GSM1900 test report
for
RA-4

FCC ID:PYARA-4
IC: 661V-RA4

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CONTENTS

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1 LABORATORY INFORMATION

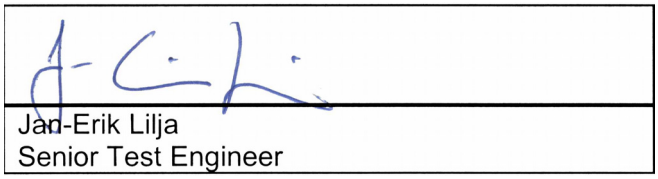
Test laboratory:	TCC Tampere Sinitaival 5 FIN-33720 TAMPERE Tel. +358 7180 46800 Fax. +358 7180 46880
FCC registration number: IC file number:	94436 (June 14, 2002) IC 3608 (March 5, 2003)

2 CUSTOMER INFORMATION

Client:	Nokia Corporation Joensuunkatu 7 FIN-24100 SALO BOX 86 FIN-24101 SALO Tel. +358-71-8008000 Fax. +358-71-8044277
Contact person:	Timo Seppälä
Receipt of EUT:	26.1.2005
Date of testing:	26.1-1.2.2005
Date of report:	04.02.2005

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:



Jan-Erik Lilja
Senior Test Engineer

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3 SUMMARY OF TEST RESULTS

Section in CFR 47	Section in RSS-133	Test	Result
§2.1046 (a)	6.2	Conducted RF output power	-
§24.232 (b)	6.2	Radiated RF output power	-
§2.1049 (h)	5.6	99% occupied bandwidth	PASS
§24.238 (a)	6.3	Bandedge compliance	PASS
§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

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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.

	Name	Type	S/N	HW	SW	EUT number
EUT	RA-4	Phone	004400571630423	5300	04.53	40164
	RA-4	Phone		5300	04.53	40167
Accessories	BP-6M	Battery	-	-	-	40169
	ACP-12E	Charger	-	5.0	-	40172
	SF-24DLIGHT	Dummy battery	-	-	-	40175

Notes: -

4.1 EUT description

The EUT is a triple band (GSM 850/1800/1900 EGPRS) 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

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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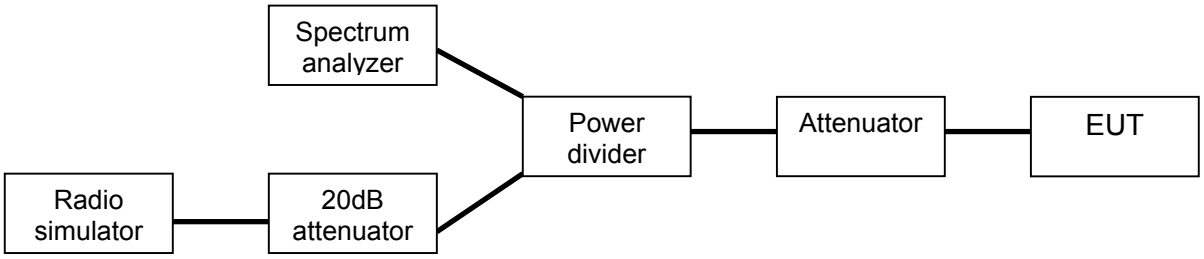
7 99% OCCUPIED BANDWIDTH

EUT	40166		
Accessories	40170		
Temp, Humidity, Air Pressure	23ºC	43 RH%	1027 mbar
Date of measurement	26.1.2005		
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	GSM, TX on, 1 time slot, PRBS 2E9-1 modulation data EGPRS, TX on, 1 time slot, PRBS 2E9-1 modulation data
EUT channel	661
EUT TX power level	Maximum

7.3 Results

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

Table 1 99% occupied bandwidth

EUT Channel	EUT operation mode	99% occupied bandwidth [kHz]
661	GSM	241.987
661	EGPRS	238.782

