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DATE: 20 December 2012

I.T.L. (PRODUCT TESTING) LTD.

FCC Radio Test Report

for

Globisens Ltd.

Equipment under test:

Wireless Data Logger

Labdisc Gensci

Written by: _____

I. Smilansky, Documentation

Approved by: _____

I. Siboni, Test Engineer

Approved by: _____

I. Raz, EMC Laboratory Manager

Measurement/Technical Report for

Globisens Ltd.

Wireless Data Logger

Labdisc Gensci

FCC ID: Q2J-DISC12

This report concerns:	Original Grant:	X
	Class I Change:	
	Class II Change:	

Equipment type: Frequency Hopping Spread Spectrum

Limits used:
47CFR15 Section 15.247

Measurement procedures used are FCC Public Notice DA-00-705 and ANSI C63.4: 2003.

Application for Certification
prepared by:
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ITL (Product Testing) Ltd.
Kfar Bin Nun
D.N. Shimshon 99780
Israel
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Applicant for this device:
(different from "prepared by")
Dov Bruker
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Petach Tiqva, 49527,
Israel
Tel: +972- 3 - 919 - 1801
e-mail: dovi@globisens.com

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1. General Information

1.1 Administrative Information

Manufacturer:	Globisens Ltd.
Manufacturer's Address:	94 Em Hamoshavot Road Petach Tiqva 49527 Israel Tel: +972-3-919-1801
Manufacturer's Representative:	Dov Bruker
Equipment Under Test (E.U.T):	Wireless Data Logger
Equipment Model No.:	Labdisc Gensci
Equipment Serial No.:	20111109943
Date of Receipt of E.U.T:	11.03.2012
Start of Test:	04.04.2012
End of Test:	15.04.2012
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Part 15 Sub-part C

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 Labdisc places an advanced science lab into the hands of young scientists. The Labdisc is the only solution for K-12 science with up to 12 wireless sensors built into a single compact device - revolutionizing science in terms of convenience, cost and portability.

The Labdisc wireless advantage means much more than just a cable-free, clean working environment, safe from hazardous materials. A single wireless transmission from the Labdisc for up to 12 sensors reduces radio interference in the classroom, while eliminating the need for costly transmitters built into every sensor. The compact Labdisc carries key features such as display, keypad, memory and battery to ensure full autonomic data collection, independent of a computer. As a result the Labdisc keeps science cost effective, and free from computing issues such as availability or, during field experiments, hard to read screens in direct sunlight. Additionally, in the laboratory, the Labdisc can operate as a sensor interface, transmitting online measurements to the computer.

1.4 Test Methodology

Radiated testing was performed according to the procedures in FCC Public Notice DA 00-705 and 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):

± 4.96 dB

2. System Test Configuration

2.1 Justification

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

During the test the Labdisc was working in partial capacity. Only the internal sensors were functioning. It was sampling all internal sensors and was transmitting data through the Bluetooth module.

2.2 EUT Exercise Software

GlobiLab software was used.

2.3 Special Accessories

No special accessories were required to achieve compliance.

2.4 Equipment Modifications

No modifications were needed in order to achieve compliance

2.5 Configuration of Tested System

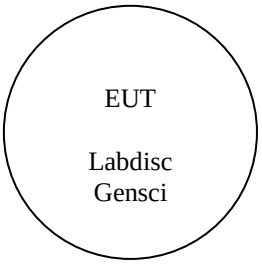


Figure 1. Configuration of Tested System

3. Test Set-up Photo

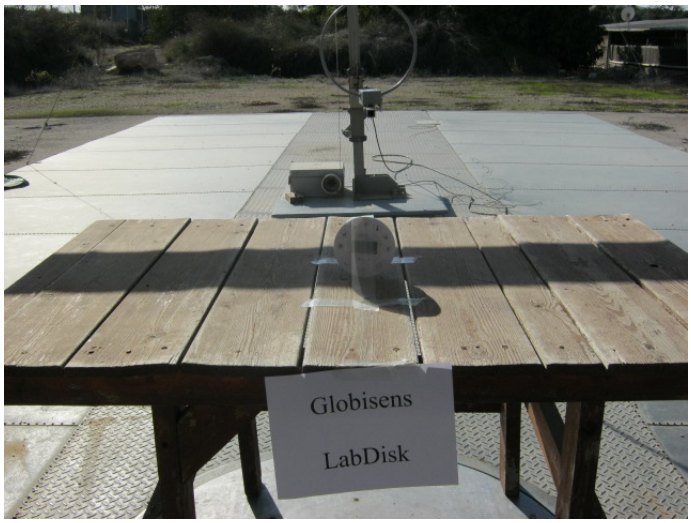


Figure 2. Radiated Emission Test

Figure 3. Radiated Emission Test

4. 6dB Minimum Bandwidth

4.1 Test Specification

F.C.C. Part 15, Subpart C: 15.247(a)(2)

4.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters. The transmitter unit operated with normal modulation. The EMI receiver was set to 100 kHz resolution BW. The spectrum bandwidth of the transmitter unit was measured and recorded. The test was performed to measure the transmitter occupied bandwidth. The EUT was set up as shown in Figure 3, and its proper operation was checked. The transmitter occupied bandwidth was measured with the EMI receiver as frequency delta between reference points on modulation envelope.

4.3 Test Results

Operation Frequency (MHz)	Bandwidth Reading (MHz)	Specification (MHz)
2402	0.500	>0.5
2441	0.505	>0.5
2480	0.500	>0.5

Figure 4 Test Results

See additional information in *Figure 4* to *Figure 6*

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 20.11.12

Typed/Printed Name: I. Siboni

6dB Minimum Bandwidth

E.U.T Description	Wireless Data Logger
Type	Labdisc Gensci
Serial Number:	20111109943

