412	6	2400	73.33	75.5	-2.17
2462	6	2483.5	54.26	73.5	-19.24

Figure 23 Band Edge Spectrum

JUDGEMENT: Passed by 2.17 dB

TEST PERSONNEL:

Tester Signature: 

Date: 23.07.13

Typed/Printed Name: A. Sharabi

### 7.3 Test Equipment Used.

#### Band edge Spectrum

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 Year
RF Filter Section	HP	85420E	3705A00248	February 26, 2013	1 Year
Antenna Biconical	EMCO	3104	2606	August 30, 2012	1 Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	1 Year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 Years
Horn Antenna	ARA	SWH-28	1007	January 26, 2011	3 Years
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	August 21, 2012	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 28, 2012	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 Year
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	1 Year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

**Figure 24 Test Equipment Used**

## 8. Radiated Emission, 9 kHz – 30 MHz

### 8.1 Test Specification

9 kHz-30 MHz, FCC, Part 15, Subpart C, Section 209

### 8.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

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 configuration tested is shown in Figure 3.1.

The frequency range 9 kHz-30 MHz was scanned.

The emissions were measured using a computerized EMI receiver complying with CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 9 kHz-30MHz, the loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter at a distance of 3 meters.

The E.U.T. was operated at the low, mid and high channels using a peak detector.

### 8.3 Measured Data

JUDGEMENT: Passed by more than 20dB.

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 209 specification.

TEST PERSONNEL:

Tester Signature: 

Date: 23.07.13

Typed/Printed Name: A. Sharabi



#### **8.4 Test Instrumentation Used, Radiated Measurements**

<b>Instrument</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial Number</b>	<b>Calibration</b>	<b>Period</b>
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 year
RF Section	HP	85420E	3705A00248	February 26, 2013	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 21, 2012	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

### 8.5 **Field Strength Calculation**

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, 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. Spurious Radiated Emission, 30 – 25000 MHz

### 9.1 Radiated Emission 30-25000 MHz

The E.U.T operation mode and test set-up are as described in Section 3.

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room, 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 configuration tested is shown in *Figure 1*.

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.

In the frequency range 1-2.9 GHz, a computerized EMI receiver complying with CISPR 16 requirements was used.

In the frequency range 2.9-25.0 GHz, a spectrum analyzer including a low noise amplifier was used. During average measurements, the IF bandwidth was 1 MHz and the video bandwidth was 100Hz. During peak measurements, the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.

The test distance was 3 meters.

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

Verification of the E.U.T emissions was based on the following methods: turning the E.U.T on and off; using a frequency span less than 10 MHz; observation of the signal level during turntable rotation. (Background noise is not affected by the rotation of the E.U.T.)

The E.U.T. was operated at the low, mid and high channels using a peak detector.



## 9.2 Test Data

JUDGEMENT: Passed by 4.6dB

For the operation frequency of 2412 MHz, the margin between the emission level and the specification limit is in the worst case 4.6dB at the frequency of 4826 MHz, horizontal polarization.

For the operation frequency of 2437 MHz, the margin between the emission level and the specification limit is in the worst case 4.7dB at the frequency of 4874 MHz, horizontal polarization.


For the operation frequency of 2462 MHz, the margin between the emission level and the specification limit is 7.0dB in the worst case at the frequency of 4924 MHz, horizontal polarization.

The results for all modulations were the same.

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 25* to *Figure 30*.