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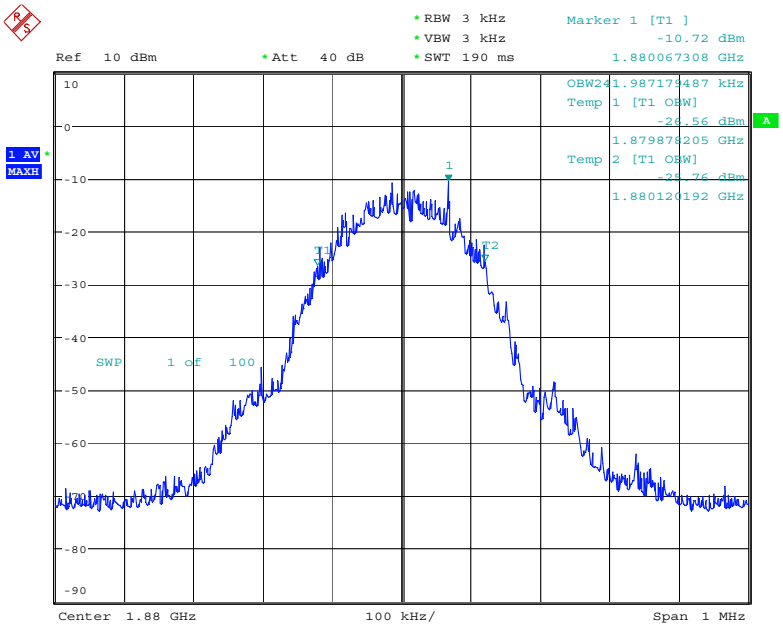
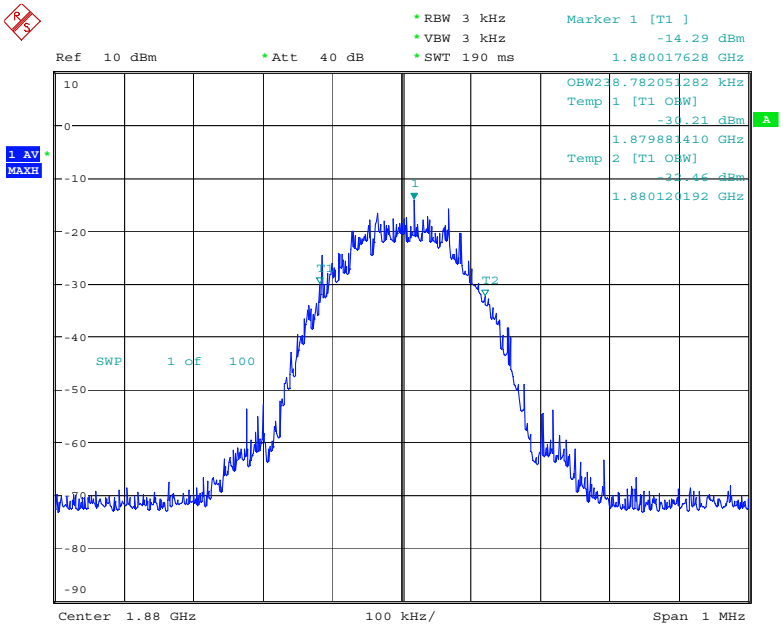
7.4 Screen shot



Picture 1 99% occupied bandwidth, GSM 1900 channel 661



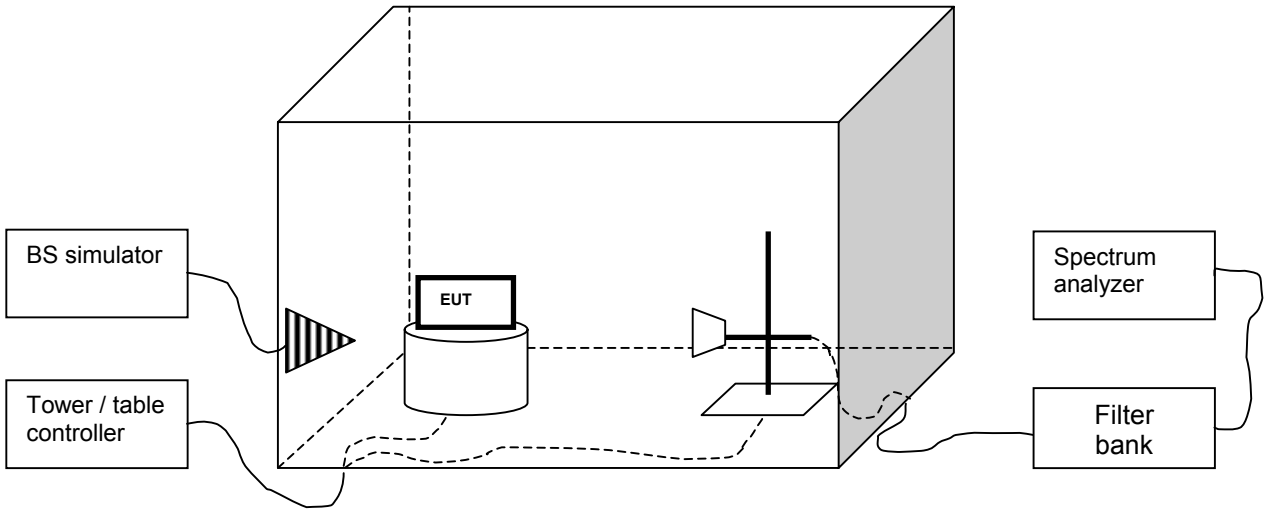
Picture 2 99% occupied bandwidth, EGPRS 1900 channel 661

