Electromagnetic Compatibility (EMC) test report for

NMM-1

Report Date: March 29, 2004

Signatures:

Tested by:

Marko Turkkila Testing Engineer

Contents approved:

Tomi Nyberg Laboratory Manager

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CONTENTS

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1 LABORATORY INFORMATION

Test Laboratory	NORDIC ACCREDITED TESTING LABORATORIES OY EMC Laboratory Koneenkatu 12 / K17 05830 Hyvinkää FINLAND Tel: +358 20 475 2600 Fax: +358 20 475 2719 e-mail: firstname.surname@ette.com
FCC registration number: **IC file number:**	910391 (January 27, 2003) IC 4616 (May 14, 2003)

2 CUSTOMER INFORMATION

Client	Nokia Corporation Keilalahdentie 2-4 02150 Espoo PL 226 00045 NOKIA GROUP Tel: 07180 08000
Contact person:	Reija Moisio Nokia Corporation / TCC Salo P.O. Box 86 (Joensuunkatu 7E / Kiila 1B) FIN -24101 SALO FINLAND Tel: +358 7180 08000 Fax: +358 7180 44123
Receipt of EUT:	March 11, 2004
Testing date:	March 11 – 27, 2004
Report date:	March 29 2004

The tests listed in this report have been done to demonstrate compliance with the applicable requirements in FCC rules Part 15 and IC standard RS133 and ICES-003.

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3 SUMMARY OF TEST RESULTS

Section in CFR 47	Section in ICES-003	RSS 133	Test	Result
§15.107	5.3		Conducted emissions to AC-mains	PASS
§15.109	5.5	9	Radiated emissions	PASS

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

4 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	GSM 1900 Mobile phone	NMM-1	001004/00/171642/3	17001
Accessories	Battery	BLC-2		17002
	Charger	ACP-12E	(ASTEC)	17003
	Data cable	DKU-2		17004
	Computer	IBM 2647	5541V3H 103	17005

Notes: -

4.1 EUT description

EUT is a GSM 1900 mobile phone with BT and W-CDMA functions.

The EUT was not modified during the tests.

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5 EUT TEST SETUPS

For each test the EUT was exercised to find out the worst case of operation modes and device configuration.

The test setup photographs are in the document referenced in section 10.

6 APPLICABLE STANDARDS

The tests were performed in guidance of CFR 47 part 15, ANSI C63.4-1992 and ICES-003.

Deviations, modifications or clarifications (if any) to above mentioned documents are written in each section under "Test method" for each test case.

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7 CONDUCTED EMISSIONS TO AC-MAINS

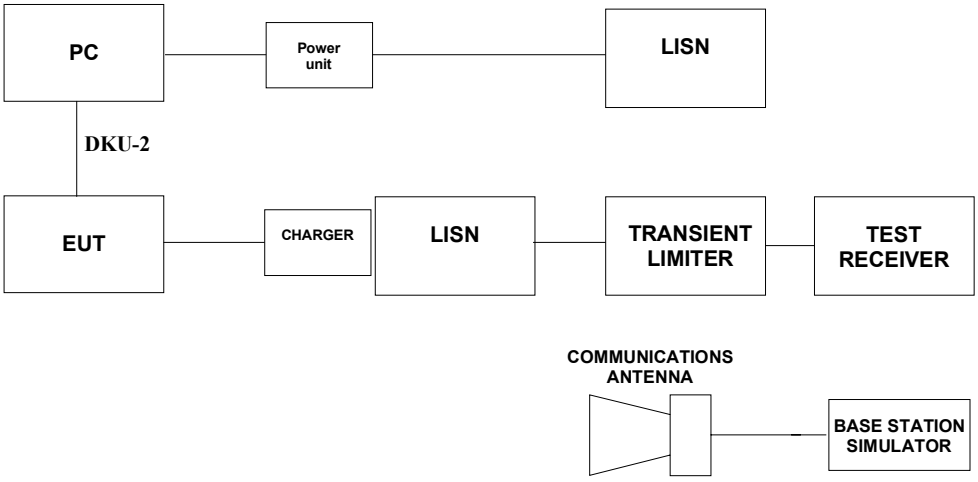
EUT	17001		
Accessories	17002, 17003, 17004, 17005		
Temp, Humidity, Air Pressure	21 ºC	38 RH%	1002 hPa
Date of measurement	March 23, 2004		
FCC rule part	§15.107		
ICES-003 section	5.3		
Measured by	Marko Turkkila		

7.1 Test setup

The BS simulator was used to provide the common control and broadcasting channel to the EUT to keep the EUT receiver on.