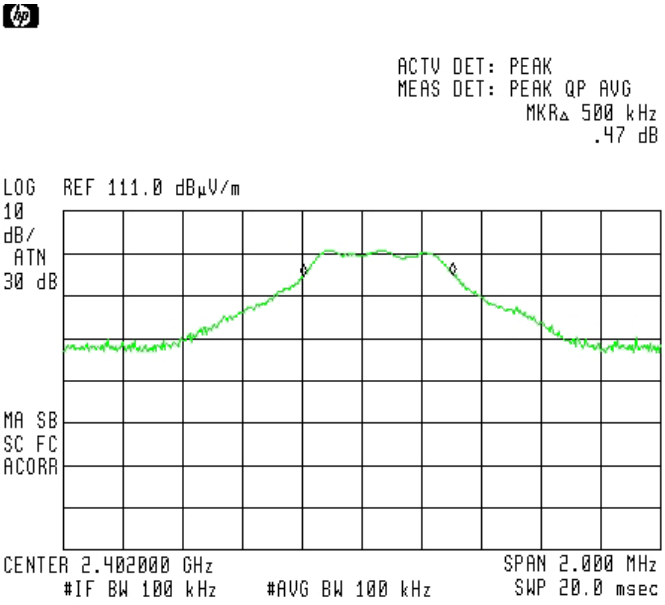


Figure 5. 2402 MHz

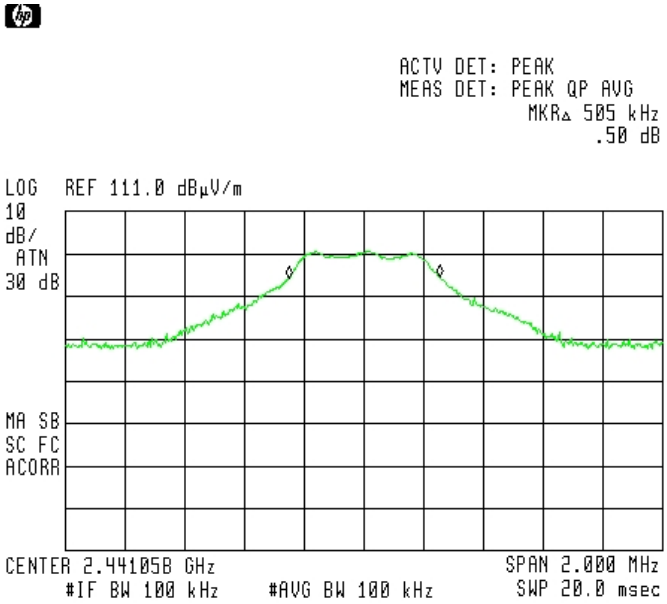


Figure 6. 2441 MHz

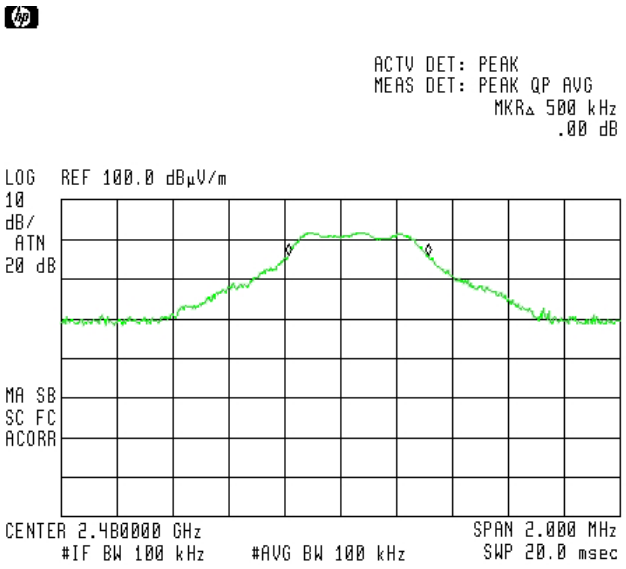


Figure 7. 2480 MHz

4.4 6dB Minimum Bandwidth Test Equipment Used.

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1 year
RF Section	HP	85420E	3705A00248	December 12, 2011	1 year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 27, 2011	2 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

Figure 8 Test Equipment Used

5. Number of Hopping Frequencies Section 15.247(a)(1)(iii)

5.1 Test Specification

FCC Part 15, Subpart C, 15.247(a)(1)(iii)

5.2 Test Procedure

The E.U.T. was set to hopping mode.
The spectrum analyzer was set to the following parameters:

Span: Every 20 MHz Frequency
Band of Operation: 2400-2483.5 MHz
RBW: 30 kHz
VBW: 30 kHz
Detector Function: Peak
Trace: Maximum Hold

5.3 Test Results

Band1 = 2400 – 2420 (MHz) = 18
Band2 = 2420 – 2440 (MHz) = 20
Band3 = 2440 – 2460(MHz) = 20
Band4 = 2460 – 2483.5 (MHz) = 21

Number of Hopping Frequencies	Specification
79	>75

Figure 9 Number of Hopping Frequencies

JUDGEMENT: Passed

See additional information in *Figure 9* to *Figure 12*

TEST PERSONNEL:

Tester Signature: _____ Date: 22.11.12
Typed/Printed Name: I. Siboni

Number of Hopping Frequencies

E.U.T Description	Wireless Data Logger
Type	Labdisc Gensci
Serial Number:	20111109943

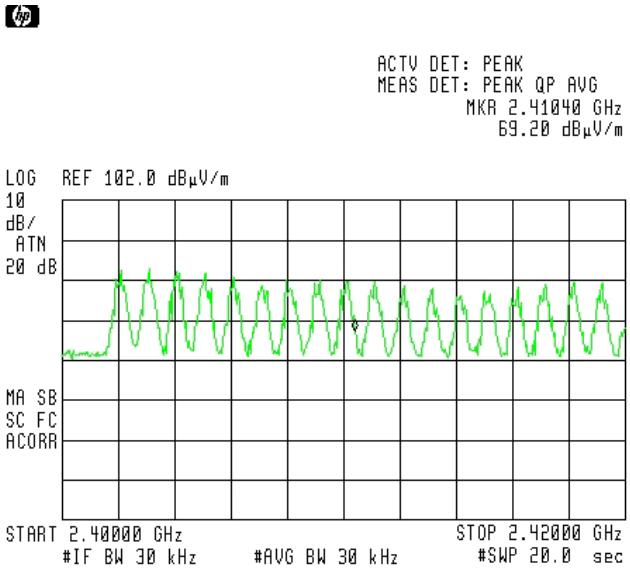


Figure 10. 2400-2420 MHz

Number of Hopping Frequencies

E.U.T Description	Wireless Data Logger
Type	Labdisc Gensci
Serial Number:	20111109943

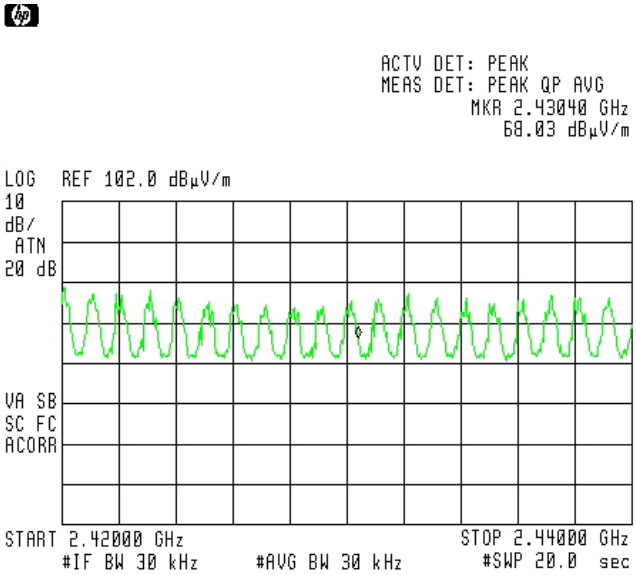


Figure 11. 2420 - 2440 MHz

Number of Hopping Frequencies

E.U.T Description	Wireless Data Logger
Type	Labdisc Gensci
Serial Number:	20111109943