TEST PERSONNEL:

Tester Signature: 

Date: 23.07.13

Typed/Printed Name: A. Sharabi

## Radiated Emission Above 1 GHz

E.U.T Description    Wi-Fi HUGS Tag  
Type                    TAG-HGS-1000  
Serial Number:        Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical    Frequency range: 1.0 GHz to 25.0 GHz  
Test Distance: 3 meters                            Detector: Peak  
Operation Frequency: 2412 MHz

Freq.	Polarity	Peak Amp	Peak. Specification	Peak. Margin
(MHz)	(H/V)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)
2390.0	H	49.0*	74.0	-25.0
2390.0	V	50.0*	74.0	-24.0
4826.0	H	69.4	74.0	-4.6
4826.0	V	65.0	74.0	-9.0

**Figure 25. 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 Amp” includes correction factor.

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



## Radiated Emission Above 1 GHz

E.U.T Description    Wi-Fi HUGS Tag  
Type                      TAG-HGS-1000  
Serial Number:        Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical      Frequency range: 1.0 GHz to 25.0 GHz  
Test Distance: 3 meters                              Detector: Average  
Operation Frequency: 2412 MHz

Freq.	Polarity	Average Amp	Average Specification	Peak. Margin
(MHz)	(H/V)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)
2390.0	H	3.0	54.0	-51.0
2390.0	V	4.0	54.0	-50.0
4826.0	H	23.4	54.0	-30.6
4826.0	V	19.0	54.0	-35.0

**Figure 26. 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 Amp” includes correction factor.

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

## Radiated Emission Above 1 GHz

E.U.T Description    Wi-Fi HUGS Tag  
Type                    TAG-HGS-1000  
Serial Number:        Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical    Frequency range: 1.0 GHz to 25.0 GHz  
Test Distance: 3 meters                            Detector: Peak  
Operation Frequency: 2437 MHz

Freq.	Polarity	Peak Amp	Peak. Specification	Peak. Margin
(MHz)	(H/V)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)
4874.0	H	69.3*	74.0	-4.7
4874.0	V	65.7*	74.0	-8.3

**Figure 27. 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 Amp” includes correction factor.

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

## Radiated Emission Above 1 GHz

E.U.T Description    Wi-Fi HUGS Tag  
Type                    TAG-HGS-1000  
Serial Number:        Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical      Frequency range: 1.0 GHz to 25.0 GHz  
Test Distance: 3 meters                              Detector: Average  
Operation Frequency: 2437 MHz

<b>Freq.</b>	<b>Polarity</b>	<b>Average Amp</b>	<b>Average Specification</b>	<b>Peak. Margin</b>
(MHz)	(H/V)	(dBμV/m)	(dB μV/m)	(dB)
4874.0	H	23.3	54.0	-30.7
4874.0	V	19.7	54.0	-34.3

**Figure 28. 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 Amp” includes correction factor.

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

## Radiated Emission Above 1 GHz

E.U.T Description    Wi-Fi HUGS Tag  
Type                    TAG-HGS-1000  
Serial Number:        Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical    Frequency range: 1.0 GHz to 25.0 GHz  
Test Distance: 3 meters                            Detector: Peak  
Operation Frequency: 2462 MHz

Freq.	Polarity	Peak Amp	Peak. Specification	Peak. Margin
(MHz)	(H/V)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)
2483.50	H	52.5**	74.0	-21.5
2483.50	V	52.9**	74.0	-21.1
4924.00	H	67.0	74.0	-7.0
4924.00	V	64.1	74.0	-9.9

**Figure 29. 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 Amp” includes correction factor.

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

\*\*“Correction Factor” = Antenna Factor + Cable Loss

## Radiated Emission Above 1 GHz

E.U.T Description    Wi-Fi HUGS Tag  
Type                    TAG-HGS-1000  
Serial Number:        Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal/Vertical      Frequency range: 1.0 GHz to 25.0 GHz  
Test Distance: 3 meters                              Detector: Average  
Operation Frequency: 2462 MHz

<b>Freq.</b>	<b>Polarity</b>	<b>Average Amp</b>	<b>Average Specification</b>	<b>Peak. Margin</b>
(MHz)	(H/V)	(dBμV/m)	(dB μV/m)	(dB)
2483.50	H	6.5	54.0	-47.5
2483.50	V	6.9	54.0	-47.1
4924.00	H	21.0	54.0	-33.0
4924.00	V	18.1	54.0	-35.9