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

EUT was connected to PC with DKU-2 data cable. PC power supply was connected to a second LISN.



Picture 1: Test setup for measurement of conducted emissions to AC-mains

7.2 EUT operation mode

EUT was set in idle mode so, that EUT receiver and other functions except the transmitter are on. EUT was connected to a PC with DKU-2 data cable.

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7.3 Limits

Frequency of emission [MHz]	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

7.4 Results

The measured interference values using peak and average detectors are shown in the pictures 2 to 5 below.
All signals closer than 6 dB to the limit have been measured using quasi peak detector and reported in the table 1 and 2

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

Frequency	Measured value [dBµV]	Limit [dBµV]	Margin to limit [dB]
0,17	42,7	65,2	22,5
0,33	43,1	59,6	16,5
0,52	35,3	56,0	20,7
0,81	35,8	56,0	20,2
1,97	33,2	56,0	22,8

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

Frequency	Measured value [dBµV]	Limit [dBµV]	Margin to limit [dB]
0,16	40,2	65,4	25,2
0,21	39,3	63,3	24,0
0,33	38,5	59,6	21,1
0,49	24,5	56,2	31,7
1,63	23,7	56,0	32,3

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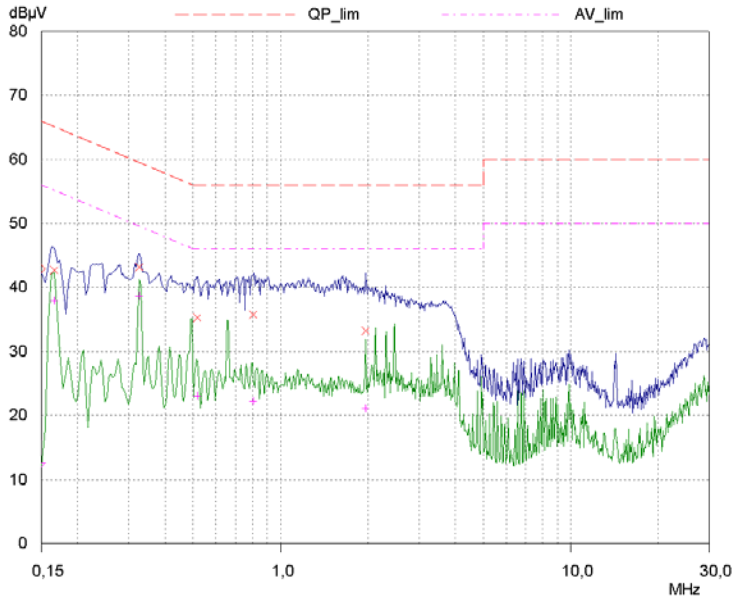
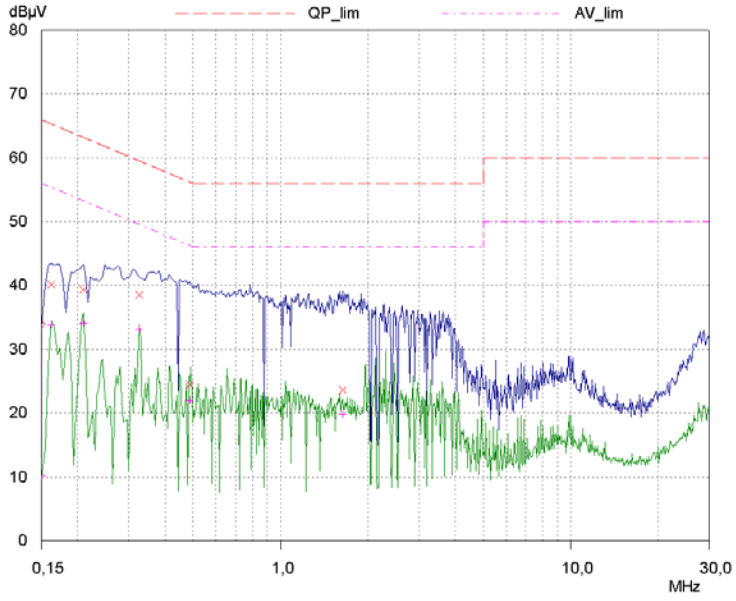
7.5 Screen shots



Picture 2: AC-mains conducted RF output power measurement results, AC line, battery charging.