8 BANDEDGE COMPLIANCE

EUT	40164		
Accessories	40169, 40172		
Temp, Humidity, Air Pressure	23ºC	43 RH%	1027 mbar
Date of measurement	26.1.2005		
FCC rule part	§24.238 (a)		
RSS-133 section	6.3		
Measured by	Jari Jantunen		
Result	PASS		

8.1 Test setup

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



8.2 EUT operation mode

EUT operation mode	GSM, TX on, 1 time slot, PRBS 2E9-1 modulation data EGPRS, TX on, 1 time slot, PRBS 2E9-1 modulation data
EUT channel	See section 8.4
EUT TX power level	Maximum

8.3 Limit

Frequency [MHz]	Level [dBm]
<1850 or 1910<	-13

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8.4 Results

The line in the screen shots is the -13dBm limit line. The results were corrected with measurement path loss set as “offset” in the spectrum analyzer. RBW/VBW was 3kHz.

Table 2 Bandedge compliance, flip closed

EUT Channel	EUT operation mode	Level [dBm]
512	GSM	-17.09
810	GSM	-16.66
512	EGPRS	-18.72
810	EGPRS	-22.45

Table 3 Bandedge compliance, flip open

EUT Channel	EUT operation mode	Level [dBm]
512	GSM	-16.44
810	GSM	-17.52
512	EGPRS	-19.56
810	EGPRS	-22.32