**Figure 30. 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 Amp” includes correction factor.

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

\*\*“Correction Factor” = Antenna Factor + Cable Loss

### 9.3 Test Instrumentation Used, Radiated Measurements Above 1 GHz

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 Year
RF Filter Section	HP	85420E	3705A00248	February 26, 2013	1 Year
Antenna Biconical	EMCO	3104	2606	August 30, 2012	1 Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	1 Year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 Years
Horn Antenna	ARA	SWH-28	1007	January 26, 2011	3 Years
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	August 21, 2012	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 28, 2012	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 Year
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	1 Year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

## 10. Transmitted Power Density

[In accordance with section 15.247(d)]

### 10.1 Test procedure

The E.U.T operation mode and test set-up are as described in Section 3.

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

The E.U.T was tested at 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 configuration tested is shown in *Figure 1*.

The spectrum analyzer was set to 3 kHz resolution BW and sweep time of 1 second for each 3 kHz “window”. The spectrum peaks were located at each of the 3 operating frequencies.

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

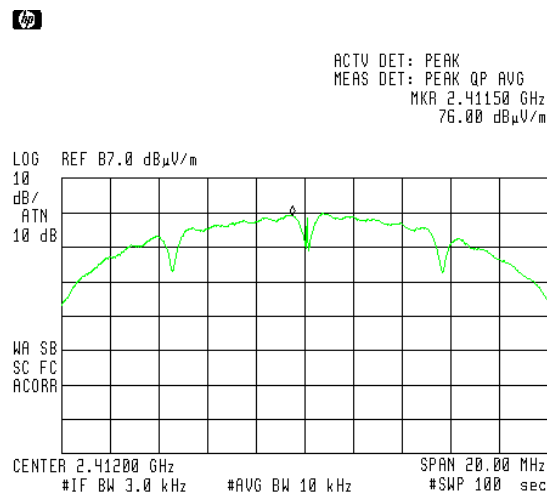


Figure 31 — Low Channel

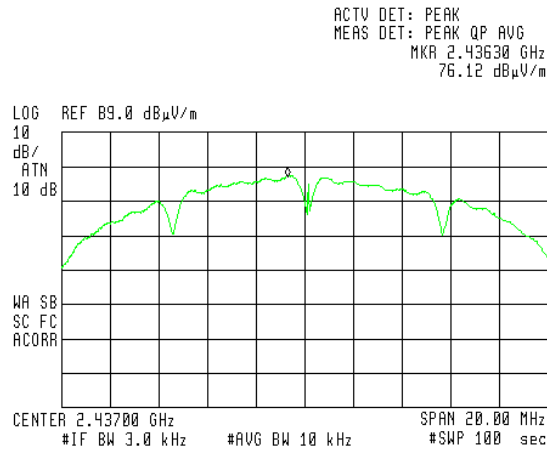


Figure 32 — Mid channel

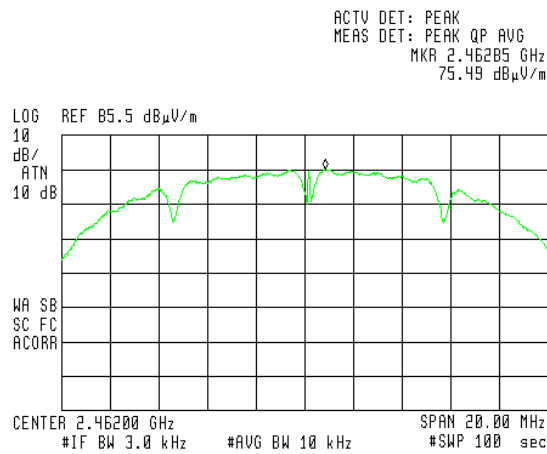


Figure 33 — High channel



## 10.2 Results table

E.U.T. Description: Wi-Fi HUGS Tag  
Model No.: TAG-HGS-1000  
Serial Number: Not designated  
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Modulation Mbps	Reading Spectrum Analyzer (dBμV/m)	Reading Spectrum Analyzer (dBm)	Specification (dBm)	Margin (dB)
2412	6	76.00	-19.67	8.0	-27.67
2437	6	76.12	-19.67	8.0	-27.67
2462	6	75.49	-19.67	8.0	-27.67

