DATE: 02 April 2012

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

CE EMC Test Report

for

Globisens Ltd.

Equipment under test:

Wireless Data Logger

Labdisc Gensci

Written by: _____

Y. Raz, Documentation

Approved by: _____

D. Yadidi, Test Engineer

Approved by: _____

I. Raz, EMC Laboratory Manager

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1. General Information

1.1 Administrative Information

Manufacturer:	Globisens Ltd.
Manufacturer's Address:	38 Haperachim St., Raanana, 43399, Israel Tel: +972-9-7740257
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:	11/03/12
Start of Test:	11/03/12
End of Test:	12/03/12
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 71100
Test Specifications:	See Section 2

1.2 Abbreviations and Symbols

The following abbreviations and symbols are applicable to this test report:

A/m	ampere per meter
AC	alternating current
AM	amplitude modulation
ARA	Antenna Research Associates
Aux	auxiliary
Avg	average
CDN	coupling-decoupling network
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dbµV	decibel referred to one microvolt
dbµV/m	decibel referred to one microvolt per meter
DC	direct current
EFT/B	electrical fast transient/burst
EMC	electromagnetic compatibility
ESD	electrostatic discharge
E.U.T.	equipment under test
GHz	gigahertz
HP	Hewlett Packard
Hz	Hertz
kHz	kilohertz
kV	kilovolt
LED	light emitting diode
LISN	line impedance stabilization network
m	meter
mHn	millihenry
MHz	megahertz
msec	millisecond
N/A	not applicable
per	period
QP	quasi-peak
PC	personal computer
RF	radio frequency
RE	radiated emission
sec	second
V	volt
V/m	volt per meter
VRMS	volts root mean square

1.3 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. 861911.
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-3006, R-2729, T-1877, G-245.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025A-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.

2. Applicable Documents

2.1	**EMC Directive: 2004**	*DIRECTIVE 2004/108/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC*
2.2	**EN 61326-1: 2006**	*Electrical Equipment for measurement, control, and laboratory use-EMC requirements. Part 1. General requirements*
2.3	**CISPR 11: 2003**	*Limits and methods of measurement of radio disturbance characteristics of industrial, scientific, and medical (ISM) radio-frequency equipment*
2.4	**IEC 61000-4-2: 2001**	*Electromagnetic Compatibility (EMC)- Part 4: Testing and Measurement Techniques-Section 2: Electrostatic discharge immunity tests: - Basic EMC publication.*
2.5	**IEC 61000-4-3: 2002**	*Electromagnetic Compatibility (EMC),- Part 4: Testing and Measurement Techniques- Section 3: Radiated, radio frequency, electromagnetic field immunity test – Basic EMC Publication.*
2.6	**IEC 61000-4-8: 1993**	*Electromagnetic compatibility (EMC), Part 4: Testing and measurement techniques, Section 8. Power frequency magnetic field immunity test.*

3. Test Site Description

3.1 Location:

The Electromagnetic Compatibility Test Facility of I.T.L. (Product testing) Ltd. Is located at
Telrad Industrial Park, Lod, 71100 Israel.
Telephone: +972-8-9153100
Fax: +972-8-9153101

3.2 Open Site:

The OATS is located on a one floor-building roof. The OATS consists of 3 meter and 10 meter ranges, using a 21.5m X 8.5m solid metal ground plane, a remote controlled turntable and an antenna mast.

3.3 Ground Plane:

The ground plane is made from steel plates, which are welded continuously together. The Ground plane is lies and welded on welded steel construction with vias to allow for water drainage.
All the power, control, and signal lines to the turntable and the 3 m and 10m antenna mast outlets are routed in shielded conduits under the plane to the control building.

3.4 Antenna Mast:

ETS model 2070-2. The antenna position and polarization are remote controlled via Fiber Optical Link using ETS/EMCO Dual Controller Type 2090. The antenna position is adjustable between 1-4 meters. Pressurized air is used to power changing the polarity of the antenna.

