



EMC Test Report

Full Compliance Measurements



SuperChrono

Measurements performed 2012-03-08

Certificate of Test

Equipment Under Test

Manufacturer: Cadson HB
Type of product: Chronograph
Model number: 1
Serial Number: 001
Tested on behalf of: Cadson HB

Summary

The equipment under test described in this report

complies with does not comply with

- Emission according to EN 61000-6-3:2007, Edition 2, Emission standard for residential, commercial and light-industrial environments.
- Immunity according to EN 61000-6-1:2007, Edition 2, Immunity for residential, commercial and light-industrial environments.

Provided that modifications described in clause 5 are implemented.

The test results in this report only apply to the specified sample of EUT.

Exclusions

No exclusions were made from the standards.

Date: Mar 12, 2012

Tested by: 

Michael Sohlberg

Approved by: 

Johan Bergstrand

Note: This is an electronic copy. The original is a signed and stamped paper version.

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Document History

Revision	Doc namn	Author	Comments
1	TR_CAD120308EMC001	Michael Sohlberg	Official revision.

1. Customer Information

Company: Cadson HB
Tomtebogatan 4
11339 Stockholm

Contact person: Mikael Sundberg

2. EUT (Equipment under test)

Type of EUT: Chronograph

Brand name of EUT: SuperChrono

Model/Name of EUT: 1

S/N of EUT: 001

Manufacturer: Cadson HB

Configuration:

Unit type	Model/Name	S/N
Main EUT	SuperChrono	001

3. General conditions

Measuring distance	
Measurement type	Distance
Radiated emission	3 m
Radiated immunity	3 m

EUT voltage: 7 VDC (internal battery)

Attached cables: -

Auxiliary equipment: -

Temperature: 20°C

Humidity: 16% R.H.

Operator: Michael Sohlberg

4. Abbreviations and explanations

EUT: Equipment under test
VDI: Voltage dips and interruptions
ESD: Electrostatic discharge

5. Modifications

The following modifications were made to the EUT in order to comply with the specified standards:

1. One decoupling capacitor of 0,1 μ F at the each sensor OP amplifier output to the microprocessor.

6. Performance Criteria

- A: During testing, normal performance within the specification limits.
- B: During testing, temporary degradation, or loss of function or performance which is self-recovering.
- C: During testing, temporary degradation, or loss of function or performance which requires operator intervention or system reset occurs.

7. General Test Information

The EUT is an equipment that measures the sound wave of a bullet, projectile or similar via two microphones and calculates the velocity of the bullet. The EUT is a battery supplied unit and has no other external connections.

The EUT was setup to activate significant functions which can cause EMC related problems. The functions of EUT were supervised via display.

8. Test Summary

8.1. Emission

Measurement	Basic Standard	Comment	Result
Radiated Emission 30 -1000 MHz	CISPR 16-2-3	Requirements (Quasi-peak) 3m distance: 30MHz – 230MHz: 40dB μ V/m 230MHz – 1000MHz: 47dB μ V/m	PASS

8.2. Immunity

Measurement	Basic Standard	Comment	Requirement Criterion	Result
ESD	EN 61000-4-2	±4kV indirect discharges into horizontal and vertical coupling planes. ±4kV contact discharges. ±8kV air discharges.	B	PASS (A)

Measurement	Basic Standard	Comment	Requirement Criterion	Result
Radiated Immunity 80 – 1000MHz	EN 61000-4-3	3V/m. 4 directions were tested. Horizontal and Vertical polarization on each direction. 1s dwell time. 80%, 1kHz AM modulation.	A	PASS (A)
Radiated Immunity 1.4–2.7GHz	EN 61000-4-3	3V/m up to 2GHz. 1V/m above 2GHz. 4 directions were tested. Horizontal and vertical polarization on each direction. 1s dwell time. 80%, 1kHz AM modulation.	A	PASS (A)

9. Radiated Emission

Result: PASS

Test setup

The EUT was tested in a semi anechoic room with a measuring distance of 3 meters. A BiConLog antenna was used for these measurements.