**Figure 34 Test Results**

JUDGEMENT: Passed by 27.67dB

TEST PERSONNEL:

Tester Signature: 

Date: 23.07.13

Typed/Printed Name: A. Sharabi

### 10.3 Test Equipment Used.

#### Transmitted Power Density

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 Year
RF Filter Section	HP	85420E	3705A00248	February 26, 2013	1 Year
Antenna Biconical	EMCO	3104	2606	August 30, 2012	1 Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	1 Year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 Years
Horn Antenna	ARA	SWH-28	1007	January 26, 2011	3 Years
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	August 21, 2012	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 28, 2012	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 Year
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	1 Year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

**Figure 35 Test Equipment Used**



## 11. Antenna Gain/Information

The antenna gain is 0 dBi.

## 12. Average Factor Calculation

1. Burst duration = 450usec
2. Time between bursts = 1000msec
3. Pulse duration = N/A
4. pulse period = N/A

$$5. \text{ Average Factor} = 20 \log \left[ \frac{\text{Pulse duration}}{\text{Pulse period}} \times \frac{\text{burst duration}}{100 \text{msec}} \times \text{Num of burst within 100msec} \right]$$

$$\text{Average Factor} = 20 \log \left[ \frac{0.45}{100} \right] = -46.9 \text{dB}$$

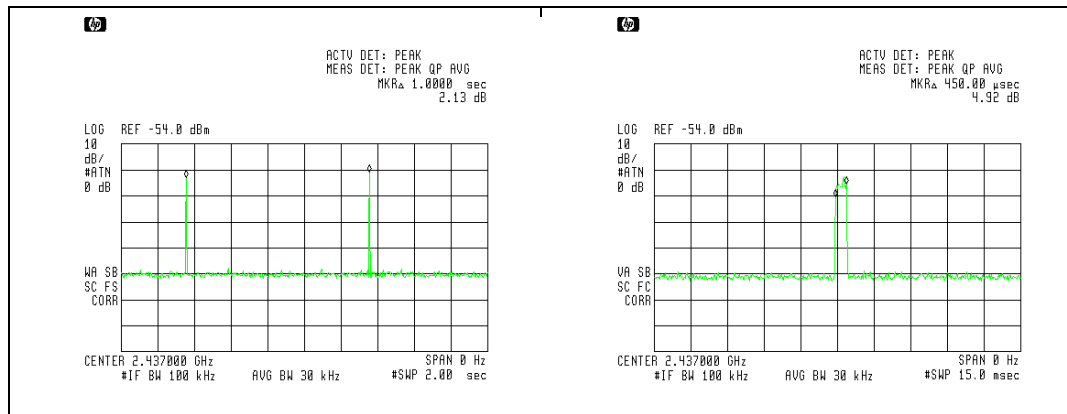


Figure 36. Duty Cycle

### 12.1 Test Equipment Used, Average Factor Calculation

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 Year
RF Filter Section	HP	85420E	3705A00248	February 26, 2013	1 Year
Antenna Biconical	EMCO	3104	2606	August 30, 2012	1 Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	1 Year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 Years
Horn Antenna	ARA	SWH-28	1007	January 26, 2011	3 Years
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	August 21, 2012	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 28, 2012	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 Year
Spectrum Analyzer	HP	8564E	3442A00275	February 28, 2013	1 Year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

## 13. R.F Exposure/Safety

Typical use of the E.U.T. is in a Tag designed to be used for real time location systems. The typical placement of the E.U.T. is in inside a variety of equipment, such as medical devices, containers, manufacturing equipment and vehicles. The typical distance between the E.U.T. and the user in the worst case application, is 3 cm.