3.5 Turntable:

ETS model 2087 series. The position of the turntable is remote-controlled via Fiber Optic Link, using ETS/EMCO Dual Controller Type 2090. The turntable is mounted in a pit and its surface is flush with the Open Site Ground Plane. Brushes near the periphery of the turntable ensure good conductive connection to the ground plane. The Turntable maximum load is 1250 Kg.

3.6 EMI Receiver:

Type HP8542E, including HP85420E R.F. filter manufactured by Hewlett-Packard, being in full compliance with CISPR 16 requirements.

3.7 E.U.T. Support:

Table mounted E.U.T.s are supported during testing on 80 cm high all-wooden tables (no metal nails or screws).

3.8 Test Equipment:

See details in Section 6.

4. Summary of Test Results

Test	Results
Radiated Emissions CISPR 11: 2003, Class **B**	The E.U.T met the performance requirements of the specification. The margin between the emission level and the specification limit is 14.8 dB in the worst case at the frequency of 220.00 MHz, vertical polarization.
ESD IEC 61000-4-2: 2001 Air Discharge, 8kV Contact Discharge, 4kV	The E.U.T met the performance requirements of the specification.
Radiated Immunity IEC 61000-4-3: 2002 (80-1000; 1400-2000 MHz) 3 V/m, 80% A.M. by 1kHz (2000-2700 MHz) 1 V/m, 80% A.M. by 1kHz	The E.U.T met the performance requirements of the specification.
Immunity to Magnetic Field IEC 61000-4-8: 1993 30 A/m, 50Hz	The E.U.T met the performance requirements of the specification.

5. Equipment Under Test (E.U.T.) 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.

6. List of Test Equipment

6.1. Immunity Tests

Equipment indicated below by an "X" used in **Tests IEC 61000-4:-2,-3,-4,-5,-6,-8,-11.**

Test equipment calibration is in accordance with ITL Q.A. Procedure PM 110, "Calibration Control Procedure", which complies with ISO 9002 and ISO/IEC Guide 17025.

Instrument	Manuf.	Model	Serial No.	Used in Test IEC 61000-4:						
				-2	-3	-4	-5	-6	-8	-11
Transient Generator	KeyTek	CEMASTER	9612436							
ESD Simulator	CDI	ESD 2000i	426	X						
Isotropic Field Probe	AR	EP-2080	23190		X					
RF Amplifier	AR	100W1000M1	19842		X					
Isotropic Field Monitor	AR	FM-2000	19719		X					
Biconilog Antenna	EMCO	3142B	1078		X					
Horn Antenna	A.H. systems	SAS 200/571	199		X					
RF Amplifier	OPHIR	5303081	1002		X					
RF Amplifier	IFI	SMX100	1194-4537		X					
RF Amplifier	IFI	M100	M612-0208		X					
Signal Generator	HP	8657A	2849U01094		X					
BulkF Current Probe	FCC	F-120-9	105							
CDN	FCC	FCC-801-M3-16A	9962							
Transient Wave- form Monitor	CDI	TWM-100	3233							
Phase Control Amplifier	CDI	PCA-1000	3217							
Single Phase Isolated Backfilter	CDI	CDI-1kVA	3221							
Surge Generator	CDI	CDI-1000i	3153							
1.2/50; 8/20usec AC Surge Unit	KeyTek	E551	9512398							
Surge Generator	EM TEST	UCS 500-M	1198-45							
AC Power Source	EM TEST	UCS 500-M	1198-45							
Current Generator	FCC	F-1000-4-8-125A	9838						X	
Magnetic Loop	FCC	F-1000-4-8/9/10-L-1M	9836						X	

6.2. Emission Tests

The equipment indicated below by an “X” was used for testing Conducted Emission (**CE**), Radiated Emission (**RE**), and **IEC 61000-3-2;3**

Test equipment calibration is in accordance with ITL Q.A. Procedure PM 110 "Calibration Control Procedure", which complies with ISO 9002 and ISO/IEC Guide 17025.