Test setup photos





9.1. Horizontal Polarization 30 – 1000MHz

Emission Radiated

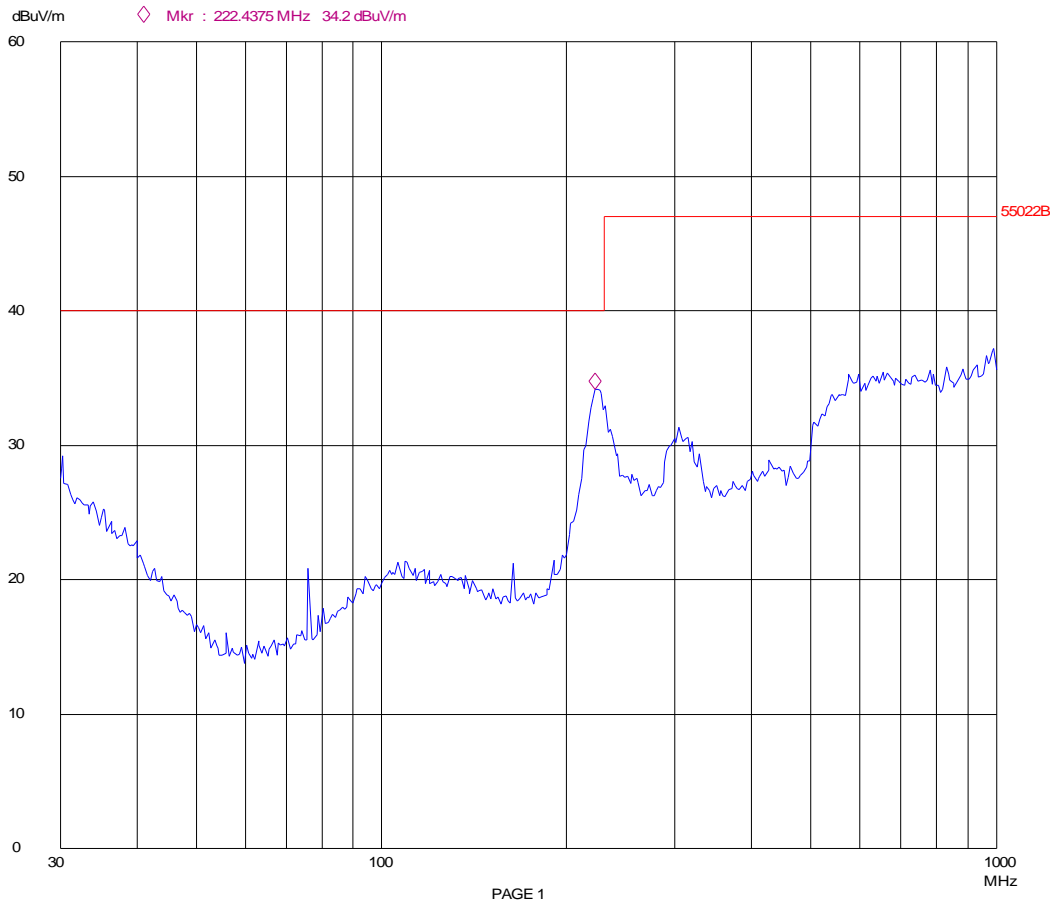
08. Mar 12 11:12

EUT: SuperChrono
Manuf: Cadson HB
Op Cond: Operating
Operator: Michael Sohlberg
Test Spec: CISPR 16-2-3
Comment: Horizontal

Overview Scan Settings (1 Range)

Frequencies				Receiver Settings			
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
30M	1000M	62.5k	120k	PK	1ms	5dBLN	ON

Transducer No.	Start	Stop	Name
5	16 30M	2750M	CABLELB
21	30M	2750M	CBL6112B



Note: Graph shows pre-scan peak detector values and the critical frequencies are selected for final measurements.

Final Measurement Values

Frequency [MHz]	Peak Detector [dB μ V/m]	Quasi Peak Detector [dB μ V/m]	Quasi- Peak Limit [dB μ V/m]	Margin to Quasi-peak Limit [dB]	Result
30,1250	29,1	22,3	40,0	17,7	PASS
76,0000	20,8	9,9	40,0	30,1	PASS
164,0000	21,4	13,5	40,0	26,5	PASS
222,4375	35,0	30,1	40,0	9,9	PASS
226,5625	34,8	30,1	40,0	9,9	PASS
304,1875	31,4	25,4	47,0	21,6	PASS

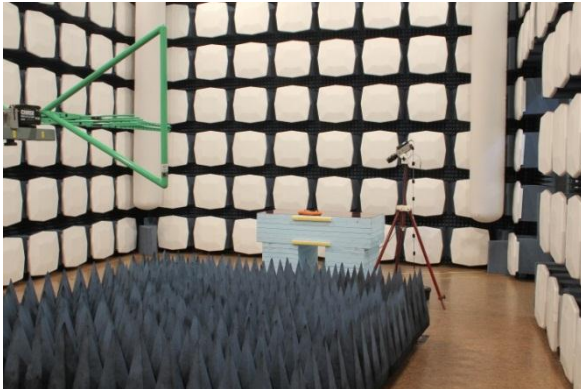
Final Measurement Values

Frequency [MHz]	Peak Detector [dB μ V/m]	Quasi Peak Detector [dB μ V/m]	Quasi- Peak Limit [dB μ V/m]	Margin to Quasi-peak Limit [dB]	Result
102,6250	26,0	14,2	40,0	25,8	PASS
164,0000	21,9	13,2	40,0	26,8	PASS
225,3125	25,4	19,4	40,0	20,6	PASS
408,6250	29,0	20,5	47,0	26,5	PASS
877,3750	36,0	28,1	47,0	18,9	PASS
948,3125	36,1	28,9	47,0	18,1	PASS