### Calculation of Maximum Permissible Exposure (MPE)

Based on Section 1.1307(b)(1) Requirements

(a) FCC limits at 2437 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 99.98 dBuV/m (Peak) = 3.0 mW

P<sub>Avg</sub>- Transmitted Power 53 dBuV/m (Avg) = 75 nW

G<sub>T</sub>- Antenna Gain, 0dBi = 1.0 numeric

R- Distance from Transmitter using 3cm worst case

(c) The peak power density is:

$$S_{Avg} = \frac{(75 \times 10^{-9}) \times 1}{4\pi(0.03)^2} = 2.38 \times 10^{-5} \frac{mW}{cm^2}$$

(e) This is below the FCC limit.

## 14. APPENDIX A - CORRECTION FACTORS

### 14.1 Correction factors for CABLE

from EMI receiver  
to test antenna  
at 3 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)	FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3	1200.0	7.3
20.0	0.6	1400.0	7.8
30.0	0.8	1600.0	8.4
40.0	0.9	1800.0	9.1
50.0	1.1	2000.0	9.9
60.0	1.2	2300.0	11.2
70.0	1.3	2600.0	12.2
80.0	1.4	2900.0	13.0
90.0	1.6		
100.0	1.7		
150.0	2.0		
200.0	2.3		
250.0	2.7		
300.0	3.1		
350.0	3.4		
400.0	3.7		
450.0	4.0		
500.0	4.3		
600.0	4.7		
700.0	5.3		
800.0	5.9		
900.0	6.3		
1000.0	6.7		

#### NOTES:

1. The cable type is RG-214.
2. The overall length of the cable is 27 meters.
3. The above data is located in file 27MO3MO.CBL on the disk marked "Radiated Emission Tests EMI Receiver".

**14.2 Correction factors for CABLE**  
**from EMI receiver**  
**to test antenna**  
**at 3 meter range.**

FREQUENCY	CORRECTION
(GHz)	FACTOR
1.0	1.2
2.0	1.6
3.0	2.0
4.0	2.4
5.0	3.0
6.0	3.4
7.0	3.8
8.0	4.2
9.0	4.6
10.0	5.0
12.0	5.8

**NOTES:**

- 1. The cable type is RG-8.*
- 2. The overall length of the cable is 10 meters.*



**14.3 Correction factors for CABLE**  
**from spectrum analyzer**  
**to test antenna above 2.9 GHz**

FREQUENCY (GHz)	CORRECTION FACTOR (dB)	FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.9	14.0	9.1
2.0	2.7	15.0	9.5
3.0	3.5	16.0	9.9
4.0	4.2	17.0	10.2
5.0	4.9	18.0	10.4
6.0	5.5	19.0	10.7
7.0	6.0	20.0	10.9
8.0	6.5	21.0	11.2
9.0	7.0	22.0	11.6
10.0	7.5	23.0	11.9
11.0	7.9	24.0	12.3
12.0	8.3	25.0	12.6
13.0	8.7	26.0	13.0

**NOTES:**

- 1. The cable type is SUCOFLEX 104 E manufactured by SUHNER.*
- 2. The cable is used for measurements above 2.9 GHz.*
- 3. The overall length of the cable is 10 meters.*

**14.4 Correction factors for CABLE**  
**from EMI receiver**  
**to test antenna**  
**at 10 meter range.**

FREQUENCY (MHz)	CORRECTION FACTOR (dB)	FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3	1200.0	9.8
20.0	0.8	1400.0	10.0
30.0	0.9	1600.0	11.3
40.0	1.2	1800.0	12.2
50.0	1.4	2000.0	13.1
60.0	1.6	2300.0	14.5
70.0	1.8	2600.0	15.9
80.0	1.9	2900.0	16.4
90.0	2.0		
100.0	2.1		
150.0	2.6		
200.0	3.2		
250.0	3.8		
300.0	4.2		
350.0	4.6		
400.0	5.1		
450.0	5.3		
500.0	5.6		
600.0	6.3		
700.0	7.0		
800.0	7.6		
900.0	8.0		
1000.0	8.7		

**NOTES:**

1. The cable type is RG-214.
2. The overall length of the cable is 34 meters.
3. The above data is located in file 34M10MO.CBL on the disk marked "Radiated Emissions Tests EMI Receiver".