Instrument	Manufacturer	Model	Serial No.	Used in Test			
				CE	RE	-2	-3
LISN	EMCO	3810/2BR	1297				
Transient Limiter	HP	11947A	3107A03041				
RF Amplifier	HP	8447F	3113A06386		X		
Current Probe	FCC	F51	163				
EMI Receiver	Rohde & Schwarz	ESCI7	100724				
EMI Receiver	HP	8546A	3650A00365		X		
Receiver RF Filter Section	HP	85460A	3650A00365		X		
EMC Analyzer	HP	HP8593	3536A00120		X		
Biconilog Antenna	EMCO	3142B	1250		X		
Antenna Mast	ETS	2070-2	ETS		X		
Turntable	ETS	2087	ETS		X		
Mast & Table Controller	ETS/EMCO	2090	ETS/EMCO		X		
Power Analysis System	EM Test	DPA 500	0501/09				
AC Power Source	EM Test	ACS 500	1101/01				

7. E.U.T. Performance Verification

7.1. Mode of Operation

The E.U.T. was operated measuring room humidity and transmitting at 2.4 GHz. The humidity measurement was updated every second.

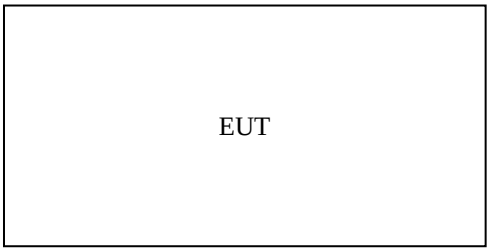

Figure 1. Test Set-up

7.2. Monitoring of E.U.T.

The updating of the humidity measurement was observed on the E.U.T. LCD display.

7.3. Definition of Failure

Updating of the humidity measurement stops and E.U.T. turns off.

8. Radiated Emission

8.1. Test Specification

30-1000 MHz, CISPR 11: 2003, CLASS B

8.2. Test Procedure

The E.U.T operation mode and test set-up are as described in section 7.1.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room. 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 effect of varying the position of the cables was investigated to find the configuration that produces maximum emission. The configuration tested is shown in the photograph, *Figure 11. Radiated Emission Test*.

The frequency range 30-1000 MHz was scanned, and the list of the highest emissions was verified and updated accordingly.

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.

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 emissions were measured at a distance of 3 meters.

8.3. Test Results

The E.U.T met the requirements of the CISPR 11: 2003, CLASS B specification requirements.

The margin between the emission level and the specification limit is 14.8 dB in the worst case at the frequency of 220.00 MHz, vertical polarization.

The details of the highest emissions are given in *Figure 2*.

Radiated Emission

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

Specification: CISPR 11: 2003, Class B

Antenna Polarization: Horizontal/Vertical
Frequency range: 30 MHz to 1000 MHz
Test distance: 3 meters
Detectors: Peak, Quasi-peak

Frequency	Peak Reading	QP Reading	Antenna Polarization:		Limit	Margin
(MHz)	dBµV/m	dBµV/m	Hor.	Ver.	dBµV/m	(dB)
372.75	31.0	25.8	X		47.5	-21.7
674.00	32.9	27.2	X		47.5	-20.3
105.42	23.8	20.2		X	40.5	-20.3
220.00	29.6	25.7		X	40.5	-14.8
71.02	26.8	24.9		X	40.5	-15.6
91.60	28.6	23.8		X	40.5	-16.7
747.20	36.5	32.7		X	47.5	-14.8

Figure 2. Radiated Emission. Antenna Polarization: HORIZONTAL/VERTICAL Detectors: Peak, Quasi-peak

Note: 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.