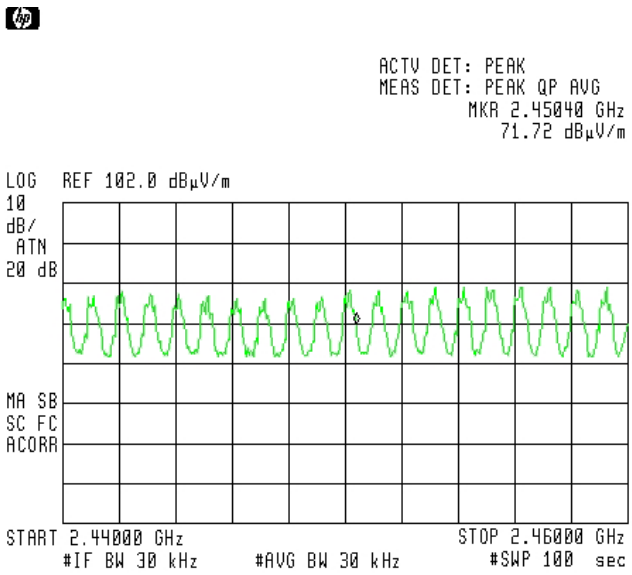


Figure 12. 2440 - 2406 MHz

Number of Hopping Frequencies

E.U.T Description	Wireless Data Logger
Type	Labdisc Gensci
Serial Number:	20111109943

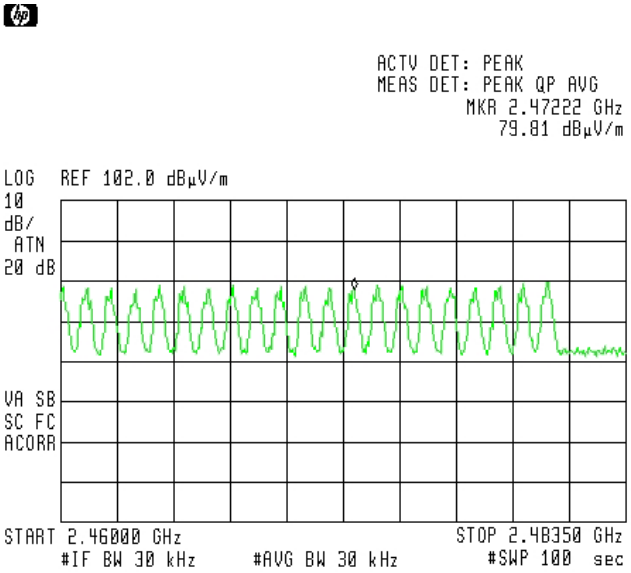


Figure 13.2460 – 2483.5 MHz

5.4 Number of Hopping Frequencies Test Equipment Used

EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1 year
RF Section	HP	85420E	3705A00248	December 12, 2011	1 year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 27, 2011	2 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

Figure 14 Test Equipment Used

6. Channel Frequency Separation

6.1 Test Specification

Specification: FCC Part 15, Subpart C, 15.247(a) (1)

6.2 Test procedure

The E.U.T. was set to hopping mode.
The spectrum analyzer was set to the following parameters:
Span: 3 MHz
RBW: 30 kHz
VBW: 30 kHz
Detector Function: Peak
Trace: Maximum Hold
The marker delta function to determine the separation between the peaks of the adjacent channels was used.

6.3 Test Results

Channel Frequency Separation (kHz)	Specification (kHz)	Margin (kHz)
1005	>1000	5

Figure 15 Channel Frequency Separation

JUDGEMENT: Passed by 5 kHz

See additional information in *Figure 15*.

TEST PERSONNEL:

Tester Signature: _____ Date: 20.11.12

Typed/Printed Name: I. Siboni

Channel Frequency Separation

E.U.T Description	Wireless Data Logger
Type	Labdisc Gensci
Serial Number:	20111109943

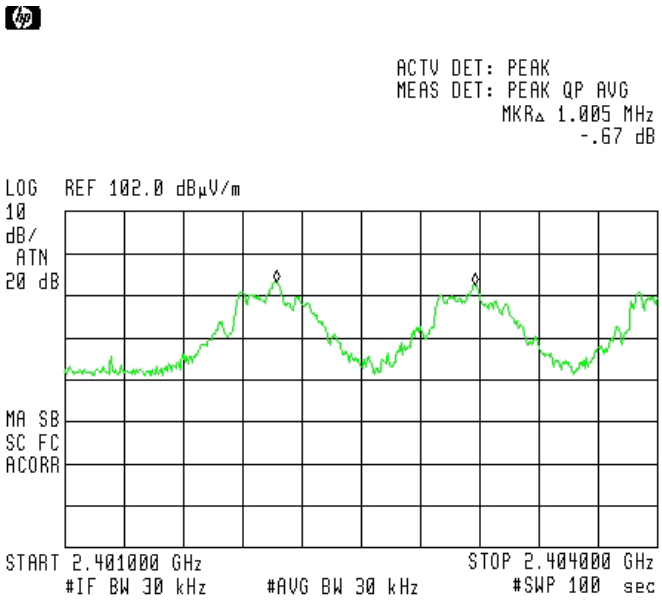


Figure 16. Frequency Separation

6.4 Channel Frequency Test Equipment Used

EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1 year
RF Section	HP	85420E	3705A00248	December 12, 2011	1 year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 27, 2011	2 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

Figure 17 Test Equipment Used

7. Radiated Power Output

7.1 Test Specification

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

7.2 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters.
The transmitter unit operated with normal modulation. The EMI receiver was set to 1 MHz resolution BW. The EUT was set up as shown in Figure 3, and its proper operation was checked.

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

The E.U.T. was tested in three operating channels and frequencies
(1 (2.401 GHz); 8 (2.441 GHz); 14 (2.480 GHz)).