10. Radiated Immunity

Result: PASS

Requirement: Criterion A
Test Result: Criterion A



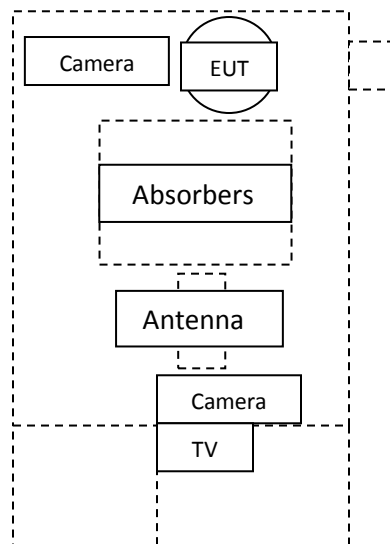
Test Description

The EUT was placed on a Styrofoam table at a distance of 3 meters from the antenna. Absorbers were placed on the floor in front of the antenna. The EUT was then subjected to radiated EM fields from 80 – 2700MHz. From 80MHz – 1GHz a biconlog antenna was used and above 1GHz a horn antenna was used.

The RF signal was swept in frequency with a 1% interval and with a dwell time of 1.25 second per frequency.

The EUT was verified by monitoring the display and shown velocity values.

Test setup



Required Field Strength			
Start freq	Stop freq	Strength	Modulation
80MHz	1000MHz	3V/m	AM 80%, 1kHz
1400MHz	2000MHz	3V/m	AM 80%, 1kHz
2000MHz	2700MHz	1V/m	AM 80%, 1kHz

Applied Field Strength			
Start freq	Stop freq	Strength	Modulation
80MHz	1000MHz	3V/m	AM 80%, 1kHz
1400MHz	2000MHz	3V/m	AM 80%, 1kHz
2000MHz	2700MHz	1V/m	AM 80%, 1kHz

Detailed Test Results

Frequency	Modulation	Horizontal Polarization		Vertical Polarization	
		Orientation	Result	Orientation	Result
80MHz-1000MHz	80% AM, 1kHz	Front	PASS (A)	Front	PASS (A)
		Left	PASS (A)	Left	PASS (A)
1400MHz – 2700MHz	80% AM, 1kHz	Front	PASS (A)	Front	PASS (A)
		Left	PASS (A)	Left	PASS (A)

Comments: No problems found.

11. ESD

Result: PASS

**Requirement: Criterion B
Test Result: Criterion A**

Test Description

Indirect discharges: 25 pulses each of $\pm 4\text{kV}$ was injected into the horizontal coupling plane at one position and into the vertical plane at four sides of the EUT.

Contact discharges: 10 pulses each of $\pm 4\text{kV}$ was injected into the EUT.

Air discharges: No air discharges appeared.

The EUT was verified by monitoring the display and shown velocity values.

