


REPORT: FCC / IC Electromagnetic Compatibility (EMC) test report

PRODUCT:

Test item description:	Mobile computer for data collection
Trade Mark:	Nordic ID Merlin
Model/Type reference:	805-2B
Serial number:	L104831340
Customer:	Nordic ID Oy Myllyojankatu 2A 24100 SALO FINLAND
Contact person:	Hannu Heino
Manufacturer:	Nordic ID Oy Myllyojankatu 2A 24100 SALO FINLAND

DATE: 7.9.2011

TESTED BY: 
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APPROVED BY: 
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1 LABORATORY INFORMATION

Test Laboratory	Intertek ETL Semko OY Koneenkatu 12 / K1 05801 Hyvinkää FINLAND
FCC registration number: IC file number:	910391 (January 27, 2003) IC 2042C-1 (May 14, 2003)

2 TEST SUMMARY

2.1 Test standards

The tests listed in this report have been done to demonstrate compliance to the FCC rules section §15.107, §15.109 and IC standard RSS-210. ICES-003

EMC-tests were performed according to measurement method specified in the reference standards -described as below.

Section in CFR 47	Section in ICES-003	Test	Result
§15.107	5.3	Conducted emissions to AC-mains	PASS
§15.109	5.5	Radiated emissions	PASS

PASS Pass
 FAIL Fail
 X Measured, but there is no applicable performance criteria
 Na Not applicable

3 EUT INFORMATION

The EUT and accessories used in the tests are listed below. Later in this report only EUT numbers are used as reference.

	Device	Type	S/N	EUT number
EUT	Nordic ID Merlin	805-2B	L104831340	1
	Nordic ID Merlin Pistol grip	ACN00103	L104803873	2
	Nordic ID Merlin	DTC805-2	-	3
	Edacpower AC adapter	EA10402M- 240	-	4
Accessories	Dell laptop	PR04S	CN-0J7316- 36521-55K-0548	5
	Dell AC-adapter	LA65NS0-00	CN-0DF263- 71615-69G-0EE5	6
	Logitech mouse	M-UAE96		7

Notes: -

3.1 EUT description

EUT is a mobile computer that includes WLAN, Bluetooth, HF RFID and 1D/2D barcode reader.

The EUT was not modified during the tests.

4 EUT TEST SETUPS

The test setup photographs are in the document referenced in section 8.

5 CONDUCTED EMISSIONS TO AC-MAINS

EUT	1,2,3,4		
Accessories	5,7		
Temp, Humidity, Air Pressure	21 °C	53 %RH	990 mbar
Date of measurement	August 30, 2011		
FCC rule part	§15.107		
ICES-003 section	5.3		
Measured by	Simo Ojanen		

5.1 Test setup

Charger was connected to line impedance stabilization network and conducted emissions to AC-mains were measured using measurement receiver.

5.2 EUT operation mode

EUT was set in idle mode so, that EUT receiver and other functions except the transmitter are on.

5.3 Limits

Frequency of emission [MHz]	FCC / IC	
	Limit [dBµV] Quasi peak	Limit [dBµV] Average
0,15 – 0,50	66 – 56*	56 – 46*
0,50 – 5	56	46
5 - 30	60	50

* The limit decreases linearly with the logarithm of the frequency

5.4 Results

The measured interference values using peak and average detectors are shown in the pictures 2 and 3 below. All signals closer than 6 dB to the limit have been measured using quasi peak or average detector and reported in the tables below.

Table 1: AC-mains conducted RF output power measurement results, AC live QP

Frequency	Measured value [dB μ V]	Limit [dB μ V]	Margin to limit [dB]
0,150	48,9	66,0	17,1
0,173	54,0	64,8	10,8
0,181	54,4	64,4	10,0
0,185	54,4	64,3	9,9
0,193	52,3	63,9	11,6
0,205	36,3	63,4	27,1

Table 2: AC-mains conducted RF output power measurement results, AC live AV

Frequency	Measured value [dB μ V]	Limit [dB μ V]	Margin to limit [dB]
0,185	40,9	54,3	13,3
0,189	41,6	54,1	12,5
0,193	37,0	53,9	16,9
0,236	34,8	52,2	17,4