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:

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

7.3 Test Results

Operation Frequency (MHz)	Polarity (H/V)	Peak Reading (dBµV/m)	Peak Reading (V/m)	Transmitted Power (mW)	Limit (mW)	Margin (mW)
2402	V	101.64	0.12	3.85	1000	-996.15
2441	V	102.80	0.14	5.25	1000	-994.75
2480	V	93.32	0.05	0.67	1000	-999.33

The following calculations were used to determine maximum radiated power output.

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

JUDGEMENT: Passed by 994.75 mW

See additional information in *Figure 17* to *Figure 19*.

TEST PERSONNEL:

Tester Signature: _____ Date: 20.11.12

Typed/Printed Name: I. Siboni

Radiated Power Output

E.U.T Description	Wireless Data Logger
Type	Labdisc Gensci
Serial Number:	20111109943

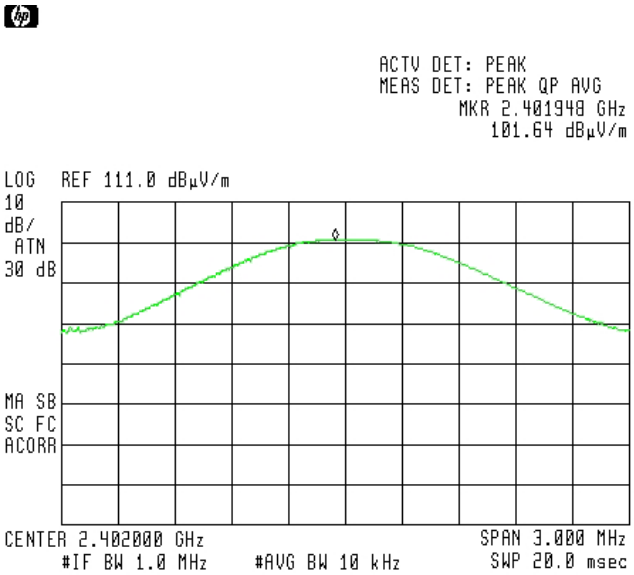


Figure 18 2402 MHz

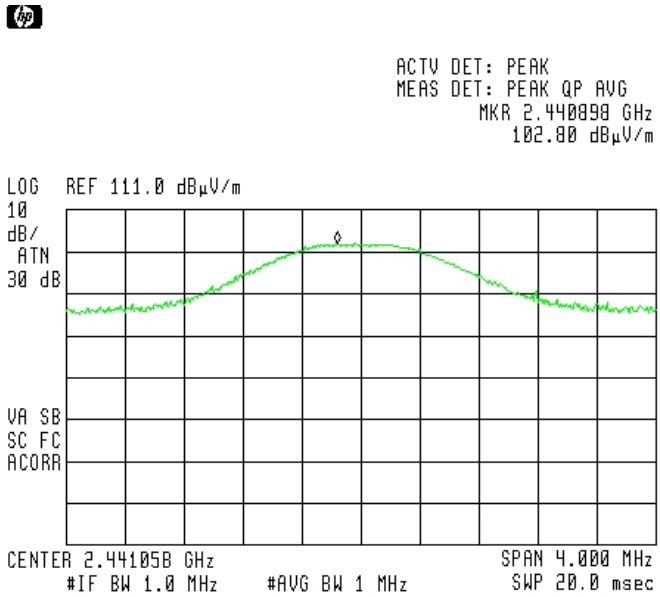


Figure 19 2441 MHz

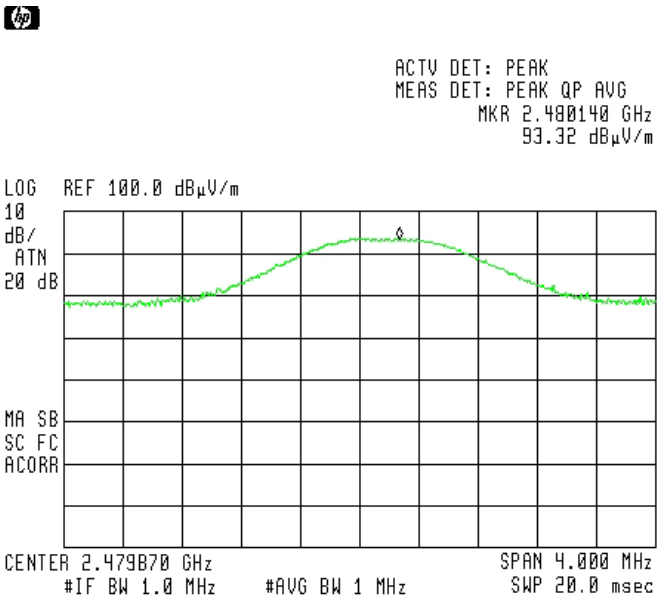


Figure 20 2480 MHz

7.4 Radiated Power Output Test Equipment Used.

Radiated Maximum Power Output

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3906A00276	December 12, 2011	1 year
RF Section	HP	85420E	3705A00248	December 12, 2011	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
Antenna-Log Periodic	A.H.System	SAS-200/511	253	January 27, 2011	2 years

Figure 21 Test Equipment Used

8. Dwell Time on Each Channel

8.1 Test Specification

FCC Part 15, Section 15.247(a)(1)(iii)

8.2 Test Procedure

The E.U.T. was tested in radiated mode using the substitution antenna. The spectrum analyzer was set to 10 kHz IF BW and 3 MHz AVG BW.

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

8.3 Test Results

The E.U.T met the requirements of the FCC Part 15, Section 15.247(a)(1)(iii).

See additional information in *Figure 21* to *Figure 22*.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 20.11.12

Typed/Printed Name: I. Siboni

Dwell Time on Each Channel

E.U.T Description	Wireless Data Logger
Type	Labdisc Gensci
Serial Number:	20111109943