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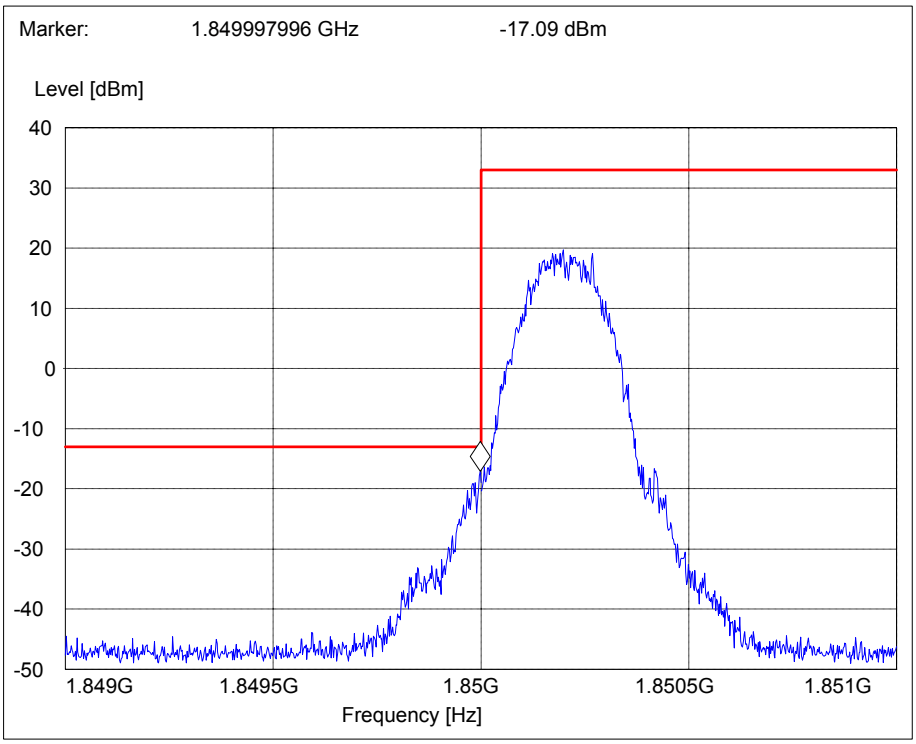
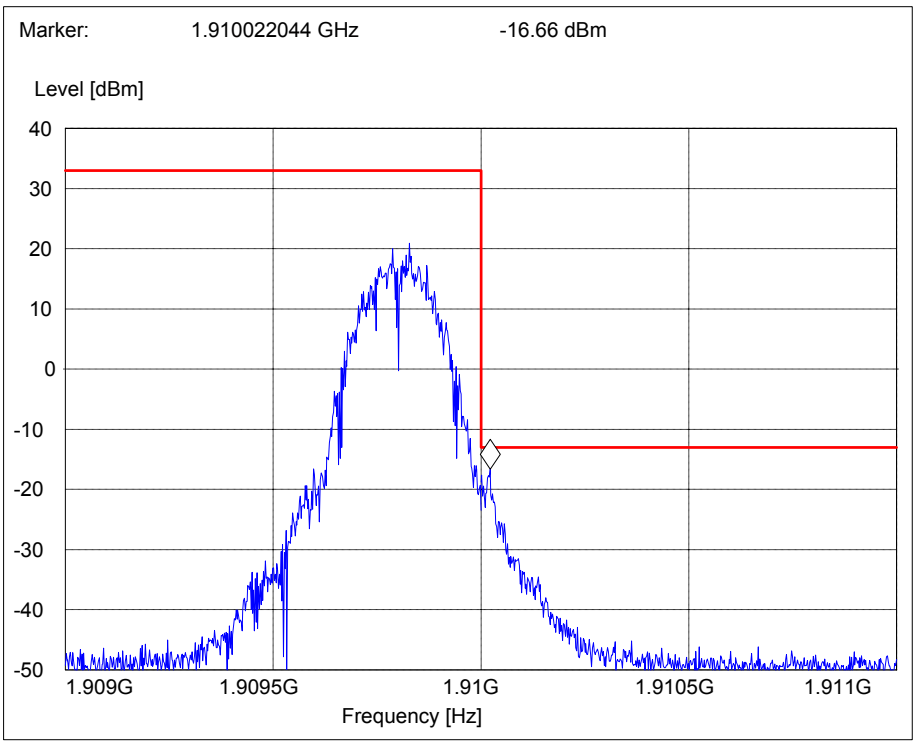
8.5 Screen shots