Picture 3: AC-mains conducted RF output power measurement results, AC neutral, battery charging.

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8 RADIATED EMISSIONS

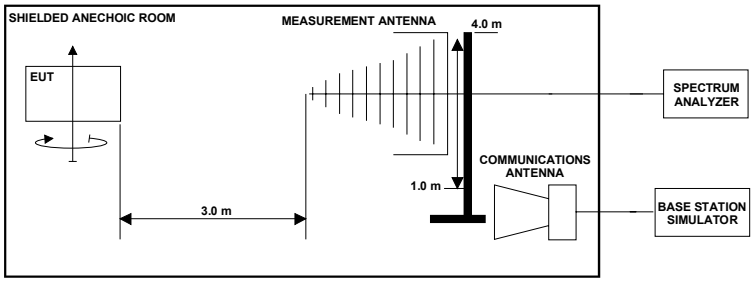
EUT	17001		
Accessories	17002, 17003, 17004, 17005		
Temp, Humidity, Air Pressure	21 ºC	32 RH%	1002 hPa
Date of measurement	March 23, 2004		
FCC rule part	§15.109		
ICES-003 section	5.5		
Measured by	Kimmo Aarnio		

8.1 Test setup

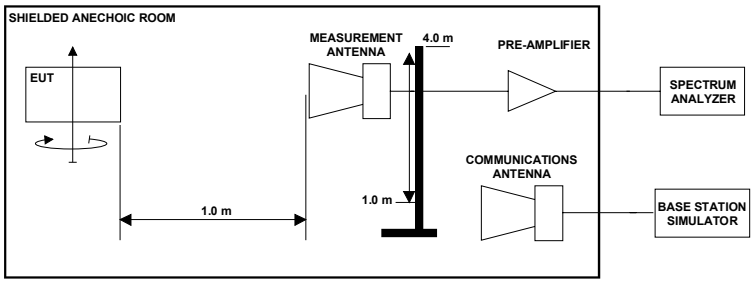
Below 1 GHz:
The EUT was set on a non-conductive turntable 0.80m height from reference ground plane in a semi-anechoic chamber.

Above 1 GHz:
The EUT was set on a non-conductive turntable 0.80m height from reference ground plane in a semi-anechoic chamber.

In the corner of the chamber there was a communications antenna, which was connected to the BS simulator located outside the chamber.
The BS simulator was used to provide the common control and broadcasting channel to the EUT to keep the EUT receiver on.



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



Picture 5: Test setup for radiated emission measurement above 1 GHz

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8.2 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 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 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 peak and average detectors and recorded

8.3 EUT operation mode

EUT was set in idle mode so, that EUT receiver and other functions except the transmitter are on. EUT was connected to a PC with DKU-2 data cable.

8.4 Limit

Table 3: Radiated emission limits for FCC class B and IC class B digital devices, measurement distance 3.0 m

FCC				
Frequency of emission [MHz]	**3m Limit [µV / m]**	**3m Limit [dBµV/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

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Table 4: Radiated emission limits for FCC class B digital devices, measurement distance 1.0 m

FCC				
Frequency of emission [MHz]	**1m Limit [µV / m]**	**1m Limit [dBµV/m]**	**Resolution bandwidth [kHz]**	**Measurement detector type**
Above 1000	500	63.5	1000	Average
Above 1000	5000	83.5	1000	Peak

8.5 Results

The measured interference values using peak detector is shown in the pictures below.

All signals closer than 6 dB to the limit have been measured using quasi peak or average detector and reported in the table 4.

Table 5: Radiated emissions using Quasi peak detector at measurement distance 3m

Frequency [MHz]	Measured value [dBµV]	Limit [dBµV/m]	Margin to limit [dB]
30.0	22,2	40	-17,8
34.74	25,2	40	-14,8
35.34	27,4	40	-12,6
78.66	22,4	40	-17,6
358.32	9,7	46	-36,3
378.66	9,1	46	-36,9

Table 6: Radiated emissions using Peak detector at measurement distance 1m.