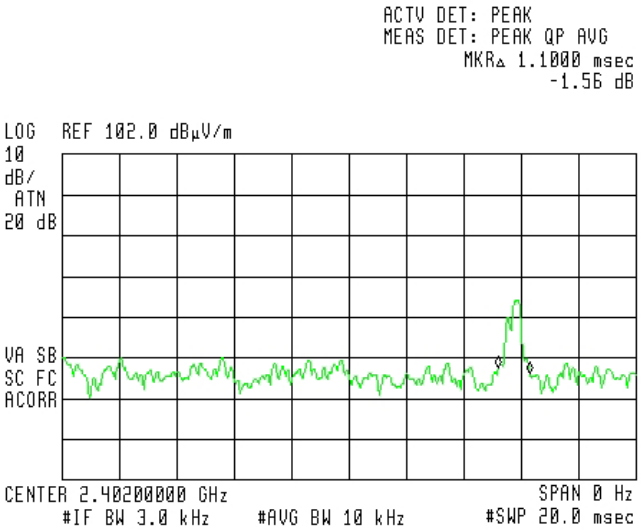


Figure 22 — Ton=1.1msec

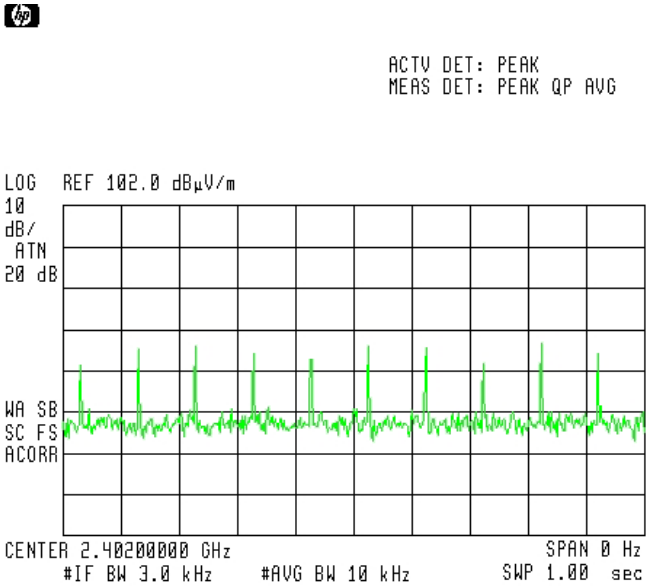


Figure 23 — Number of channels in 1 sec. =10

[31.6 x 10=316, 316 x 1.1 msec =0.347 sec , spec=0.4 sec]

8.4 Dwell Time on Each Channel Test Equipment Used.

EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1 year
RF Section	HP	85420E	3705A00248	December 12, 2011	1 year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 27, 2011	2 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

Figure 24 Test Equipment Used

9. 26 dB Bandwidth

9.1 Test procedure

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

9.2 Test procedure

The E.U.T. was set to the applicable test frequency. The spectrum analyzer was set to 100 kHz resolution BW. The spectrum bandwidth of the E.U.T. at the point of 26 dB below maximum peak power was measured and recorded.

9.3 Test Results

Operation Frequency (MHz)	Reading (MHz)
2402	1.34
2441	1.33
2480	1.33

Figure 25 26 dB Bandwidth

JUDGEMENT: Passed

See additional information in *Figure 25* to *Figure 27*.

TEST PERSONNEL:
Tester Signature: _____ Date: 20.11.12

Typed/Printed Name: I. Siboni

26dB Minimum Bandwidth

E.U.T Description	Wireless Data Logger
Type	Labdisc Gensci
Serial Number:	20111109943

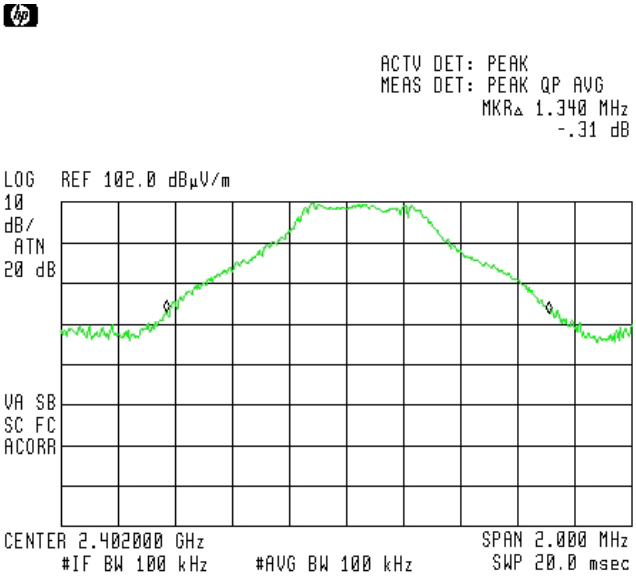


Figure 26 — 2402.0 MHz

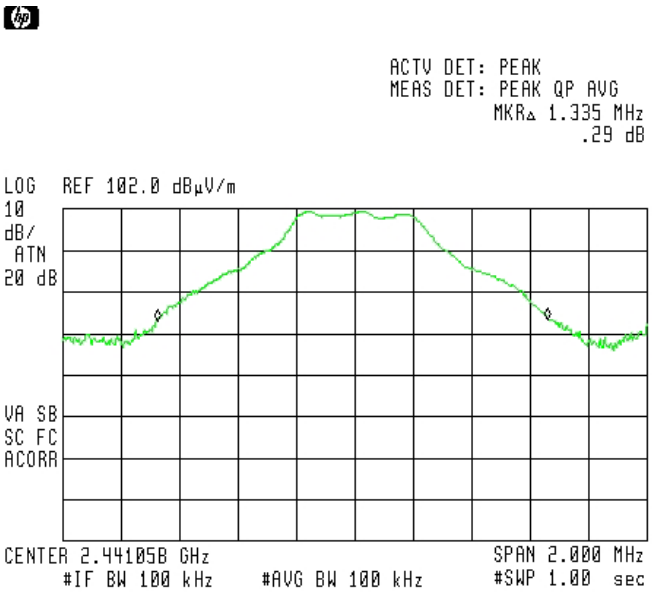


Figure 27 — 2441.0 MHz

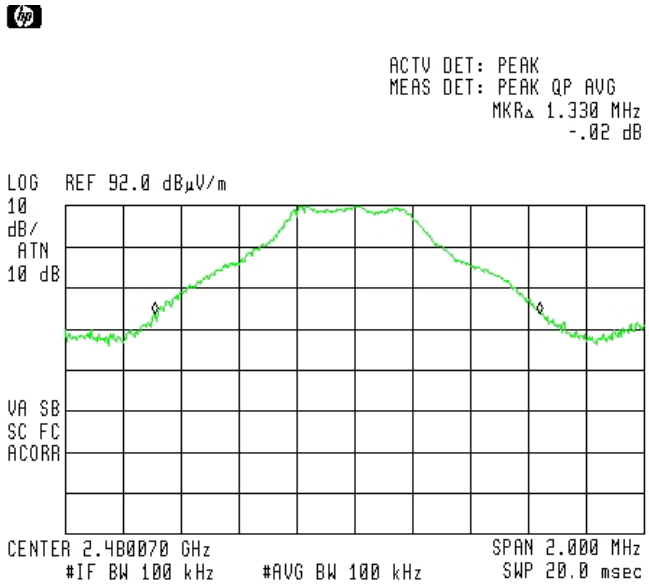


Figure 28 — 2480.0 MHz

9.4 26 dB Bandwidth Test Equipment Used.

EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1 year
RF Section	HP	85420E	3705A00248	December 12, 2011	1 year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 27, 2011	2 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

Figure 29 Test Equipment Used

10. Band Edge

[In Accordance with section 15.247(d)]

10.1 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters.
The transmitter unit operated with normal modulation. The EMI receiver was set to 1 MHz resolution BW. The EUT was set up as shown in Figure 1, and its proper operation was checked.

The EMI receiver was adjusted to the transmission channel at the maximum radiated level. The display line was set to 20 dBc and the EMI receiver was set to the band edge frequencies.
Maximum power level below 2400 MHz and above 2483.5 MHz was measured relative to power level at 2410 MHz, and 2475 MHz correspondingly.

The E.U.T. was tested in 2 operating channels and frequencies
(1 (2.410 GHz); 14 (2.475 GHz)).

The E.U.T. was tested at 2410 and 2475 MHz with QPSK modulation.

10.2 Test Results

Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBµV/m)	Specification (dBµV/m)	Margin (dB)
2402	2400.0	79.9	81.6	1.7
2480	2483.5	66.2	73.3	7.1

Figure 30 Band Edge

JUDGEMENT: Passed by 1.7 dB

See additional information in *Figure 30* to *Figure 31*.

TEST PERSONNEL:

Tester Signature: _____ Date: 20.11.12

Typed/Printed Name: I. Siboni

Band Edge

E.U.T Description	Wireless Data Logger
Type	Labdisc Gensci
Serial Number:	20111109943

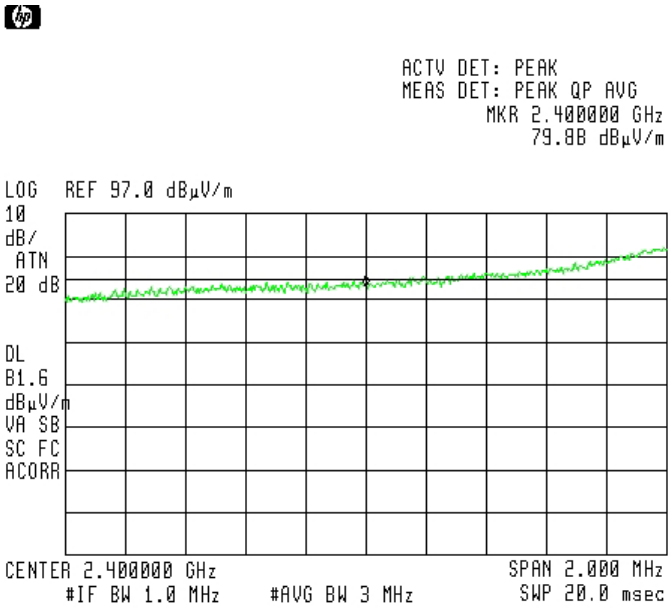


Figure 31 — 2400 MHz

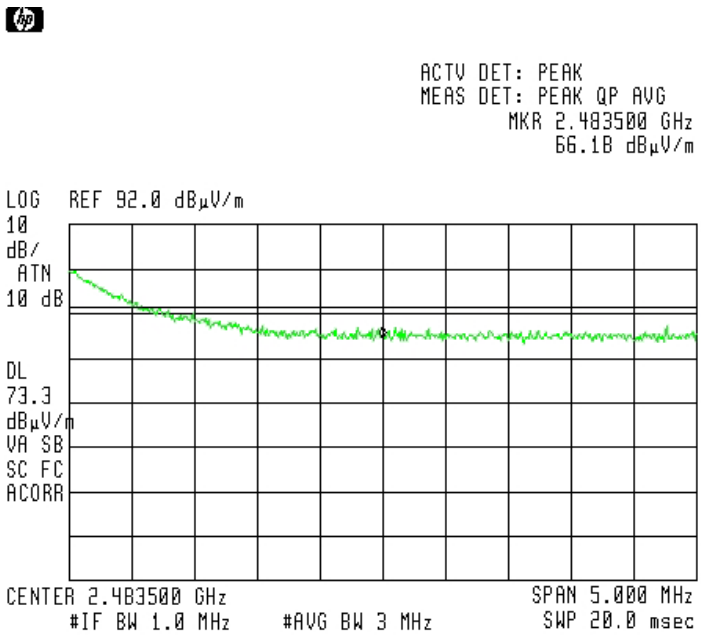


Figure 32 — 2483.5 MHz

10.3 Band Edge Test Equipment Used.

Band edge Spectrum

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3906A00276	December 12, 2011	1 year
RF Section	HP	85420E	3705A00248	December 12, 2011	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
Antenna-Log Periodic	A.H.System	SAS-200/511	253	January 27, 2011	2 years

Figure 33 Test Equipment Used

11. Radiated Emission, 9 kHz – 30 MHz

11.1 Test Specification

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

11.2 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 1.

The E.U.T. highest frequency source or used frequency is 2.4 GHz.

The frequency range 9 kHz-30 MHz was scanned.

The emissions were measured using a computerized EMI receiver complying to 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 frequency of 2402, 2441 and 2480 MHz. These frequencies were measured using a peak detector.

11.3 Test Results

JUDGEMENT: Passed

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

The results for all three operating frequencies were the same.

No signals were detected in the frequency range of 9 kHz – 30 MHz.

TEST PERSONNEL:

Tester Signature: _____ Date: 20.11.12

Typed/Printed Name: I. Siboni

11.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1 year
RF Section	HP	85420E	3705A00248	December 12, 2011	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 19, 2011	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

Figure 34 Test Equipment Used

11.5 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 [dBμv/m]
RA: Receiver Amplitude [dBμv]
AF: Receiving Antenna Correction Factor [dB/m]
CF: Cable Attenuation Factor [dB]

Example: FS = 30.7 dBμV (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dBμV

No external pre-amplifiers are used.

12. Spurious Radiated Emission 30 – 25000 MHz

12.1 Test Specification

30 MHz- 25000 MHz, F.C.C., Part 15, Subpart C

12.2 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.

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 MHz-25000 MHz was scanned, and the list of the highest emissions was verified and updated accordingly.

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.

The E.U.T. highest frequency source or used frequency is 2.4 GHz.

In the frequency range of 30 MHz – 2.9 GHz the emissions were measured using a computerized EMI receiver complying to 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 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 tested in three operating frequencies 2402, 2445, and 2480 MHz.

12.3 Test Results

JUDGEMENT: Passed by 6.0 dB

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

See additional information in *Figure 34* to *Figure 35*.