## 12.6 Correction factors for LOG PERIODIC ANTENNA

### Type LPD 2010/A at 3 and 10 meter ranges.

#### Distance of 3 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.1
250.0	10.2
300.0	12.5
400.0	15.4
500.0	16.1
600.0	19.2
700.0	19.4
800.0	19.9
900.0	21.2
1000.0	23.5

#### Distance of 10 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.0
250.0	10.1
300.0	11.8
400.0	15.3
500.0	15.6
600.0	18.7
700.0	19.1
800.0	20.2
900.0	21.1
1000.0	23.2

#### NOTES:

1. Antenna serial number is 1038.
2. The above lists are located in file number 38M30.ANT for a 3 meter range,  
and file number 38M100.ANT for a 10 meter range.
3. The files mentioned above are located on the disk marked "Radiated Emission  
Test EMI Receiver".

**14.5 Correction factors for LOG PERIODIC ANTENNA  
Type SAS-200/511  
at 3 meter range.**

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
1.0	24.9
1.5	27.8
2.0	29.9
2.5	31.2
3.0	32.8
3.5	33.6
4.0	34.3
4.5	35.2
5.0	36.2
5.5	36.7
6.0	37.2
6.5	38.1

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
7.0	38.6
7.5	39.2
8.0	39.9
8.5	40.4
9.0	40.8
9.5	41.1
10.0	41.7
10.5	42.4
11.0	42.5
11.5	43.1
12.0	43.4
12.5	44.4
13.0	44.6

**NOTES:**

1. Antenna serial number is 253.
2. The above lists are located in file number SAS3M0.ANT for a 3 meter range.
3. The files mentioned above are located on the disk marked "Antenna Factors".

**14.6 Correction factors for BICONICAL ANTENNA  
Type BCD-235/B,  
at 3 meter range**

FREQUENCY (MHz)	AFF (dB/m)
20.0	19.4
30.0	14.8
40.0	11.9
50.0	10.2
60.0	9.1
70.0	8.5
80.0	8.9
90.0	9.6
100.0	10.3
110.0	11.0
120.0	11.5
130.0	11.7
140.0	12.1
150.0	12.6
160.0	12.8
170.0	13.0
180.0	13.5
190.0	14.0
200.0	14.8
210.0	15.3
220.0	15.8
230.0	16.2
240.0	16.6
250.0	17.6
260.0	18.2
270.0	18.4
280.0	18.7
290.0	19.2
300.0	19.9
310	20.7
320	21.9
330	23.4
340	25.1
350	27.0

**NOTES:**

1. Antenna serial number is 1041.
2. The above list is located in file 19BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".

**14.7 Correction factors for BICONICAL ANTENNA  
Type BCD-235/B,  
10 meter range**

FREQUENCY (MHz)	AFE (dB/m)
30.0	12.1
40.0	10.6
50.0	10.6
60.0	8.9
70.0	8.5
80.0	9.6
90.0	9.4
100.0	9.6
110.0	10.3
120.0	10.7
130.0	12.6
140.0	12.7
150.0	12.7
160.0	13.8
170.0	13.7
180.0	14.9
190.0	13.4
200.0	13.1
210.0	14.0
220.0	14.5
230.0	15.8
240.0	16.0
250.0	16.6
260.0	16.7
270.0	18.3
280.0	18.5
290.0	19.3
300.0	20.9

**NOTES:**

1. Antenna serial number is 1041.
2. The above list is located in file 41BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".



