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Appendices -

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233027C

Date of handing in: 18.03.2013

Tested by:



Timo Hietala, Test Engineer

Reviewed by:



Timo Leismala, Test Manager

SORT OF EQUIPMENT:

Heart beat monitor

MARKETING NAME:

FirstBeat

TYPE:

Bodyguard 2

MANUFACTURER:

Firstbeat Technologies Oy, Finland

CLIENT:

Firstbeat Technologies Oy, Finland

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Nemko Oy

FCC REG. NO.

359859 October 20, 2011

IC FILE NO.

2040F-1 November 22, 2012

SUMMARY:

In regard to the performed tests the equipment under test fulfils the requirements defined in the test specifications, see page 2 for details

The test results are valid for the tested unit only. Without a written permission of Nemko Oy it is allowed to copy this report as a whole, but not partially.

Summary of performed tests and test results

<i>Section in CFR 47</i>		<i>Result</i>
15.109	Radiated emissions	PASS
15.107	AC power line conducted emissions	PASS

<i>Section in IC ES-003</i>		<i>Result</i>
6.2	Radiated emissions	PASS
6.1	AC power line conducted emissions	PASS

Explanations:

- PASS The EUT passed that particular test.
FAIL The EUT failed that particular test.
X The measurement was done, but there is no applicable performance criteria.
NA The measurement is not applicable (battery powered device)

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1. EUT and Accessory Information

1.1 EUT description

The EUT is a heart beat monitor.

Operating Voltage: **3.7 VDC**

The highest internal clock at any time is 8MHz at measuring mode and 32MHz at USB mode. The highest test frequency according to CISPR 22 Ed. 6.0 is 1000 MHz.

1.2 EUT and accessories

Equipment under test (EUT):

- Heart beat monitor, type Bodyguard 2, S/N: BG101300027

Peripheral devices:

- IBM HP5320m, S/N: CND0241M8M, laptop computer
- AC/DC adapter for laptop, type: PPP009H, S/N: F32921018044603
- USB Mouse, Logitech M100, S/N: -
- Headphones, Sennheiser CX215, S/N: -

Cables:

From	To	Type	Length [m]
Electrode	EUT	Electrode cable, shielded	0.4
Mains supply network	AC/DC adapter	Mains cable, unshielded	1.0
AC/DC adapter	Laptop	DC cable, shielded	2.0
Mouse	EUT	shielded	1.8
Headphones	EUT	shielded	1.3

Operating voltage of the EUT during the tests:

- 3.7V DC (rechargeable battery)

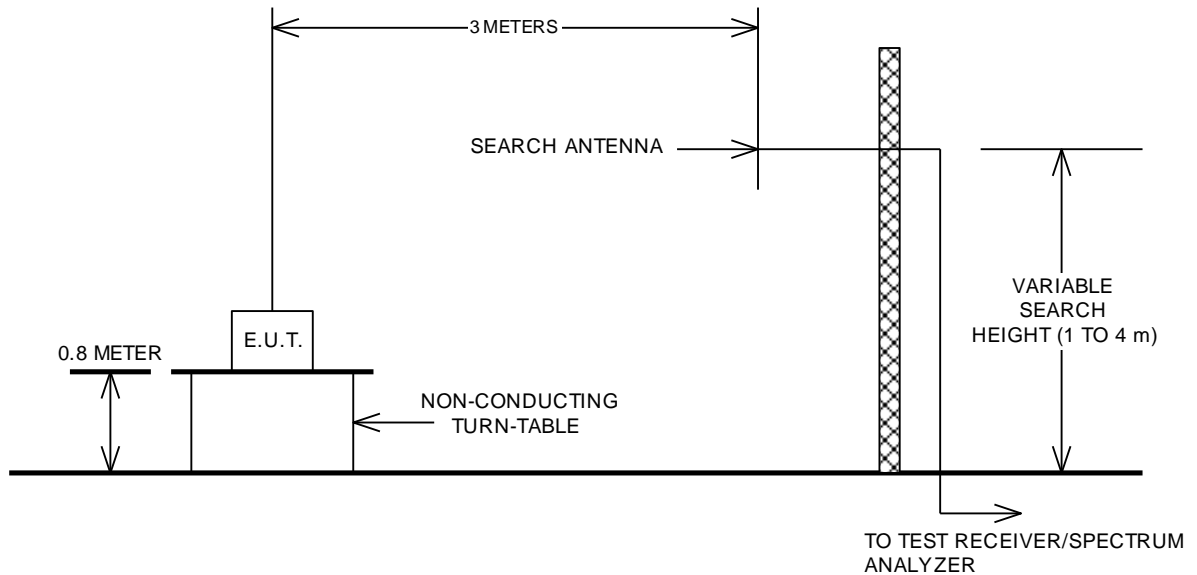
Operating voltage of the peripheral devices during the tests:

- 115 V AC, 60 Hz (rated 100 – 240 V AC 50/60 Hz)

2. Test setups

Setup 1 (Radiated measurements)

The test was performed inside a semi anechoic shielded room. For the duration of the test the EUT was placed on a non-conductive support 0.8 m high standing on the turntable. The tower and turn table were remotely controlled to turn the EUT and change the antenna polarization and height. The measured signal was routed from the measuring antenna to the spectrum analyzer.



FCC Part 15.109 Limit values

Frequency band MHz	Quasi-peak dB(μ V/m) @3m	Quasi-peak dB(μ V/m) @10m
30 – 88	40.0@3m	29.5@10m
88 – 216	43.5@3m	33.0@10m
216 – 960	46.0@3m	35.5@10m
960 – 1000	54.0@3m	43.5@10m

3. Standards and measurement methods

The test were performed in guidance of the CFR 47 Part 15, SUBPART B, Paragraph 15.109 (2010), ANSI C63.4 (2003), CISPR 22 Ed. 6.0, ICES-003:2012.

4. Test results

4.1 Radiated emission

The test was performed as a compliance test. The test parameters concerned were as follows:

<i>Site name</i>	Nemko Oy / Perkaa
<i>FCC rule part</i>	§ 15.109
<i>IC</i>	IC ES-003 6.2
<i>Date of testing</i>	18.03.2013, 26.04.2013
<i>Test equipment</i>	319, 544, 709, 350
<i>Test conditions</i>	22 °C, 30 % RH
<i>Test result</i>	PASS

4.1.1 EUT operation mode

<i>EUT operation mode</i>	Measuring mode
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4.1.2 Test method and limit

The test was performed in a semi-anechoic shielded room. The EUT was placed on a non-conductive 0.8 m high table standing on the turntable (see photographs 1 and 2). During the test in the frequency range 30-1000 MHz the distance from the EUT to the measuring antenna was 10 m. In order to find the maximum levels of the disturbance radiation the angle of the turntable, the height of the measuring antenna and the lay-out of the EUT cables were varied during the tests. The test was performed separately with the measuring antenna being both in horizontal and vertical polarizations.

The CFR 47 Part 15.109 limit of 200 $\mu\text{V/m}$ has been calculated to correspond 46 $\text{dB}(\mu\text{V/m})$ as follows: $[\text{dB}(\mu\text{V/m})]=20\log[\mu\text{V/m}]$.

FCC Part 15.109 Limit values

<i>Frequency band MHz</i>	<i>Quasi-peak $\text{dB}(\mu\text{V/m})$ @3m</i>	<i>Quasi-peak $\text{dB}(\mu\text{V/m})$ @10m</i>
30 – 88	40.0@3m	29.5@10m
88 – 216	43.5@3m	33.0@10m
216 – 960	46.0@3m	35.5@10m
960 – 1000	54.0@3m	43.5@10m

