GSM1900 test report
for

NPL-2

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CONTENTS

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1 LABORATORY INFORMATION

Test laboratory:	TCC Tampere Sinitaival 5 FIN-33720 TAMPERE Tel. +358 7180 46800 Fax. +358 7180 46880
FCC registration number: IC file number:	94436 (June 14, 2002) IC 3608 (March 5, 2003)

2 CUSTOMER INFORMATION

Client:	Nokia Corporation Nokia Technology Platform Lise-Meitner-Strasse 10 D-89081 Ulm / Germany Tel. +49 731 1754 6728 Fax. +49 731 1754 6806
Contact person:	Thomas Reitmayer
Receipt of EUT:	20.7.2004
Date of testing:	21.-22.7.2004
Date of report:	28.7.2004

The tests listed in this report have been done to demonstrate compliance with the applicable requirements in FCC rules Part 24 and IC standard RSS-133.

Contents approved:

Jari Jantunen EMC test engineer

3 SUMMARY OF TEST RESULTS

Section in CFR 47	Section in RSS-133		Result
§2.1046 (a)	6.2	Conducted RF output	-
§24.232 (b)	6.2	Radiated RF output	-
§2.1049 (h)	5.6	99% occupied bandwidth	PASS
§24.238 (a)	6.3	Bandedge compliance	-
§24.238 (a), §2.1051	6.3	Spurious emissions at antenna terminals	-
§24.238 (a), §2.1053	6.3	Radiated spurious emissions	PASS
§24.235, §2.1055 (a)(1)(b)	7	Frequency stability, temperature variation	PASS
§24.235, §2.1055 (d)(1)(2)	7	Frequency stability, voltage variation	PASS

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

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4 EUT INFORMATION

The EUT and accessries 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 mobile phone GSM mobile phone	NPL-2 NPL-2	004400341794822 004400341795142	40025 40026
Accessories	Battery Battery Dummy battery	BL-4C BL-4C SWE L 0194.100	067038663807324312 067038663807324312 -	40029 40030 40031

Notes: EUT 40025 and 40026 SW version is 5.80 and HW version is 1006.

4.1 EUT description

The EUT is a triple band (GSM 900/1800/1900) GSM mobile phone.

The EUT was not modified during the tests.

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 12.

6 APPLICABLE STANDARDS

The tests were performed in guidance of CFR 47 part 24, part 2, ANSI/TIA/EIA-603-A and RSS-133. 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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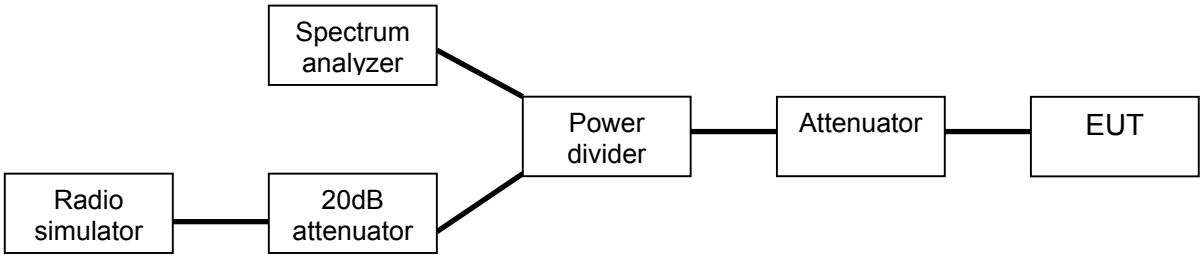
7 99% OCCUPIED BANDWIDTH

EUT	40026		
Accessories	40029		
Temp, Humidity, Air Pressure	21 ºC	45 RH%	1026 mbar
Date of measurement	22.7.2004		
FCC rule part	§2.1049 (h)		
RSS-133 section	5.6		
Measured by	Jari Jantunen		

7.1 Test setup

The BS simulator was used to set the TX channel and power level and modulate the TX signal with different bit patterns.



7.2 EUT operation mode

EUT operation mode	TX on, 1 time slot transmission, PRBS 2E9-1 modulation
EUT channel	661
EUT TX power level	0 (+30dBm)

7.3 Results

The 99% occupied bandwidth was measured using the in-built function of the spectrum analyzer.