9. Immunity to Electrostatic Discharge

9.1. Test Specification

IEC 61000-4-2: 2001

9.2. Test Procedure

In the case of tabletop equipment, the E.U.T. was set up on a wooden table 0.8 meter high on an insulating support 0.5 mm thick above the reference ground plane. In the case of floor-standing equipment, the EUT and cables were set up on an insulating support 0.1m above the reference plane. The test setup is shown in the photograph, Figure 12. Immunity to Electrostatic Discharge Test.

The locations of test points are shown in the photographs, *Figure 3* to *Figure 8*.

9.2.1 Air Discharge

Potentials of 2, 4, and 8 kV were applied near each applicable test point. At places where discharge occurred, the potential was applied twenty times; ten times negative and ten times positive. The E.U.T.'s performance during the test was verified as detailed in Section 7.

9.2.2 Contact Discharge

Potentials of 2, and 4 kV were applied to each applicable test point. In places where discharge occurred, the potential was then applied twenty times; ten negative and ten positive discharges. The E.U.T.'s performance during the test was verified as detailed in Section 7.

9.2.3 Indirect Discharge (vertical and horizontal coupling plane)

Potentials of 2, and 4 kV were applied to the center of the vertical edge of the coupling plane at a distance of 0.1 meters from the outer casing of the E.U.T. to each applicable test point.

The potential was applied 10 times for each polarity, to each location of the coupling plane. All four faces of the E.U.T. were completely illuminated.

An ESD of the same characteristics as for the vertical coupling plane was applied to the horizontal coupling plane, at each side of the E.U.T., at a distance of 0.1 meter from it's outer casing.

Additional details are shown in Figures 4-5 of IEC 61000-4-2: 2001.

The E.U.T.'s performance during the test was verified as detailed in Section 7

9.3. Test Results

The E.U.T met the requirements of specification IEC 61000-4-2: 2001.

Immunity to Electrostatic Discharge

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

Specification: IEC 61000-4-2: 2001

AIR:

Figure 3. ESD Test Points

Immunity to Electrostatic Discharge

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

Specification: IEC 61000-4-2: 2001

Contact:

AIR:

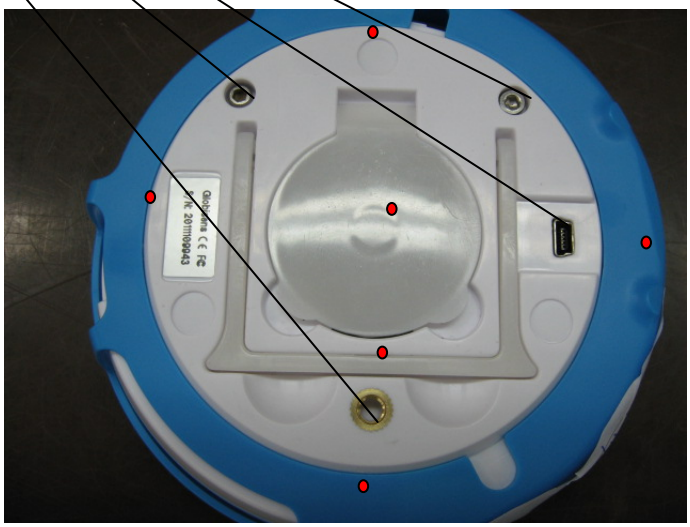

Figure 4. ESD Test Points

Immunity to Electrostatic Discharge

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

Specification: IEC 61000-4-2: 2001

AIR:

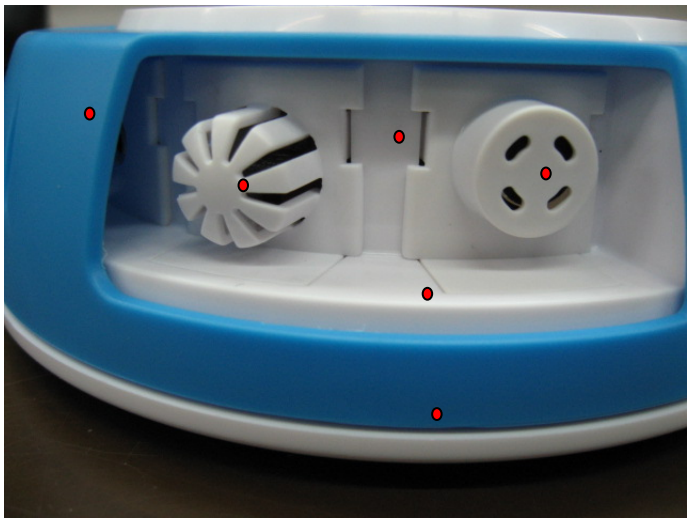

Figure 5. ESD Test Points

Immunity to Electrostatic Discharge

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

Specification: IEC 61000-4-2: 2001

Contact:

AIR:

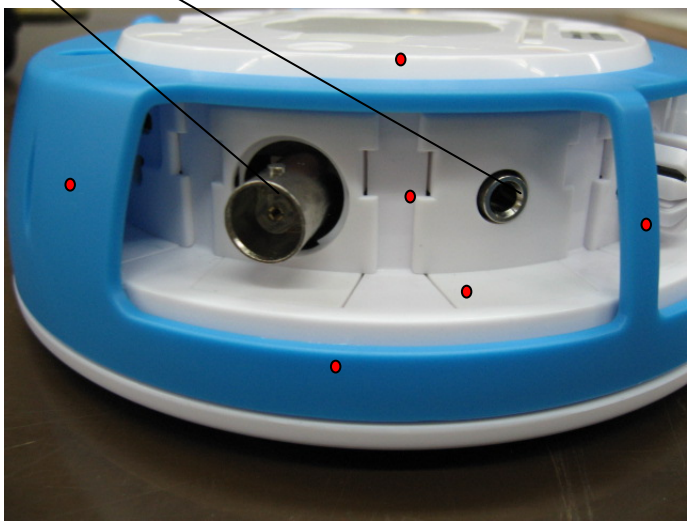

Figure 6. ESD Test Points

Immunity to Electrostatic Discharge

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

Specification: IEC 61000-4-2: 2001

Contact:

AIR:

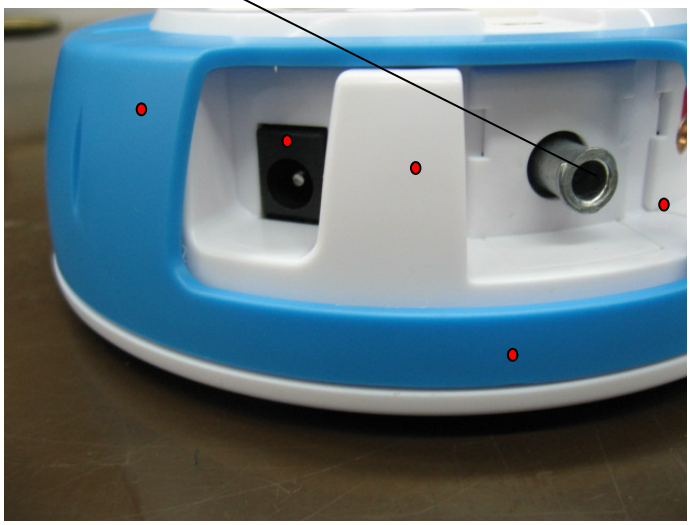

Figure 7. ESD Test Points

Immunity to Electrostatic Discharge

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

Specification: IEC 61000-4-2: 2001

Contact:

AIR:

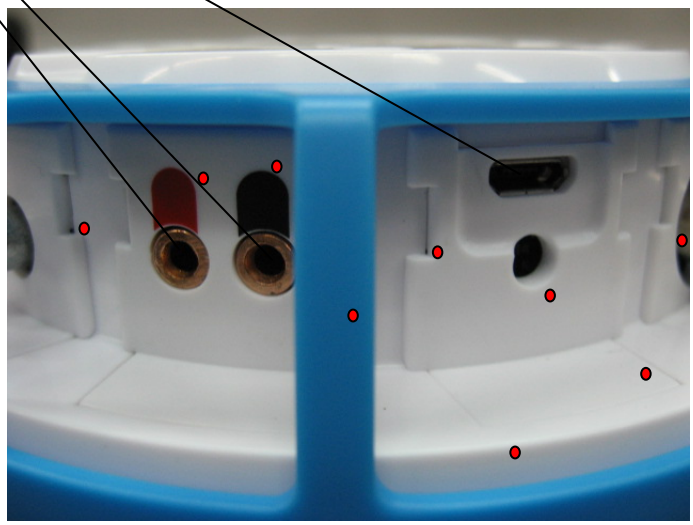

Figure 8. ESD Test Points

10. Immunity to Radiated Field

10.1. Test Specification

IEC 61000-4-3: 2002

10.2. Test Procedure

The E.U.T. was subjected to a field of 3V/m, amplitude modulated 80% by a 1kHz sinusoidal signal in the frequency range of 80-1000, a field of 3V/m, amplitude modulated 80% by a 1kHz sinusoidal signal in the frequency range 1400-2000 MHz and a field of 1V/m, amplitude modulated 80% by a 1kHz sinusoidal signal in the frequency range of 2000-2700 MHz.

The Radiated Field was applied in vertical and horizontal polarization using Biconilog antenna in the frequency range of 80-2000 MHz and horn antennas in the frequency range 2000-2700 MHz.

The Radiated Field was calibrated and tested for uniformity in accordance with Section 6.2 of IEC 61000-4-3.

The calibration values for the driver signal generator were based on the data given in I.T.L. "Radiated Immunity Calibration Test Report" No. PM-112R-IMM.

The frequency was swept using discrete increments having a value less than 1% of the fundamental frequency.

The test was carried out in a shielded room, as described in Section 3. The performance of the E.U.T was verified during the test as described in Section 7.

The test setup is illustrated in the photograph, *Figure 13. Immunity to Radiated Field Test.*

When a degradation in the performance of the E.U.T. was observed, the radiated field intensity level was reduced to the threshold level, and its value was recorded.

Note: Opinion and Interpretation:
The most sensitive surface of the E.U.T. was fully tested.
The most sensitive E.U.T. surface was determined as follows:
A preliminary radiated emission test in the frequency range
80 – 1000 MHz was performed inside the semi-anechoic chamber using an E-field probe and spectrum analyzer. The surface having the maximum radiation level was selected as the most sensitive surface.

10.3. Test Results

The E.U.T. passed the radiated immunity tests as required by the specification, IEC 61000-4-3: 2002.

Additional details are given in *Figure 9*.

Radiated Immunity

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

Specification: IEC 61000-4-3: 2002

Frequency (MHz)		Antenna Polarity	Specification (V/m)	PASS / FAIL	Immunity Threshold (V/m)
From	To				
80	1000	Horizontal	3.0	Pass	
80	1000	Vertical	3.0	Pass	
1400	2000	Horizontal	3.0	Pass	
1400	2000	Vertical	3.0	Pass	
2000	2700	Horizontal	1.0	Pass	
2000	2700	Vertical	1.0	Pass	

Figure 9. Immunity to Radiated Field

11. Immunity to Magnetic Field

11.1. Test Specification

IEC 61000-4-8: 1993

11.2. Test Procedure

The E.U.T. operation mode and test setup are described in section 7.1.

For table top equipment, the E.U.T. and cables were placed on an insulating support, 0.1m thickness, which was placed on a reference non-magnetic (aluminum) ground plane. The ground plane was placed on a wood table.

For floor standing equipment, the E.U.T. and cables were placed on an insulating support, 0.1m thickness, which was placed on a reference non-magnetic (aluminum) ground plane. The ground plane was placed on the floor.