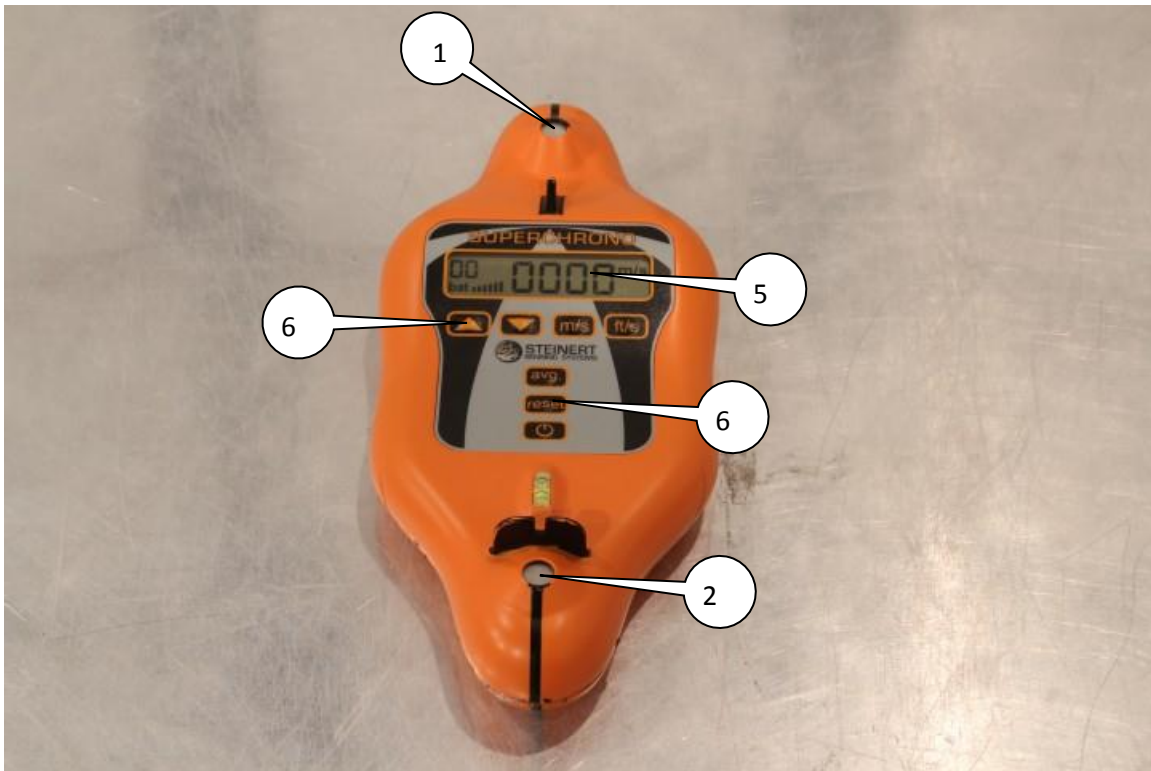
Detailed Test Results

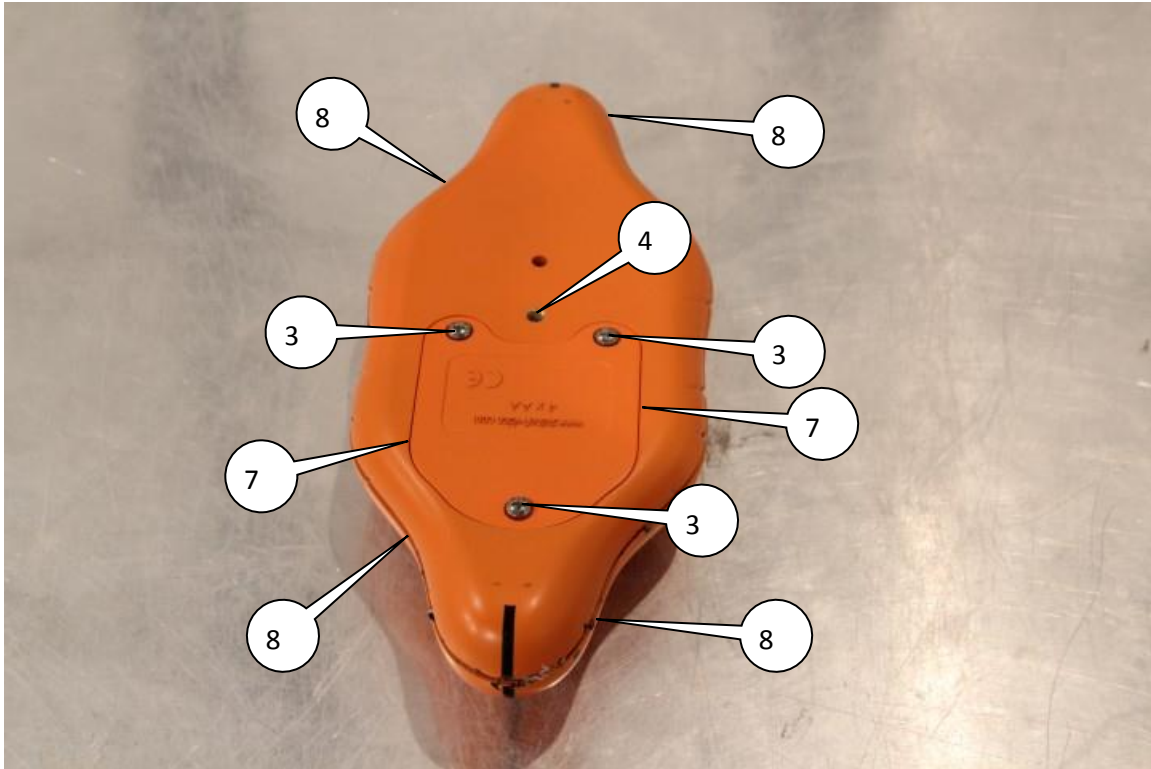
Test	Injection point	Comment	Requirement	Result	Ref
Indirect discharges	Horizontal coupling plane	-	B	A	-
Indirect discharges	Vertical coupling plane	Four sides of the EUT.	B	A	-
Contact discharges	Upper sensor metal part	No problems found.	B	A	1
Contact discharges	Lower sensor metal part	No problems found.	B	A	2
Contact discharges	Battery lid screws	No problems found.	B	A	3
Contact discharges	Backside attachment	No problems found.	B	A	4
Contact discharges	Battery holder terminals	5 pulses each of $\pm 4\text{kV}$ was injected into the battery holder terminals.	B	A	-
Air discharges	Display	No problems found.	B	A	5
Air discharges	Buttons	No problems found.	B	A	6
Air discharges	Around battery lid joints	No problems found.	B	A	7
Air discharges	Around chassis joints	No problems found.	B	A	8