4.1.3 Test results

<i>EUT operation mode</i>	EUT measuring mode
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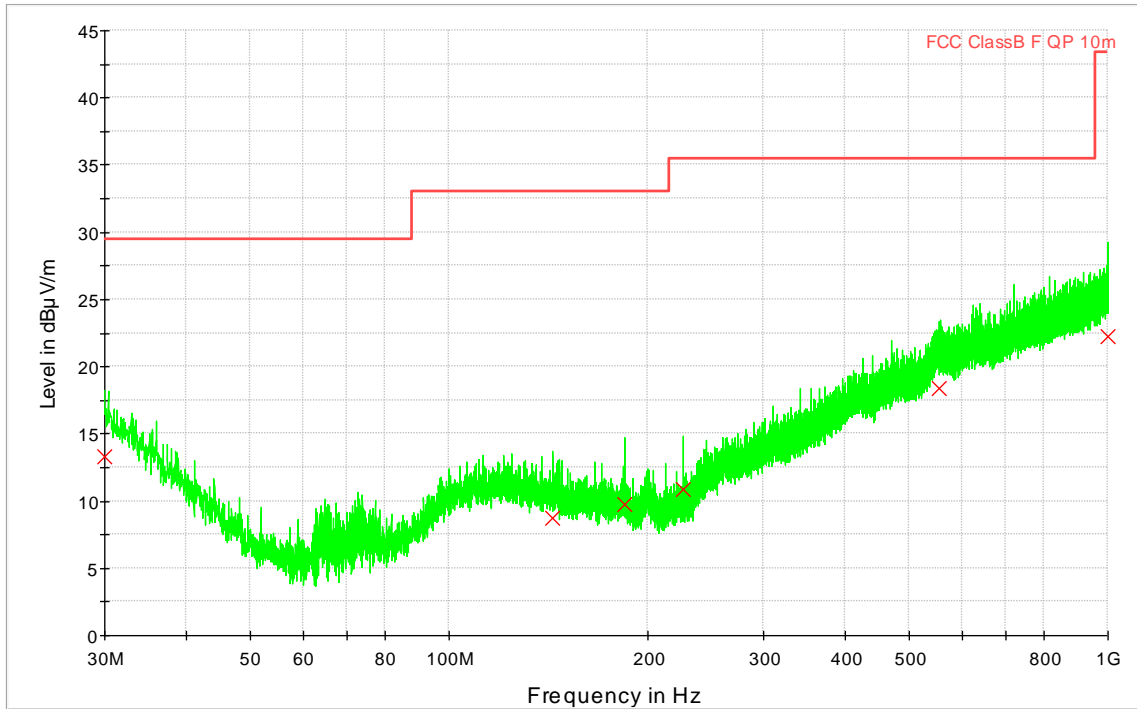


Figure 1. Radiated emissions, 30-1000 MHz.

Measurement results (Quasi-Peak):

Frequency MHz	Level dBµV/m	Limit dBµV/m	Margin dB	Exceed	Height cm	Polarization Hor/Ver	Azimuth degrees
30.000	13.3	29.5	16.2	-	100	V	15
143.840	8.7	33.0	24.3	-	100	V	270
184.440	9.8	33.0	23.2	-	100	V	225
227.000	10.9	35.5	24.6	-	100	V	215
553.760	18.4	35.5	17.1	-	280	V	315
999.700	22.3	43.5	21.2	-	160	H	90

The measurement results were obtained as described below.

$$E \text{ [dB}(\mu\text{V/m)}] = U_{RX} + A_{CABLE} + AF - G_{PREAMP}$$

Where

- U_{RX} receiver reading
- A_{CABLE} attenuation of the cable
- AF antenna factor
- G_{PREAMP} gain of the preamplifier