The E.U.T. was subjected to the magnetic field by using an induction coil. The induction coil was rotated 90° to expose the E.U.T. to all the different field orientations.

For E.U.T.'s larger than the induction coil, the coil was shifted by steps of 50% (of the coil size), so that the volume of the E.U.T. was tested.

In case of performing the tests outside of a shielded room, it will be verified that the magnetic field level with the E.U.T. in "OFF", is at least 20 dB below the test level.

The test setup is illustrated in the photograph *Figure 14. Immunity to Magnetic Field*.

11.3. Test Results

The E.U.T. passed the Magnetic Immunity tests as required by specification IEC 61000-4-8: 1993.

Additional details are given in *Figure 10*.

Immunity to Magnetic Field

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

Specification: IEC 61000-4-8: 1993

	PASS / FAIL	Strength of Magnetic Field (A/m)
Vertical	Pass	30.0
Vertical at 90°	Pass	30.0
Horizontal	Pass	30.0

Figure 10. Immunity to Magnetic Field

12. Set Up Photographs

Figure 11. Radiated Emission Test

Figure 12. Immunity to Electrostatic Discharge Test

Figure 13. Immunity to Radiated Field Test

Figure 14. Immunity to Magnetic Field

13. Signatures of the E.U.T.'s Test Engineers

Test	Test Engineer Name	Signature	Date
Radiated Emissions	D. Yadidi		02.04.12
ESD	D. Yadidi		02.04.12
Radiated Immunity	D. Yadidi		02.04.12
Magnetic Immunity	D. Yadidi		02.04.12

14. APPENDIX A - CORRECTION FACTORS

14.1. Correction factors for CABLE

from EMI receiver
to test antenna
at 3 AND 10 meter range.

FREQUENCY	CORRECTION FACTOR		FREQUENCY	CORRECTION FACTOR
(MHz)	(dB)		(MHz)	(dB)
30	1.96		700	11.25
35	2.08		800	12.53
40	2.26		900	13.86
45	2.43		1000	14.86
50	2.59		1200	15.7
55	2.65		1400	17.05
60	2.86		1600	18.2
65	2.96		1800	19.4
70	3.04		2000	21.3
75	3.27			
80	3.41			
85	3.54			
90	3.68			
95	3.77			
100	3.93			
110	4.19			
120	4.41			
130	4.6			
140	4.83			
150	5.06			
160	5.35			
170	5.57			
180	5.7			
190	5.84			
200	6.02			
250	6.86			
300	7.59			
350	8.09			
400	8.7			
450	9.15			
500	9.53			
550	9.82			
600	10.24			
650	10.74			

NOTES:

1. The cable type is **RG-214/U**

14.2. Correction factors for GAIN Amplifier 8447F 30M-1.3G

FREQUENCY (MHz)	GAIN (dB)
20	27.16
30	27.18
50	27.15
100	27.01
200	26.48
500	27.54
1000	26.96
1100	26.69
1200	26.28
1300	25.85

14.3. Correction factors for Bilog ANTENNA

Model: 3142
Antenna serial number: 1250
3 meter range

FREQUENCY (MHz)	AFE (dB/m)	FREQUENCY (MHz)	AFE (dB/m)
30	18.4	1100	25
40	13.7	1200	24.9
50	9.9	1300	26
60	8.1	1400	26.1
70	7.4	1500	27.1
80	7.2	1600	27.2
90	7.5	1700	28.3
100	8.5	1800	28.1
120	7.8	1900	28.5
140	8.5	2000	28.9
160	10.8		
180	10.4		
200	10.5		
250	12.7		
300	14.3		
400	17		
500	18.6		
600	19.6		
700	21.1		
800	21.4		
900	23.5		
1000	24.3		

15. APPENDIX B - MEASUREMENT UNCERTAINTY

15.1. 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