Comment: No problems found.



Number refers to the ref column in the detailed test result chart above.





12. Measuring Test Equipment

12.1. Emission

Equipment	Model	Serial Number	Used
EMI Test Receiver	Rohde & Schwarz ESCS-30	826547/0002	<input checked="" type="checkbox"/>
Biconical Antenna 30 – 300MHz	EMCO 3110B	9804-3100	<input type="checkbox"/>
Logperiodic Antenna 300-1000MHz	EMCO 3147	9909-1379	<input type="checkbox"/>
BiConLog Antenna	Chase CBL6112B	2473	<input checked="" type="checkbox"/>
Antenna Tower	EMCO 2071	9805-2157	<input checked="" type="checkbox"/>
Turntable	EMCO 2090	9804-1322	<input checked="" type="checkbox"/>
LISN	Rohde & Schwarz ESH3-Z5	825562/009	<input type="checkbox"/>
LISN	Rohde & Schwarz ENV216	100371	<input type="checkbox"/>
Pulse Limiter	Rohde & Schwarz ESH3-Z2	357.8810.52	<input type="checkbox"/>
Current Sensing Probe	A.H. Systems BCP-516	130	<input type="checkbox"/>
ISN	Teseq ISN T4	23022	<input type="checkbox"/>
ISN	Teseq ISN ST08	26415	<input type="checkbox"/>
Harmonics & Flicker analyzer	TTI HA1600A	289850	<input type="checkbox"/>

12.2. Immunity

Signal Generator	Rohde & Schwarz SME06	825782/008	<input checked="" type="checkbox"/>
BiConLog Antenna	Chase CBL6112B	2473	<input checked="" type="checkbox"/>
Horn Antenna	EMCO 3115	9806-5510	<input checked="" type="checkbox"/>
RF Power Amplifier 800-4200MHz	Amplifier Research 50S1G4M2	23637	<input checked="" type="checkbox"/>
RF Power Amplifier 80-1000MHz	Amplifier Research 200W1000M3A	23633	<input checked="" type="checkbox"/>
RF Power Amplifier 150kHz – 80MHz	Amplifier Research 150A220M4	23512	<input type="checkbox"/>
Effect Meter	Rohde & Schwarz NRVD	849708/029	<input checked="" type="checkbox"/>
Effect Meter Probe	Rohde & Schwarz NRV-Z5	825598/019	<input checked="" type="checkbox"/>
Effect Meter Probe	Rohde & Schwarz NRV-Z5	825598/020	<input checked="" type="checkbox"/>
CDN 5 poles	Fischer Custom Communications FCC-801-M5-16A	9814	<input type="checkbox"/>
CDN 3 poles	Fischer Custom Communications FCC-801-M3-16A	9885	<input type="checkbox"/>
CDN 2 poles	Fischer Custom Communications FCC-801-M2-16A	9844	<input type="checkbox"/>
CDN 1 pole	Fischer Custom Communications FCC-801-M1-16A	9823	<input type="checkbox"/>
EM Clamp	Fischer Custom Communications F-2031-23	117	<input type="checkbox"/>
Attenuator 10dB	Narda 769-10	03998	<input type="checkbox"/>
Surge/Burst/Power Failure	Haefely ECOMPACT 4	154214	<input type="checkbox"/>
Capacitive Clamp	Schlöder SFT 400		<input type="checkbox"/>
ESD simulator	Schlöder SESD 200	805240	<input checked="" type="checkbox"/>
BCI Clamp	A.H. Systems ICP 523	50	<input type="checkbox"/>