TEST PERSONNEL:

Tester Signature: _____ Date: 20.11.12

Typed/Printed Name: I. Siboni

Radiated Emission

E.U.T Description	Wireless Data Logger
Type	Labdisc Gensci
Serial Number:	20111109943

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 (MHz)	Freq. (MHz)	Polarity (H/V)	Peak Reading (dBµV/m)	Peak. Specification (dB µV/m)	Peak. Margin (dB)
2402.	2390.00	H	60.04	74.0	-13.9
2402	2390.00	V	59.75	74.0	-14.2
2402	4804.00	H	65.42	74.0	-8.6
2402	4804.00	V	62.41	74.0	-11.6
2440	4880.00	H	67.59	74.0	-6.4
2440	4880.00	V	63.48	74.0	-10.5
2480	2483.50	H	61.43	74.0	-12.6
2480	2483.50	V	61.23	74.0	-12.8
2480	4960.00	H	65.39	74.0	-11.6
2480	4960.00	V	67.08	74.0	-6.9

Figure 35. 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

E.U.T Description Wireless Data Logger
Type Labdisc Gensci
Serial Number: 20111109943

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 (MHz)	Freq. (MHz)	Polarity (H/V)	Average Reading (dBµV/m)	Avg. Specification (dB µV/m)	Avg. Margin (dB)
2402	2390.00	H	47.3	54.0	-6.7
2402	2390.00	V	47.1	54.0	-6.9
2402	4804.00	H	45.25	54.0	-8.7
2402	4804.00	V	43.55	54.0	-10.5
2440	4880.00	H	45.42	54.0	-8.6
2440	4880.00	V	43.70	54.0	-10.3
2480	2483.50	H	47.9	54.0	-6.1
2480	2483.50	V	48.0	54.0	-6.0
2480	4960.00	H	45.51	54.0	-8.5
2480	4960.00	V	46.04	54.0	-8.0

Figure 36. 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

12.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1 Year
RF Filter Section	HP	85420E	3705A00248	December 12, 2011	1 Year
Antenna Biconical	ARA	BCD 235/B	1041	November 12, 2011	1 Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	March 29, 2012	1 Year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 27, 2011	2 Years
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 14, 2012	2 Years
Horn Antenna	ARA	SWH-28	1007	January 26, 2011	2 Years
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	November 5, 2011	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 23, 2011	1 Year
Spectrum Analyzer	HP	8546E	3442A00275	January 11, 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

Figure 37 Test Equipment Used

12.5 Field Strength Calculation 30 – 1000 MHz

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

$$[dB\mu v/m]\ FS = RA + AF + CF$$

FS:	Field Strength [dBμv/m]
RA:	Receiver Amplitude [dBμv]
AF:	Receiving Antenna Correction Factor [dB/m]
CF:	Cable Attenuation Factor [dB]

Example: FS = 30.7 dBμV (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dBμV

No external pre-amplifiers are used.

13. Radiated Power Spectral Density

[In accordance with section 15.247(d)]

13.1 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters.
The transmitter unit operated with normal modulation. The EMI receiver was set to 1 MHz resolution BW. The EUT was set up as shown in Figure 1, and its proper operation was checked.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
The E.U.T. was tested in three operating channels and frequencies
(1 (2.402 GHz); 8 (2.441 GHz); 14 (2.480 GHz)).

Then the EMI receiver was set to 3 kHz resolution BW, span of 300.0 kHz, and sweep time of 100 seconds. The spectrum peaks were located at each of the 3 operating frequencies.

Radiated peak output power levels were converted to power level according to the formula as shown below:

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

13.2 Test Results

Frequency	E	Spectral Density Result	Antenna Gain	Antenna Distance	Calculated Results	Calculated Results	Spec.	Margin
(MHz)	(dbµV/m	(V/m)	(dBi)	(m)	(mW)	(dBm)	(dBm)	(dB)
2402	90.15	0.032	0.5	3	0.27	-5.69	8.0	-13.7
2441	90.33	0.033	0.5	3	0.29	-5.38	8.0	-13.4
2480	83.01	0.014	0.5	3	0.05	-13.01	8.0	-21.0

Figure 38 Test Results

JUDGEMENT: Passed by 13.4 dB

See additional information in *Figure 38* to *Figure 40*.

TEST PERSONNEL:

Tester Signature: _____ Date: 20.11.12

Typed/Printed Name: I. Siboni

Radiated Power Spectral Density

E.U.T Description	Wireless Data Logger
Type	Labdisc Gensci
Serial Number:	20111109943