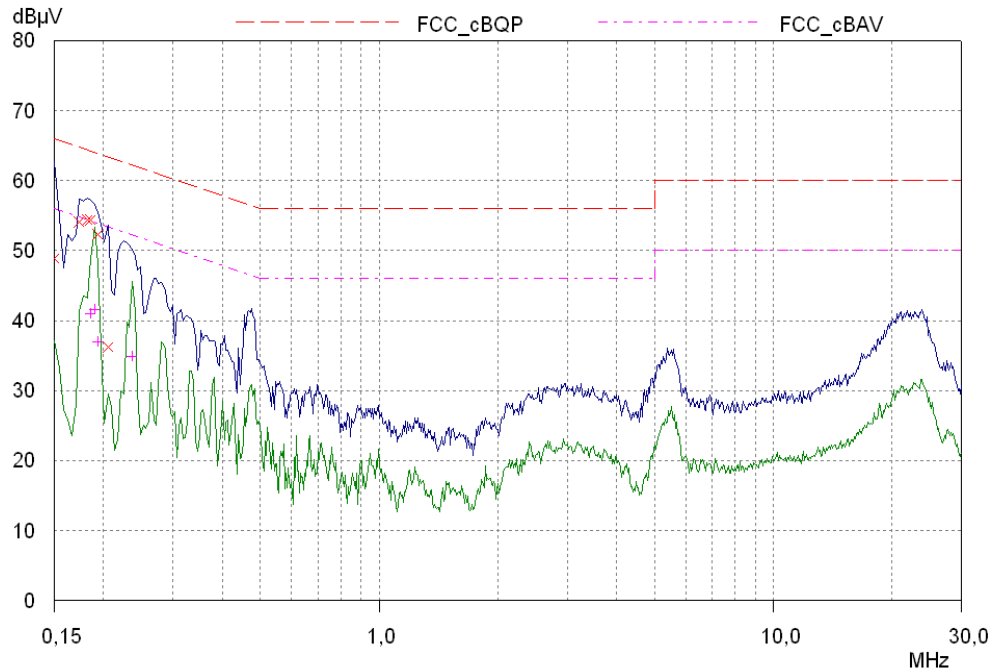
Table 3: AC-mains conducted RF output power measurement results, AC neutral QP

Frequency	Measured value [dB μ V]	Limit [dB μ V]	Margin to limit [dB]
0,150	58,8	66,0	7,2
0,158	53,5	65,6	12,1
0,181	56,1	64,4	8,4
0,189	56,4	64,1	7,7
0,205	48,6	63,4	14,8
0,213	40,5	63,1	22,6
0,224	49,7	62,7	13,0

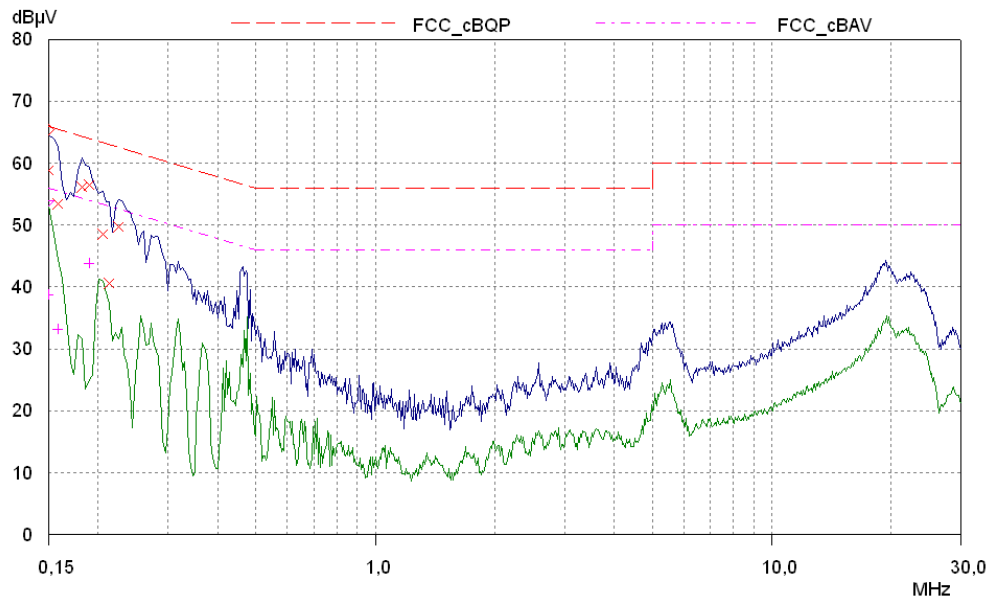
Table 4: AC-mains conducted RF output power measurement results, AC neutral AV