Table 1 99% occupied bandwidth, channel 661

EUT Channel	99% occupied bandwidth [kHz]
661	238.782

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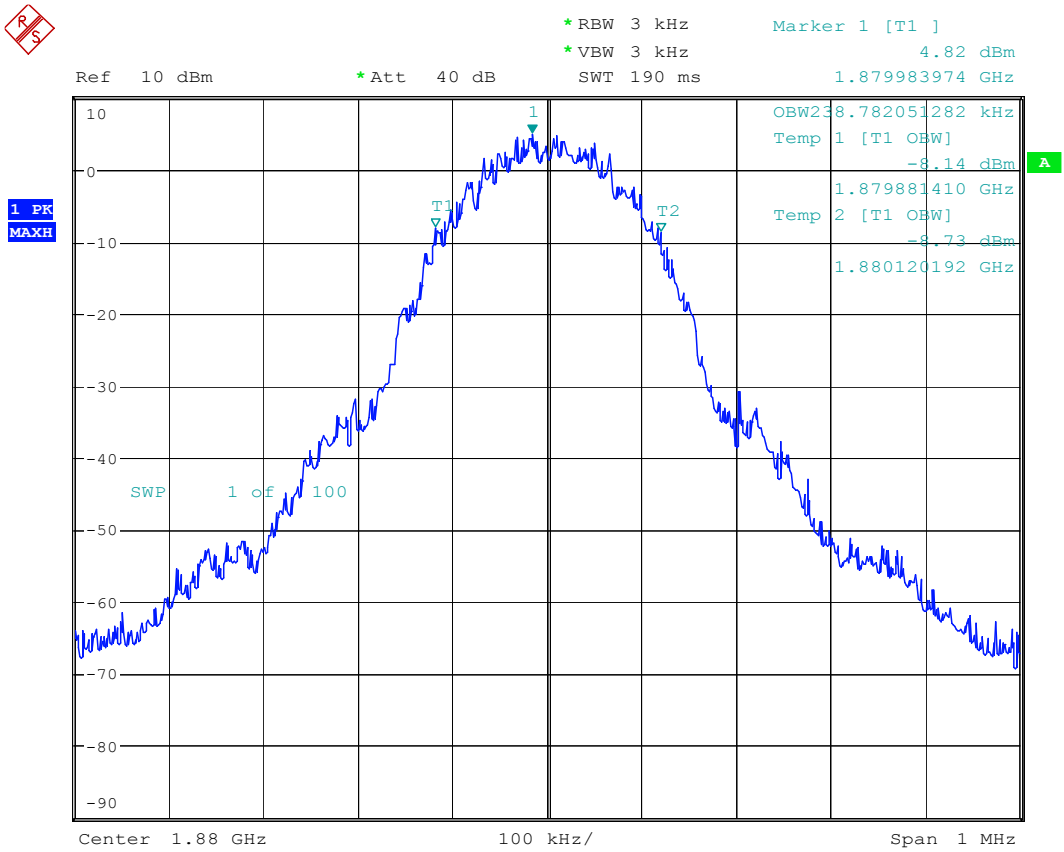
7.4 Screen shot



Picture 1 99% occupied bandwidth, channel 661

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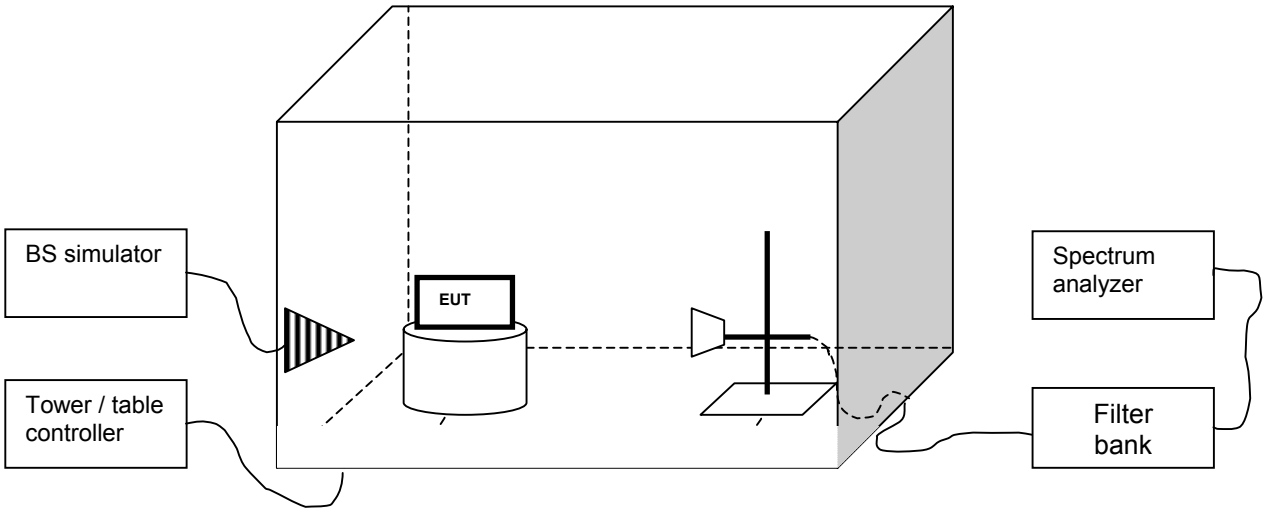
8 SPURIOUS RADIATED EMISSION