Picture 3 Lower bandedge, GSM 1900 channel 512, flip closed



Picture 4 Upper bandedge, GSM 1900 channel 810, flip closed

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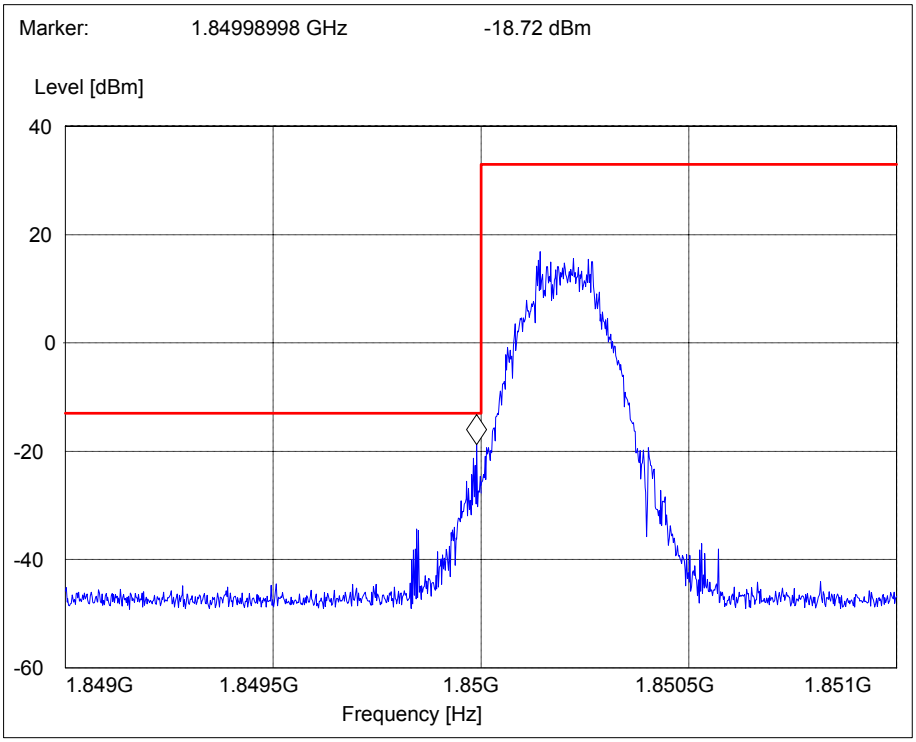
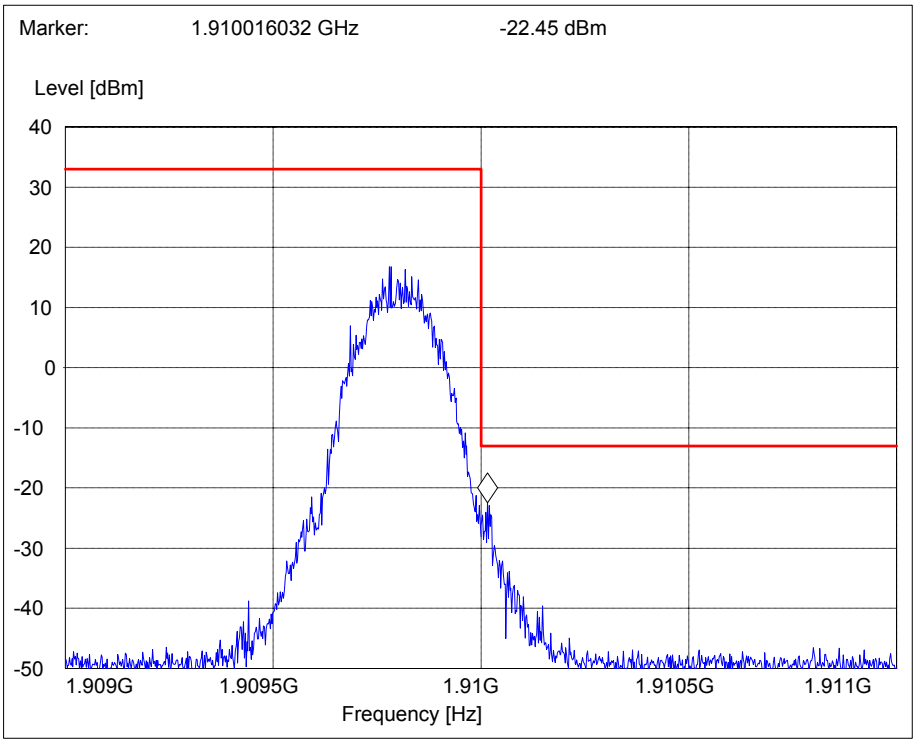