Frequency	Measured value [dB μ V]	Limit [dB μ V]	Margin to limit [dB]
0,150	38,8	56,0	17,2
0,158	33,2	55,6	22,4
0,189	43,9	54,1	10,2

5.5 Screen shots



Picture 1: AC-mains conducted RF output power measurement results, AC live



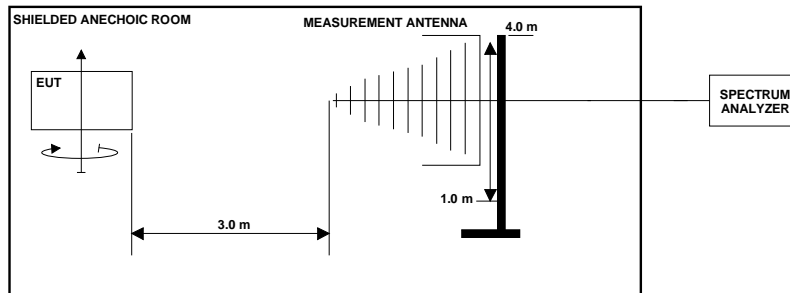
Picture 2: AC-mains conducted RF output power measurement results, AC neutral

6 RADIATED EMISSIONS

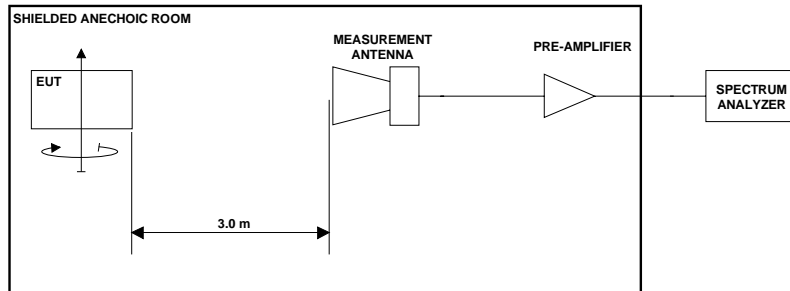
EUT	1,2,3,4		
Accessories	5,6,7		
Temp, Humidity, Air Pressure	23 °C	55 %RH	1008 mbar
Date of measurement	August 26-29, 2011		
FCC rule part	§15.109		
ICES-003 section	5.5		
Measured by	Simo Ojanen		

6.1 Test setup

The EUT was set on a non-conductive turntable 0,80m height from reference ground plane in a semi-anechoic chamber. EUT was on receiver mode.



Picture 3: Test setup for radiated emission measurement below 1 GHz



Picture 4: Test setup for radiated emission measurement above 1 GHz

6.2 Test method

The test system used is computer controlled. The measurement antenna calibrated antenna factors and connecting cable losses are added in a computer software to the measured results. The results corrected with antenna factors and cable losses are recorded.

Measurement procedure below 1 GHz frequencies:

1. The maximum emission levels were searched by rotating and manipulating the EUT and by scanning the measurement antenna in height from 1,0 to 4,0 m and by using peak detector.
2. All signal levels closer to 6 dB to the limit were measured using Quasi peak detector and recorded

Measurement procedure above 1 GHz frequencies:

1. The maximum emission levels were searched by rotating and manipulating the EUT and by using peak detector and recorded.

6.3 EUT operation mode

EUT was set in idle mode so, that EUT receiver and other functions except the transmitter are on.