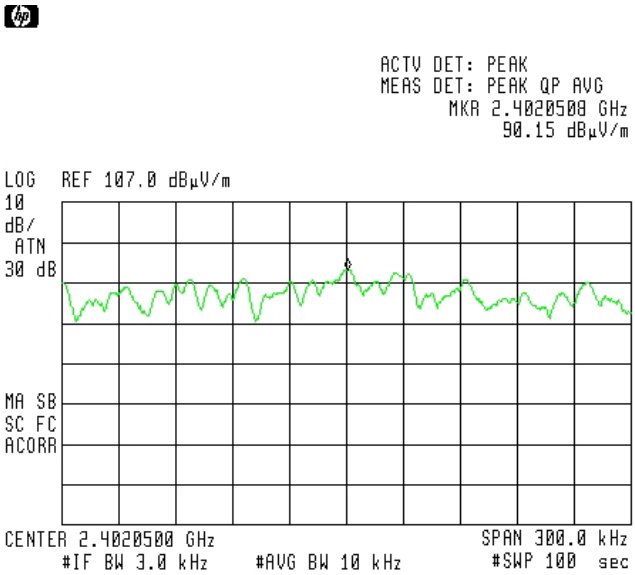


Figure 39 — 2402 MHz

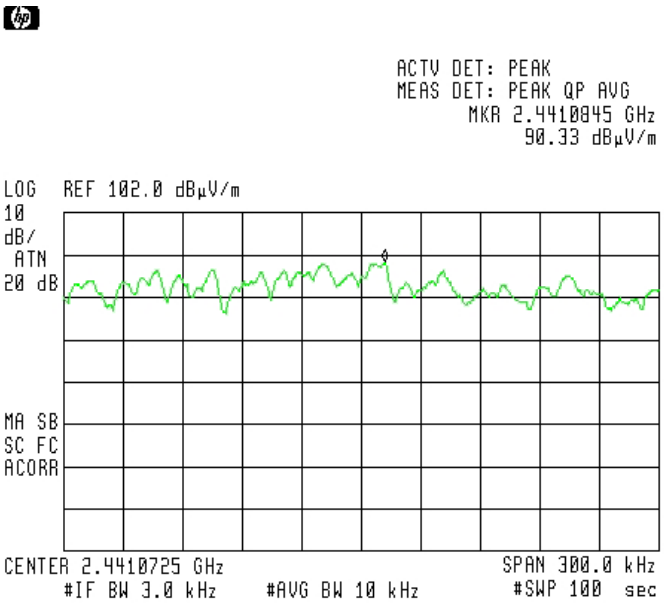


Figure 40 — 2441 MHz

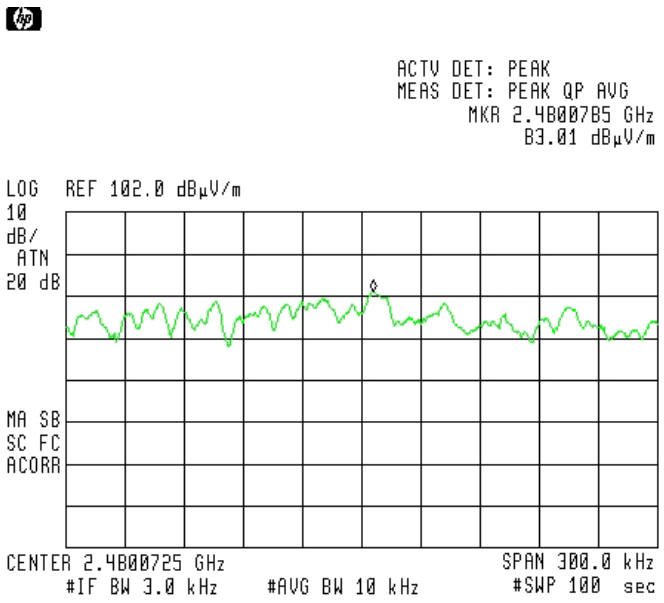


Figure 41 — 2480 MHz

13.3 Radiated Power Spectral Density Test Equipment Used.

Transmitted Power Density

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	December 12, 2011	1 year
RF Section	HP	85420E	3705A00248	December 12, 2011	1 year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 27, 2012	2 years
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

Figure 42 Test Equipment Used

14. Antenna Gain/Information

The antenna gain is 0.5 dBi.

"High Frequency Ceramic Solutions"

2450 MHz Antenna — **P/N 2450AT18B100**
Detail Specification: 08/10/09 — Page 1 of 3

General Specifications

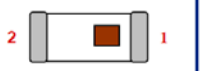
Part Number	2450AT18B100
Frequency Range	2400 - 2500 Mhz
Peak Gain	0.5 dBi typ. (XZ-V)
Average Gain	-0.5 dBi typ. (XZ-V)
Return Loss	9.5 dB min.

Input Power	3W max.
Impedance	50 Ω
Operating Temperature	-40 to +85°C
Reel Quanity	3,000

P/N Suffix	Packaging Style	Bulk	Suffix = S	Eg. 2450AT18B100S
		T & R	Suffix = E	Eg. 2450AT18B100E
	Termination Style	100% Tin	Suffix = None	Eg. 2450AT18B100(E or S)
		Tin / Lead	Please consult Factory	

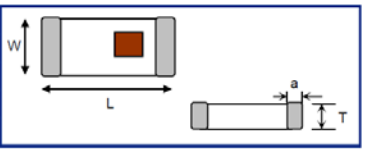
Terminal Configuration

No.	Function
1	Feeding Point
2	NC



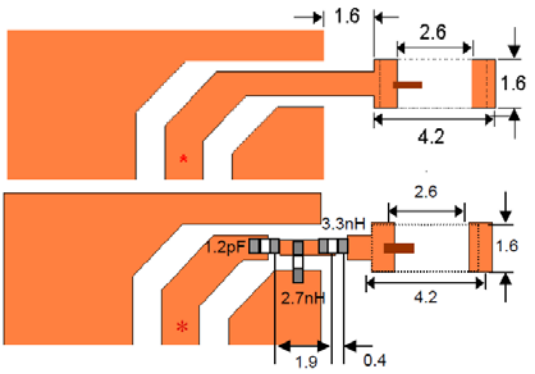
Mechanical Dimensions

	In	mm
L	0.126 ± 0.008	3.20 ± 0.20
W	0.063 ± 0.008	1.60 ± 0.20
T	0.051 +.004/-.008	1.30 +0.1/-0.2
a	0.020 ± 0.012	0.50 ± 0.30



Mounting Considerations

Mount these devices with brown mark facing up. Units: mm
Line width should be designed to provide 50 Ω impedance matching characteristics.



a) Without Matching Circuits

b) With Matching Circuits

JTI P/N for Matching Circuit:
Cap (1.2pF): 500R07S1R2BV4T
Inductor (2.7nH): L-07C2N7SV6T
Inductor (3.3nH): L-07C3N3SV6T

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15. R.F Exposure/Safety

Typical use of the E.U.T. is attached to an iPod or iPhone. The distance between the E.U.T. and the user in the worst case application, is 10 cm.

Calculation of Maximum Permissible Exposure (MPE)

Based on Section 1.1307(b)(1) 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

P_t- Transmitted Power (Peak) (Calculated, includes antenna gain) 5.25 mw

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

G_T- Antenna Gain, 0.5 dBi = 1.12 numeric

R- Distance from Transmitter using 10 cm worst case

(c) The peak power density is :

$$S_p = \frac{5.25}{4\pi(10)^2} = 0.004\frac{mW}{cm^2}$$

(d) This is below the FCC limit.

16. APPENDIX B - CORRECTION FACTORS

16.1 Correction factors for CABLE

**from EMI receiver
to test antenna
at 3 meter range.**

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3
20.0	0.6
30.0	0.8
40.0	0.9
50.0	1.1
60.0	1.2
70.0	1.3
80.0	1.4
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

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	7.3
1400.0	7.8
1600.0	8.4
1800.0	9.1
2000.0	9.9
2300.0	11.2
2600.0	12.2
2900.0	13.0

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".

16.2 Correction factors for CABLE

from EMI receiver to test antenna at 3 meter range.

FREQUENCY (GHz)	CORRECTION FACTOR (dB)
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.

16.3 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.

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 38M3O.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".*

16.4 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".*

16.5 Correction factors for BICONICAL ANTENNA

Type BCD-235/B,
at 3 meter range

FREQUENCY (MHz)	AFE (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".

16.6 Correction factors for Double-Ridged Waveguide Horn

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

FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)	FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (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			

16.7 Correction factors for ***Horn Antenna***

Model: SWH-28
at 1 meter range.

FREQUENCY (GHz)	AFE (dB /m)	Gain (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

16.8 Correction factors for ACTIVE LOOP ANTENNA

Model 6502
S/N 9506-2950

FREQUENCY	Magnetic Antenna Factor	Electric Antenna Factor
(MHz)	(dB)	(dB)
.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