Frequency [MHz]	Measured value [dBµV] @ 1m	Limit [dBµV/m] @ 1m	Margin to limit [dB]
3931.5	50,5	84	-33,5
3943.5	46,2	84	-37,8
11689.5	47,1	84	-36,9

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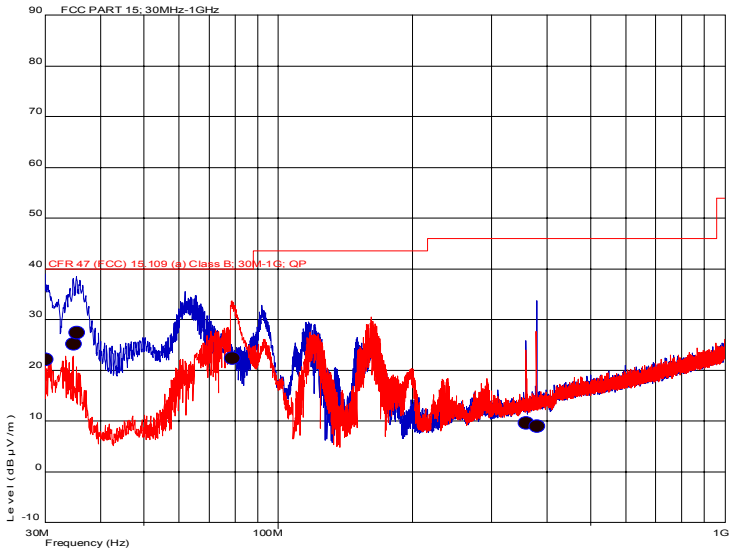
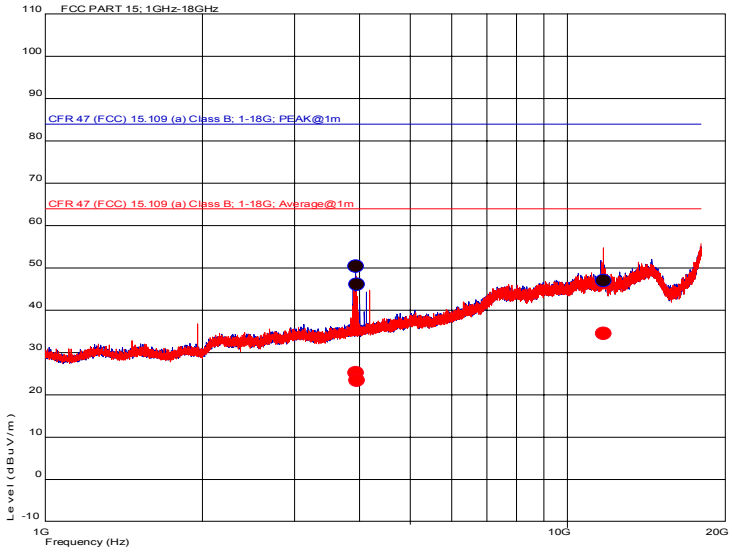


Picture 6: radiated emission results using PEAK detector, 30 – 1000 MHz, EUT vertical. red = horizontal, blue = vertical



Picture 7: radiated emission results using PEAK detector, 1 - 18 GHz, EUT vertical. red = horizontal, blue = vertical

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9 TEST EQUIPMENT

All testing and measurement equipment has been calibrated once a year, except the antennas which are calibrated every two years.

9.1 Conducted measurements

Equipment	Manufacturer	Model
Measurement receiver	Rohde & Schwarz	ESCS 30
GSM Base station simulator	HP	8922M + 83220E
GSM Base station simulator	Anritsu	MT8820A
Transient limiter / 10 dB attenuator	Chase	CFL 9206
Line Impedance Stabilization Network (LISN)	Rohde & Schwarz	ESH 3-Z5

9.2 Radiated measurements

Equipment	Manufacturer	Model
Spectrum Analyzer	Agilent	E7405A
GSM Base station simulator	HP	8922M + 83220E
GSM Base station simulator	Anritsu	MT8820A
Antenna	Chase	CBL 6140
Antenna	Schwarzbeck	BBHA 9120D
Pre-amplifier	JCA	118-400
Turn table / antenna mast controller	EMCO	2090
Antenna mast	EMCO	2075-2

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10 TEST SETUP PHOTOGRAPHS

Test setup photograph can be found in a separate document

T04-017D-EMC_PHOTOS.doc

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