6.4 Limit

Table 5: Radiated emission limits for FCC class A, measurement distance 10m

FCC				
Frequency of emission [MHz]	Limit [$\mu\text{V} / \text{m}$]	Limit [$\text{dB}\mu\text{V}/\text{m}$]	Resolution bandwidth [kHz]	Measurement detector type
30 – 88	90	39.1	120	Quasi peak
88 – 216	150	43,5	120	Quasi peak
216 – 960	210	46,4	120	Quasi peak
960 – 1000	300	49,5	120	Quasi peak
Above 1000	300	49,5	1000	Average
Above 1000	3000	69,5	1000	Peak

Table 6: Radiated emission limits for FCC class B and IC class B digital devices, measurement distance 3,0 m

FCC				
Frequency of emission [MHz]	Limit [$\mu\text{V} / \text{m}$]	Limit [$\text{dB}\mu\text{V}/\text{m}$]	Resolution bandwidth [kHz]	Measurement detector type
30 – 88	100	40	120	Quasi peak
88 – 216	150	43,5	120	Quasi peak
216 – 960	200	46	120	Quasi peak
960 – 1000	500	54	120	Quasi peak
Above 1000	500	54	1000	Average
Above 1000	5000	74	1000	Peak
IC				
30 - 230		40	120	Quasi peak
230 – 1000		47	120	Quasi peak

6.5 Results

The measured interference values using peak and average detectors are shown in the pictures below.

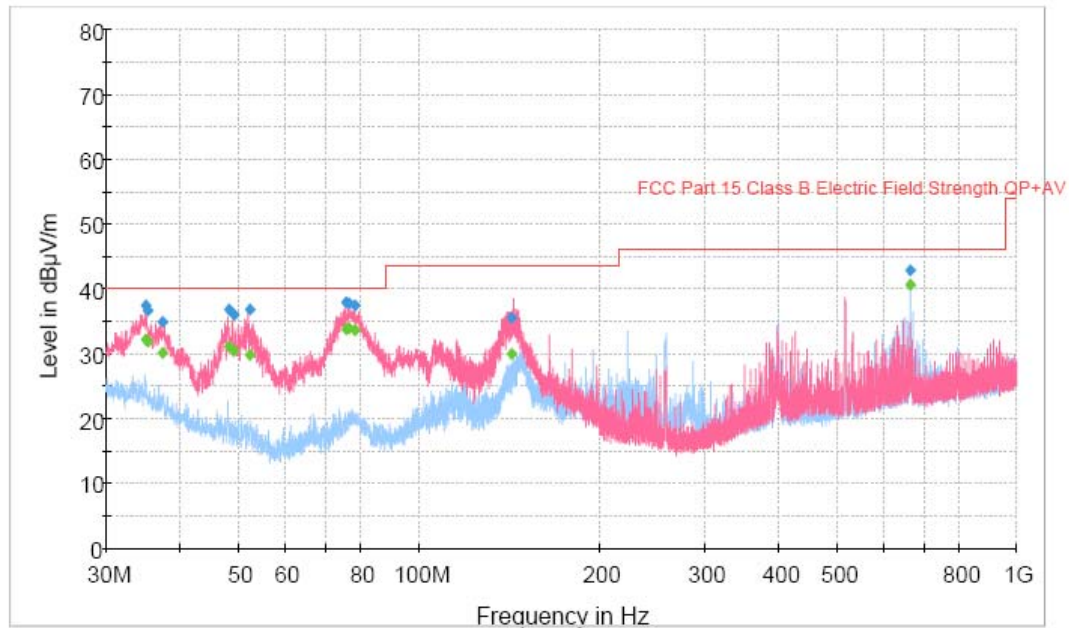
All signals closer than 6 dB to the limit below 1 GHz have been measured using quasi peak detector and reported in the table 5, above 1GHz signals have been measured with average detector and reported in table 6.