EUT operation mode | **EUT connected to laptop PC USB port**

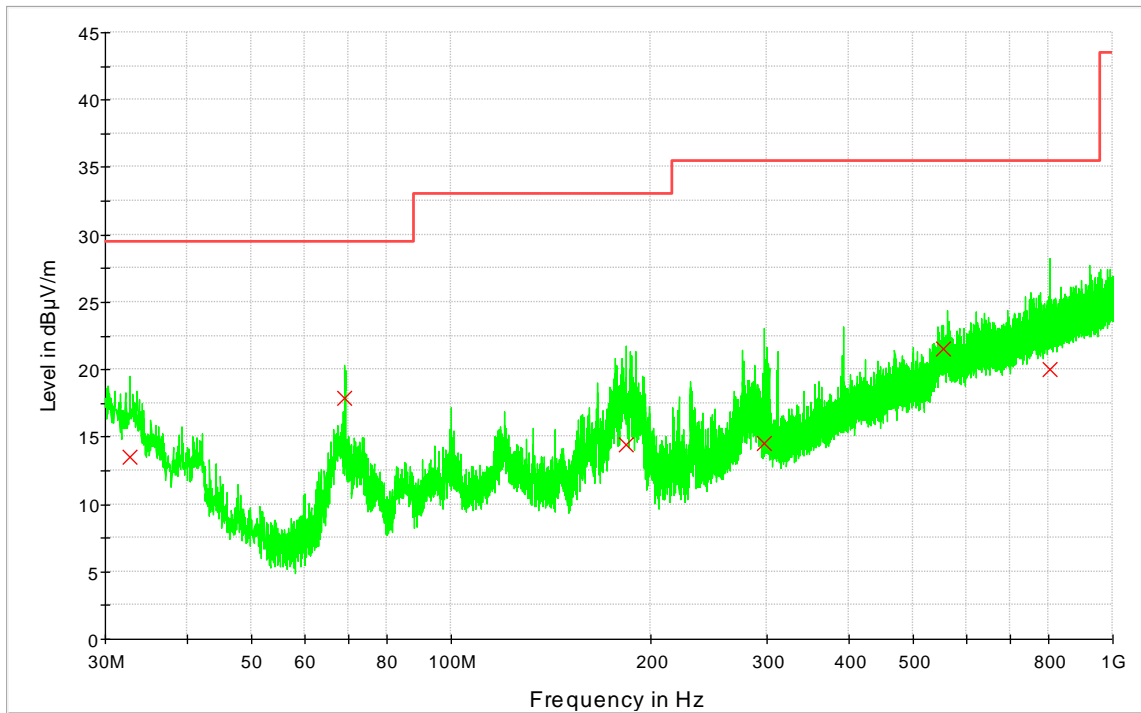


Figure 2. Radiated emissions, 30-1000 MHz.

Measurement results (Quasi-Peak):

Frequency MHz	Level dBµV/m	Limit dBµV/m	Margin dB	Exceed	Height cm	Polarization Hor/Ver	Azimuth degrees
32.680	13.5	29.5	16.0	-	102	V	210
69.000	17.9	29.5	11.6	-	394	V	113
183.440	14.4	33.0	18.6	-	147	V	348
297.680	14.5	35.5	21.0	-	151	H	154
554.160	21.5	35.5	14.0	-	290	V	352
803.960	20.0	35.5	15.5	-	302	H	259

4.2 Conducted disturbance at mains ports emission test

The test was performed as a compliance test. The test parameters concerned were as follows:

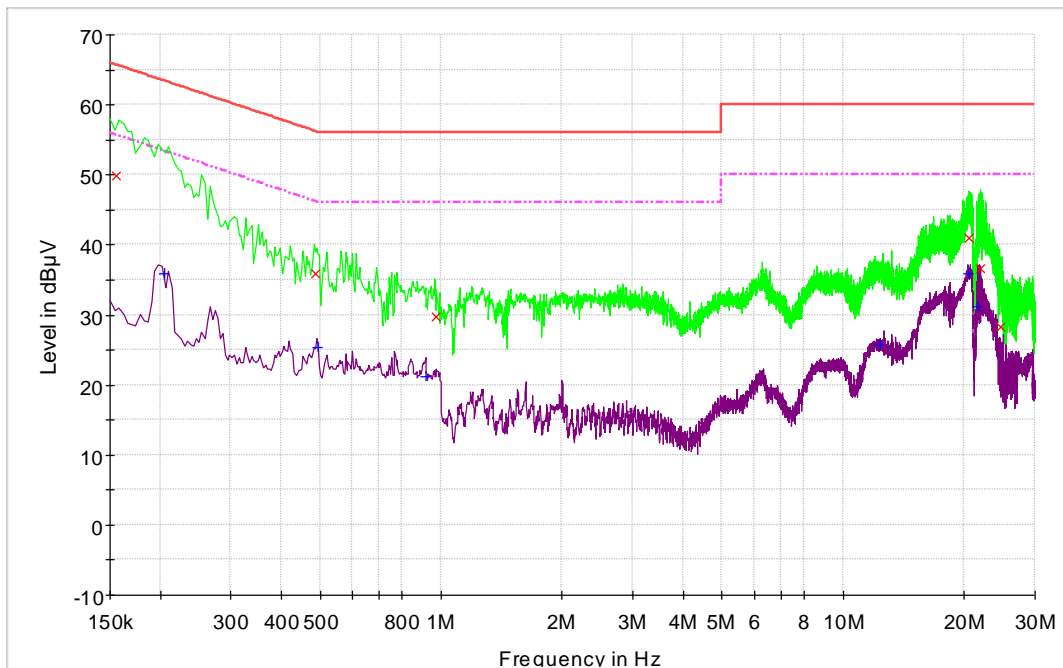
Parameter	Specification
Frequency range	0.150 – 30 MHz
Site name	Nemko Oy / Perkaa
FCC rule part	§ 15.107
IC	RSS Gen 7.25
Date of testing	29.4.2013
Test equipment	745, 694, 348
Test uncertainty U95	±3.5dB
Test conditions	24 °C, 30 % RH