Picture 5 Lower bandedge, EGPRS 1900 channel 512, flip closed



Picture 6 Upper bandedge, EGPRS 1900 channel 810, flip closed

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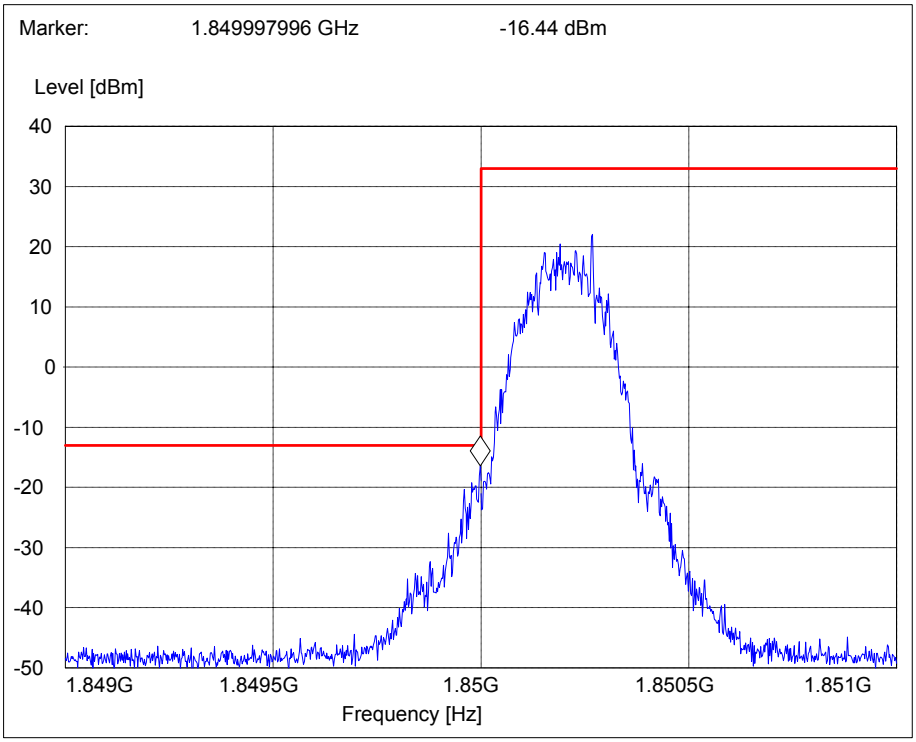
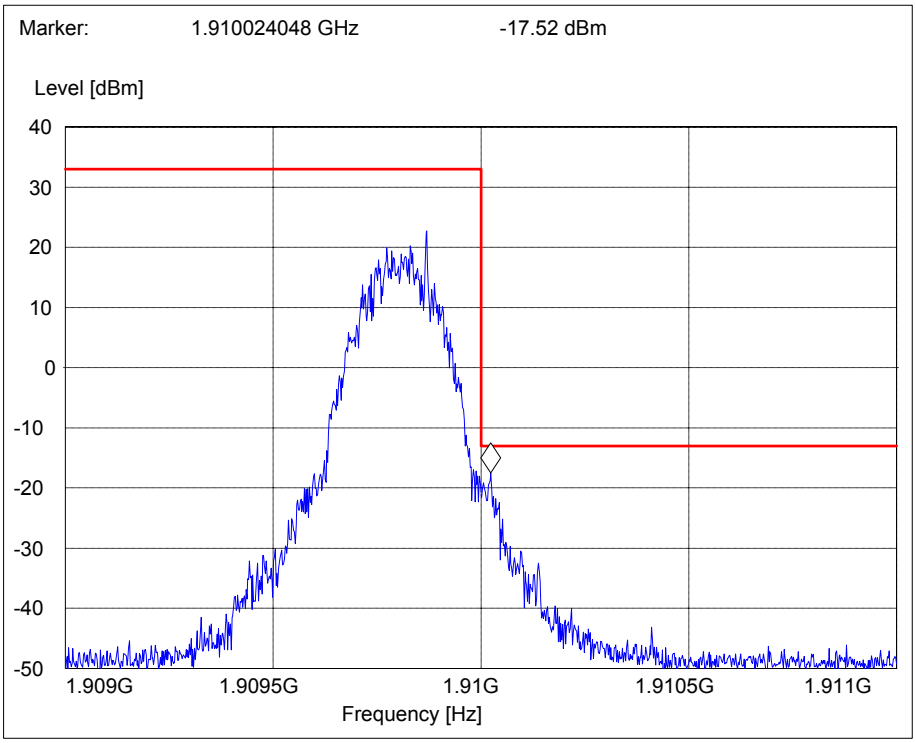