Table 7: Radiated emissions using Quasi peak detector

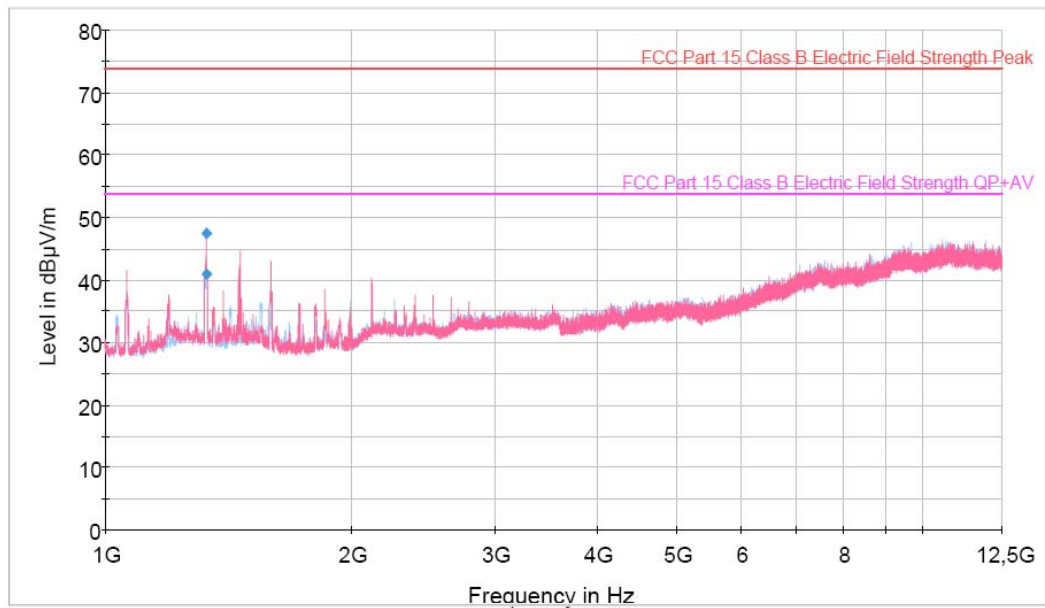
Frequency	Measured value [dB μ V]	Limit [dB μ V/m]	Margin to limit [dB]
35,0	32,2	40,0	7,8
35,2	31,9	40,0	8,1
37,3	30,1	40,0	9,9
48,2	31,0	40,0	9,0
49,1	30,5	40,0	9,5
52,2	29,9	40,0	10,1
75,6	33,8	40,0	6,2
76,4	34,0	40,0	6,0
78,1	33,6	40,0	6,4
143,2	29,9	43,5	13,6
665,0	40,7	46,0	5,3

Table 8: Radiated emissions using Average detector

Frequency	Measured value [dB μ V]	Limit [dB μ V/m]	Margin to limit [dB]
1330	41,0	54,0	13,0



Picture 5: radiated emission results, 30 – 1000 MHz,
red = vertical, blue = horizontal



Picture 6: radiated emission results, 1 – 12,5 GHz,
red = vertical, blue = horizontal

7 TEST EQUIPMENT

7.1 Conducted measurements

DEVICE	MANUFACTURER	SPKTT	SERIAL
EMI test receiver	Rohde & Schwarz ESCS30	020	849650/0016
LISN	Rohde & Schwarz ESH3-Z5	049	833874/029
10dB trans.limiter	Teseq CFL9206A	227	30634
Measuring software	R&S ESxS-K1	-	Ver 2.20