The test was performed inside a shielded room where the floor and one of the walls of the test site comprised the reference ground plane (RGP). For the duration of the test the EUT was placed on a non-conductive table 0.8 m high 0.4 m apart from the vertical RGP (see photograph 3). The excess lengths of the cables of the EUT were made into bundles 30-40 cm in length. The power input cable of the EUT was connected to an artificial mains network. The test was performed separately on each phase and also on the neutral wire.

The disturbances were first examined by performing a spectrum scan by using a peak detector. The general procedure in the conducted disturbance emission test is that no further measurements are necessary if the disturbance levels measured by using the peak detector are below the limit value defined for the measurement performed by using an average detector. If not, then at the test frequencies concerned the measurement is performed also by using a quasi-peak detector. If the disturbance levels measured by using the quasi-peak detector are below the limit value defined for the measurement performed by using an average detector, then measurements by using the average detector are not necessary.

4.2.1 Test results

Line N



The graphs of the disturbances measured by using a peak and average detectors in the frequency range of 0.150 - 30 MHz.

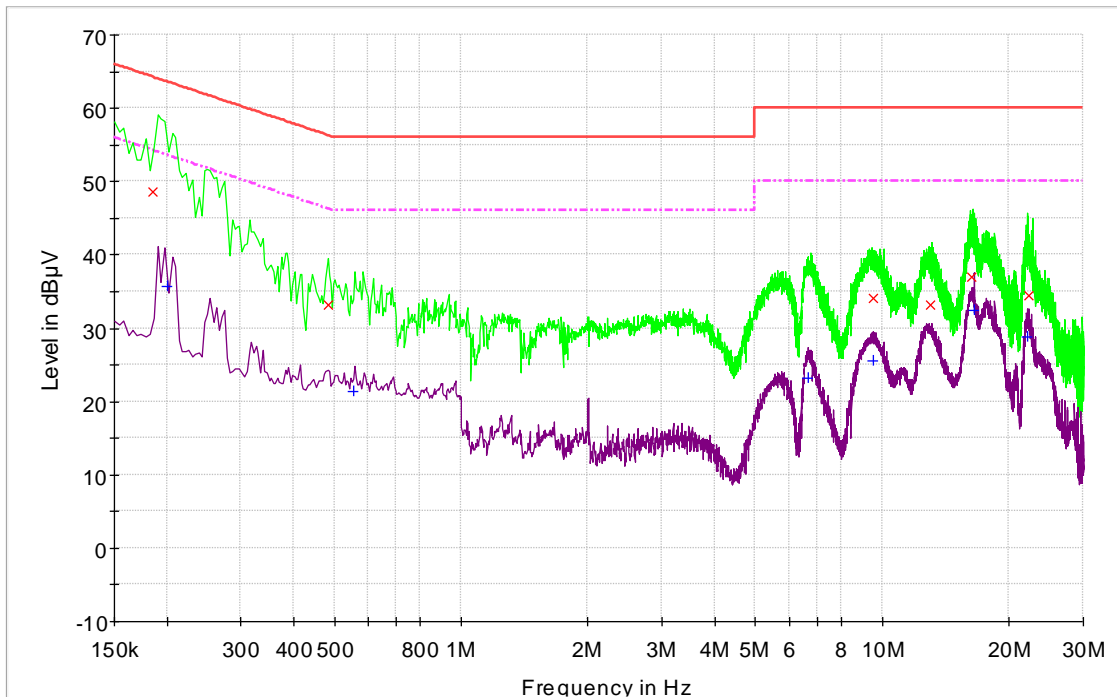
Measurement results (QP):