Picture 7 Lower bandedge, GSM 1900 channel 512, flip open



Picture 8 Upper bandedge, GSM 1900 channel 810, flip open

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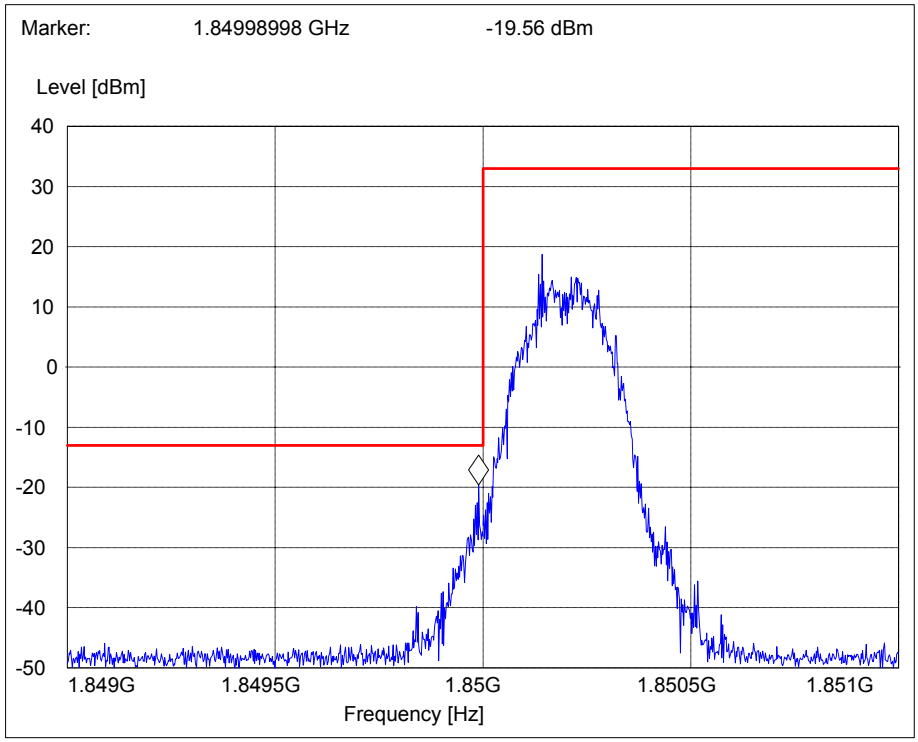
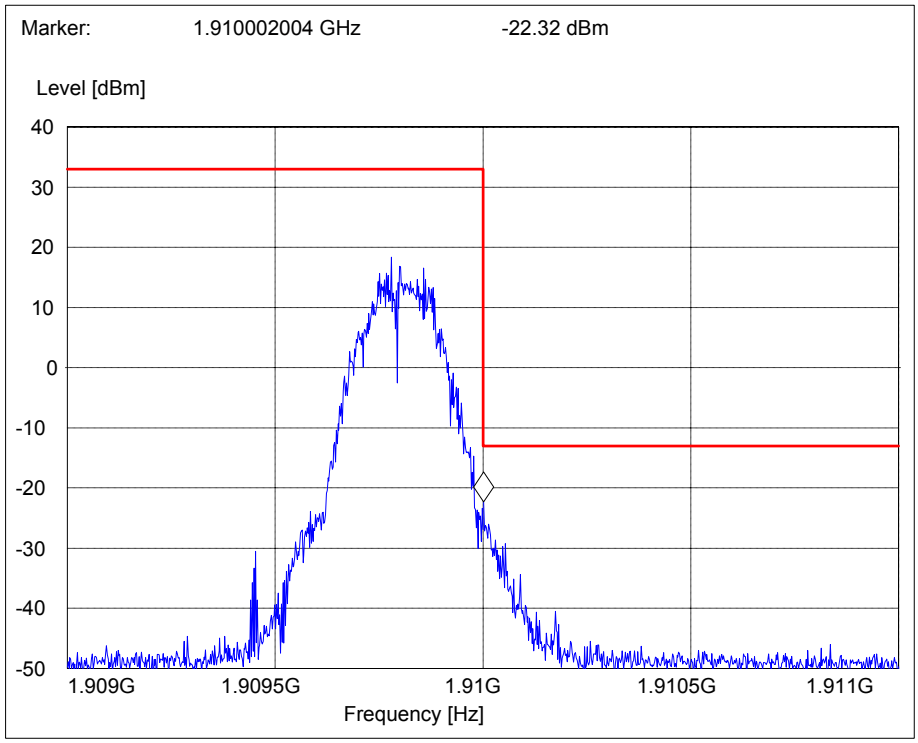