## 14.8 Correction factors for Horn

## Double-Ridged Waveguide

**Model: 3115, S/N 29845  
at 3 meter range.**

FREQUENCY	ANTENNA	ANTENN	FREQUENCY	ANTENNA	ANTENNA
(GHz)	FACTOR	A Gain	(GHz)	FACTOR	Gain
(dB 1/m)	(dBi)		(dB 1/m)	(dBi)	
1.0	24.8	5.4	10.0	38.8	11.4
1.5	26.1	7.6	10.5	38.9	11.8
2.0	28.6	7.7	11.0	39.0	12.1
2.5	29.8	8.4	11.5	39.6	11.8
3.0	31.4	8.4	12.0	39.8	12.0
3.5	32.4	8.7	12.5	39.6	12.5
4.0	33.7	8.6	13.0	40.0	12.5
4.5	33.4	9.9	13.5	39.8	13.0
5.0	34.5	9.7	14.0	40.2	13.0
5.5	35.1	9.9	14.5	40.6	12.9
6.0	35.4	10.4	15.0	41.3	12.4
6.5	35.6	10.8	15.5	39.5	14.6
7.0	36.2	10.9	16.0	38.8	15.5
7.5	37.3	10.4	16.5	40.0	14.6
8.0	37.7	10.6	17.0	41.4	13.4
8.5	38.3	10.5	17.5	44.8	10.3
9.0	38.5	10.8	18.0	47.2	8.1
9.5	38.7	11.1			



**14.9 Correction factors for**

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

<b>FREQUENCY</b> (GHz)	<b>AFE</b> (dB /m)	<b>Gain</b> (dB1)
18.0	40.3	16.1
19.0	40.3	16.3
20.0	40.3	16.1
21.0	40.3	16.3
22.0	40.4	16.8
23.0	40.5	16.4
24.0	40.5	16.6
25.0	40.5	16.7
26.0	40.6	16.4





**14.10 Correction factors for**

**Horn Antenna  
Model: V637**

<b>FREQUENCY</b> (GHz)	<b>APE</b> (dB /m)	<b>Gain</b> (dB1)
26.0	43.6	14.9
27.0	43.7	15.1
28.0	43.8	15.3
29.0	43.9	15.5
30.0	43.9	15.8
31.0	44.0	16.0
32.0	44.1	16.2
33.0	44.1	16.4
34.0	44.1	16.7
35.0	44.2	16.9
36.0	44.2	17.1
37.0	44.2	17.4
38.0	44.2	17.6
39.0	44.2	17.8
40.0	44.2	18.0



**14.11 Correction factors for ACTIVE LOOP ANTENNA**  
**Model 6502**  
**S/N 9506-2950**

<b>FREQUENCY</b>	<b>Magnetic Antenna Factor</b>	<b>Electric Antenna Factor</b>
<b>(MHz)</b>	<b>(dB)</b>	<b>(dB)</b>
.009	-35.1	16.4
.010	-35.7	15.8
.020	-38.5	13.0
.050	-39.6	11.9
.075	-39.8	11.8
.100	-40.0	11.6
.150	-40.0	11.5
.250	-40.0	11.6
.500	-40.0	11.5
.750	-40.1	11.5
1.000	-39.9	11.7
2.000	-39.5	12.0
3.000	-39.4	12.1
4.000	-39.7	11.9
5.000	-39.7	11.8
10.000	40.2	11.3
15.000	-40.7	10.8
20.000	-40.5	11.0
25.000	-41.3	10.2
30.000	42.3	9.2

## 15. Comparison Industry Canada Requirements With FCC

**AeroScout WiFi HUGS Tag**

**M/N: TAG-HGS-1000**

**IC: 5115A-TAGHGS1000**

**FCC ID: Q3HTAGHGS1000**

Test	FCC	IC
❑ Radiated Emission	15.209	RSS 210 Issue 8 Clause 2.5
❑ Max power / Peak power	15.247(b)(3)	RSS 210 Issue 8 A8.4(4)
❑ 6dB BW	15.247(a)2	RSS 210 Issue 8 A8.2a
❑ Power density	15.247(e)	RSS 210 Issue 8 A8.2b
❑ Spurious radiated emission in the restricted band	15.205(c)	RSS 210 Issue 8 2.5 RSS Gen 7.2.2 (Table 1)
❑ Band edge spectrum	15.247(d)	RSS 210 Issue 8 A8.5
❑ RF Exposure Limits	1.1307(b)(1)	RSS 102 4.4