EUT	40025		
Accessories	40029		
Temp, Humidity, Air Pressure	21 ºC	44 RH%	1023 mbar
Date of measurement	21.7.2004		
FCC rule part	§24.238 (a), §2.1053		
RSS-133 section	6.3		
Measured by	Jari Jantunen		
Result	PASS		

8.1 Test setup

A set of LP/HP/BS filters was used to prevent overloading the spectrum analyzer. The BS simulator was used to set the TX channel and power level and modulate the TX signal with different bit patterns. The test was done using an automated test system, where the measurement devices were controlled by a computer.



8.2 Test method

a) The emissions were searched and maximized by moving the turn table and measuring antenna and manipulating the EUT.

b) All suspicious frequencies with emission levels were recorded.

c) The EUT was replaced with a substituting antenna.

d) For each frequency recorded, the substituting antenna was fed with the power (from signal generator) giving the same reading as in (b). These power levels were reported.

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8.3 EUT operation mode

EUT operation mode	TX on, 1 time slot transmission, PRBS 2E9-1 modulation
EUT channel	661
EUT TX power level	0 (+30dBm)

8.4 Limit

Frequency [MHz]	Level [dBm]
30 – 19100	-13

8.5 Results

The formula below was used to calculate the EIRP of the spurious emissions. If there were no emissions closer than 20dB below the limit line, then the emission levels were measured at the transmitter's harmonics.

$$P_{Emission[dBm]} = P_{SubstTX[dBm]} - L_{Cable[dB]} + G_{Antenna[dBi]}$$

where the variables are as follows:

$P_{Measured\ [dBm]}$	Measured emission level (from step b in 8.2)
$P_{Subst\_TX\ [dBm]}$	Signal generator power (from step d in 8.2) fed to the substituting antenna
$L_{Cable\ [dB]}$	Loss of the cable between antenna and signal generator (from step d in 8.2)
$G_{Antenna\ [dBi]}$	Gain of the substitutive antenna over isotropic radiator

Table 2 Emission levels, channel 661

Frequency [MHz]	$P_{Measured}$ [dBm]	Correction factor [dB]	$P_{Emission}$ [dBm]
3760.023046	-24.0	-1.3	-22.7
17045.58417	-52.9	-20.5	-32.4
17319.13327	-56.4	-22.9	-33.5
17431.86974	-56.1	-23.6	-32.5
17640.78657	-56.9	-27.1	-29.8
17762.53106	-57.4	-27.3	-30.1

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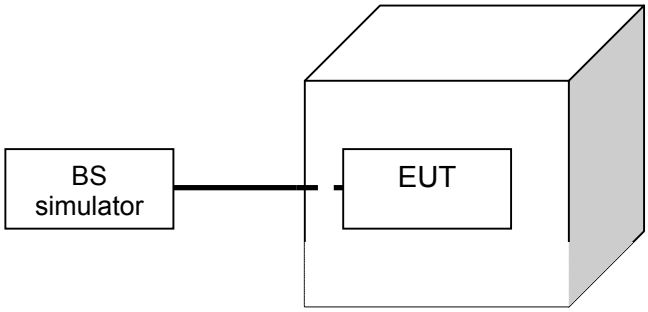
9 FREQUENCY STABILITY, TEMPERATURE VARIATION

EUT	40026		
Accessories	40030		
Temp, Humidity, Air Pressure	21 ºC	45 RH%	1026 mbar
Date of measurement	22.7.2004		
FCC rule part	§24.235, §2.1055 (a)(1)(b)		
RSS-133 section	7		
Measured by	Jari Jantunen		
Result	PASS		

9.1 Test setup

The BS simulator was used to set the TX channel and power level and modulate the TX signal with different bit patterns.



9.2 EUT operation mode

EUT operation mode	TX on, 1 time slot transmission, PRBS 2E9-1 modulation
EUT channel	661
EUT TX power level	0 (+30dBm)

9.3 Limit

Frequency deviation [ppm]
± 2.5

9.4 Test method

a) The climate chamber temperature was set to the minimum value and the temperature was allowed to stabilize.