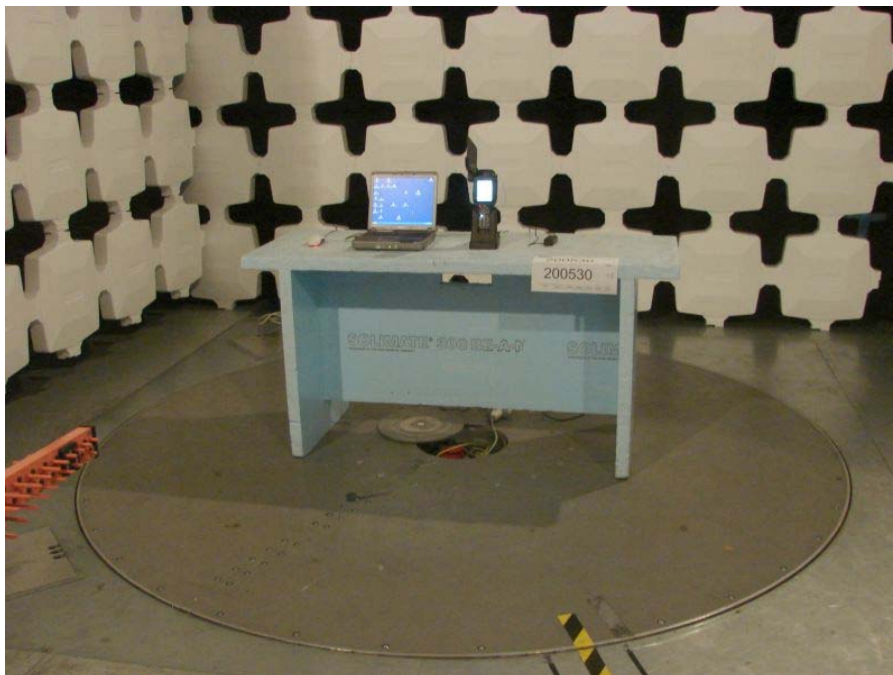
7.2 Radiated measurements

DEVICE	MANUFACTURER	SPKTT	SERIAL
EMI test receiver	Rohde & Schwarz ESU26	219	100173
Horn Antenna	Schwarzbeck BBHA9120D	138	365
X-wing BiLog antenna	Teseq CBL6143A	221	29611
3 dB attenuator	Huber+Suhner 3dB/2W	214	-
Pre-amplifier	JCA 118-400	142	-
3m Semi-anechoic chamber	ETS Euroshield	081	-
Measuring software	R&S EMC32	-	Ver 8.51.0

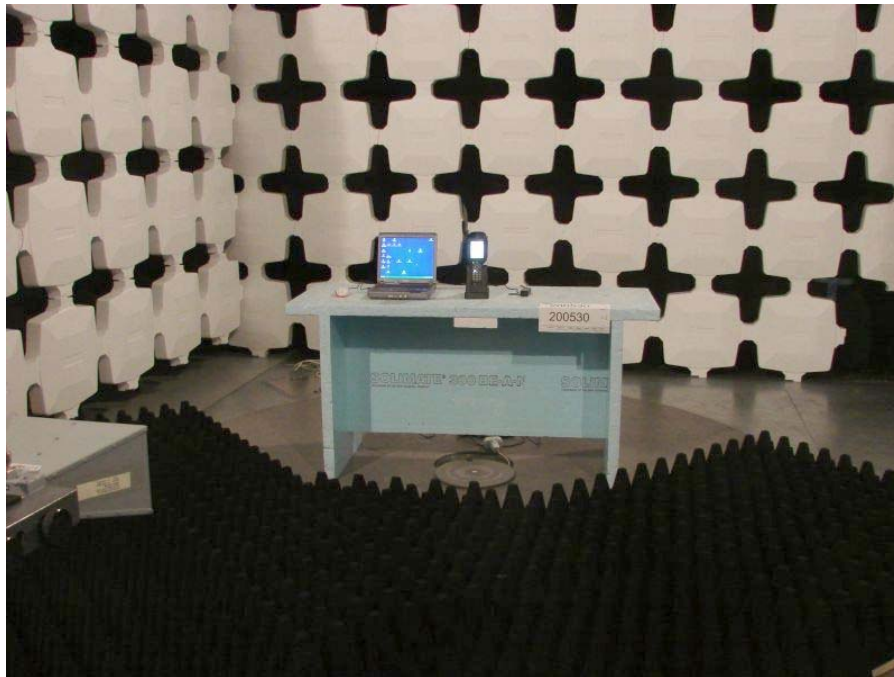
8 TEST SETUP PHOTOGRAPHS



Picture 7: Test setup for measurement of conducted emissions to AC-mains



Picture 8: Radiated emission test setup for below 1 GHz frequencies



Picture 9: Radiated emission test setup for above 1 GHz frequencies