Frequency MHz	Level dB μ V	Limit dB μ V	Margin dB	Line	Conclusion Pass/Fail
0.15	49.9	65.7	15.8	N	Pass
0.48	35.9	56.2	20.3	N	Pass
0.97	29.7	56.0	26.3	N	Pass
20.56	41.0	60.0	19.0	N	Pass
21.98	36.5	60.0	23.5	N	Pass
24.61	28.3	60.0	31.7	N	Pass

Measurement results (Average):

Frequency MHz	Level dB μ V	Limit dB μ V	Margin dB	Line	Conclusion Pass/Fail
0.20	35.8	53.4	17.6	N	Pass
0.49	25.3	46.1	20.8	N	Pass
0.91	21.2	46.0	24.8	N	Pass
12.39	25.7	50.0	24.3	N	Pass
20.56	35.9	50.0	14.1	N	Pass
21.67	31.2	50.0	18.8	N	Pass

Line L



The graphs of the disturbances measured by using a peak and average detectors in the frequency range of 0.150 - 30 MHz.

Measurement results (QP):

Frequency MHz	Level dB μ V	Limit dB μ V	Margin dB	Line	Conclusion Pass/Fail
0.18	48.6	64.3	15.7	L	Pass
0.48	33.1	56.3	23.1	L	Pass
9.48	34.1	60.0	25.9	L	Pass
13.01	33.2	60.0	26.8	L	Pass
16.28	36.9	60.0	23.1	L	Pass
22.23	34.4	60.0	25.6	L	Pass

Measurement results (Average):

Frequency MHz	Level dB μ V	Limit dB μ V	Margin dB	Line	Conclusion Pass/Fail
0.20	35.7	53.6	17.9	L	Pass
0.55	21.4	46.0	24.6	L	Pass
6.66	23.3	50.0	26.7	L	Pass
9.53	25.6	50.0	24.4	L	Pass
16.53	32.4	50.0	17.6	L	Pass
22.15	28.9	50.0	21.1	L	Pass

5. List of test equipment

Each active test equipment is calibrated once a year, antennas every 18 months and other passive equipment every 24 months.

Nr.	Equipment	Type	Manufacturer	Serial number	Cal date	Cal due
319	Antenna	CBL6112	Chase	2018	12.7.2012	1.2014
348	Shielded room	RFSD-100	Euroshield Oy	1320		
350	Semianechoic shielded room	RFD-F-100	Euroshield Oy	1327	26.10.2012	10.2014
525	Double-Ridged Horn	3115	Emco	6691	10.10.2012	4.2014
542	Double-Ridged Horn	3115	Emco	00023905	10.10.2012	4.2014
544	RF-amplifier	ZFL-1000VH2	Mini-Circuits	QA0749010	9.1.2013	1.2014
564	RF amplifier	CA018-4010	CIAO Wireless	132	9.1.2013	1.2014
566	Spectrum analyzer	E4448A	Agilent	US42510236	17.4.2013	4.2014
694	EMI Test Receiver	ESPC	Rohde & Schwarz	842888/023	11.12.2012	12.2013
709	EMI test receiver	ESU8	Rohde & Schwarz	100297	11.05.2012	5.2013
745	2-Line V-Network	ENV216	Rohde & Schwarz	101466	9.5.2012	5.2013