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b) The EUT was placed in the chamber

c) The EUT was set in idle mode for 45 minutes.

d) The EUT was set to transmit.

e) The transmit frequency error was measured immediately

f) The steps c - e were repeated for each temperature

9.5 Results

Table 3 Frequency deviation, temperature variation

Temperature [ºC]	Deviation [Hz]	Deviation [ppm]
-20	-45	0.023936
-10	-43	0.022872
0	32	0.017021
10	-33	0.017553
20	34	0.018085
30	37	0.019680
40	43	0.022872
50	47	0.025000

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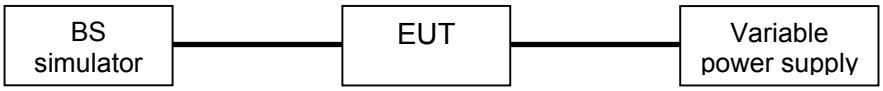
10 FREQUENCY STABILITY, VOLTAGE VARIATION

EUT	40026		
Accessories	40031		
Temp, Humidity, Air Pressure	21 ºC	45 RH%	1026 mbar
Date of measurement	22.7.2004		
FCC rule part	§24.235, §2.1055 (d)(1)(2)		
RSS-133 section	7		
Measured by	Jari Jantunen		
Result	PASS		

10.1 Test setup

The BS simulator was used to set the TX channel and power level and modulate the TX signal with different bit patterns.



10.2 EUT operation mode

EUT operation mode	TX on, 1 time slot transmission, PRBS 2E9-1 modulation
EUT channel	661
EUT TX power level	0 (+30dBm)

10.3 Limit

Frequency deviation [ppm]
± 2.5

10.4 Test method

The EUT battery was replaced with an adjustable power supply. The frequency stability was measured at nominal voltage and at the battery cut-off point.

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10.5 Results

Table 4 Frequency deviation, voltage variation

Level	Voltage [V]	Deviation [Hz]	Deviation [ppm]
Nominal	3.7	49	0.026064
Battery cut-off point	3.23	44	0.023404

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11 TEST EQUIPMENT

Each test equipment is calibrated once a year.

11.1 Conducted measurements

Equipment	Manufacturer	Model
EMI receiver	Rohde & Schwarz	ESI 40
Radio communication tester	Rohde & Schwarz	CMU-200
Attenuator 10 dB	Huber+Suhner AG	6251.17.A
Step attenuator 110dB	Hewlett-Packard	8496A
Power splitter	Hewlett-Packard	11667A
High pass filter	Trilithic	WHK2010-10SS
Low pass filter	Trilithic	WLK1750-10SS
Tunable notch filter	Wainwright	WRCD1850/1910-0.2/40
Temperature chamber	Vötsch	VT4002
DC power supply	HP	6632A
Multimeter	Fluke	87

11.2 Radiated measurements

Equipment	Manufacturer	Model
3m semi-anechoic chamber	TDK	
EMI receiver	Rohde & Schwarz	ESI 40
Preamplifier	MITEQ	AMF-5D-020180-26-10P
Preamplifier	MITEQ	AMF-4D-10M-3G-25-20P
Dipole antenna	EMCO	3125-870
Dipole antenna	EMCO	3125-1880
Biconilog antenna	Rohde & Schwarz	HL562
Double ridged waveguide antenna	EMCO	3115
Double ridged waveguide antenna	EMCO	3115
Horn antenna	EMCO	3116
Reference dipole set	Schwarzbeck	UHAP/VHAP

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Communication antenna	EMC Automation	LPA-8020
Radio communication tester	Rohde & Schwarz	CMU-200
Signal generator	Hewlett-Packard	83640L
Step attenuator 110dB	Hewlett-Packard	8496A
Power splitter	Hewlett-Packard	11667A
High pass filter	Trilithic	WHK2010-10SS
Low pass filter	Trilithic	WLK1750-10SS
Tunable notch filter	Wainwright	WRCD1850/1910-0.2/40
Turntable controller	Deisel	HD-100
Turntable	Deisel	DS412
Antenna mast controller	EMCO	2090
Antenna mast	EMCO	2075
Temperature chamber	Vötsch	VT4002
DC power supply	Hewlett-Packard	6632A
Multimeter	Fluke	87

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12 TEST SETUP PHOTOGRAPHS

See "NPL-2_test_setup_photographs.doc".

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