Picture 9 Lower bandedge, EGPRS 1900 channel 512, flip open



Picture 10 Upper bandedge, EGPRS 1900 channel 810, flip open

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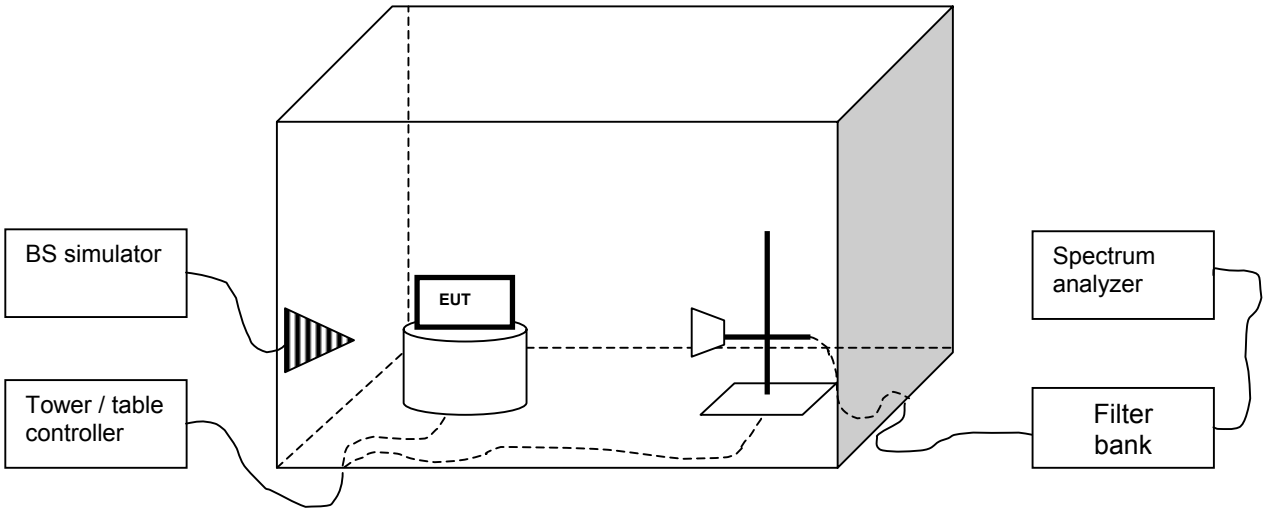
9 SPURIOUS RADIATED EMISSION

EUT	40164		
Accessories	40169, 40172		
Temp, Humidity, Air Pressure	23ºC	43 RH%	1027 mbar
Date of measurement	26.1.2005		
FCC rule part	§24.238 (a), §2.1053		
RSS-133 section	6.3		
Measured by	Jari Jantunen		
Result	PASS		

9.1 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.



9.2 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 known power (from signal generator).

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9.3 EUT operation mode

EUT operation mode	GSM, TX on, 1 time slot, PRBS 2E9-1 modulation data EGPRS, TX on, 1 time slot, PRBS 2E9-1 modulation data
EUT channel	661
EUT TX power level	Maximum

9.4 Limit

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

9.5 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.

$$Correction\ \ Factor = P_{receiver[dBm]} - P_{SubstTX[dBm]} - L_{Cable[dB]} + G_{Antenna[dBi]}$$

$$P_{Emission[dBm]} = P_{Measured[dBm]} - Correction\ \ Factor$$

where the variables are as follows:

$P_{receicer\ [dBm]}$	Measured emission level when substituting
Correction Factor	Calculated factor [dB]
$P_{Measured\ [dBm]}$	Measured emission level (from step b in 9.2)
$P_{Subst\_TX\ [dBm]}$	Signal generator power (from step d in 9.2) fed to the substituting antenna
$L_{Cable\ [dB]}$	Loss of the cable between antenna and signal generator (from step d in 9.2)
$G_{Antenna\ [dBi]}$	Gain of the substitutive antenna over isotropic radiator
$P_{Emission\ [dBm]}$	$P_{Measured\ [dBm]}$ decreased with correction factor

Table 4 Emission levels, GSM1900,channel 661, flip closed

Frequency [MHz]	$P_{Measured}$ [dBm]	Correction Factor [dB]	$P_{Emission}$ [dBm]
3760,00	-62.40	-9.30	-53.10
5640,00	-61.50	-11.80	-49.70
7520,00	-63.90	-14.90	-49.00
9400,00	-62.40	-18.60	-43.80
11280,00	-65.20	-19.60	-45.60
13160,00	-64.50	-21.50	-43.00
15040,00	-65.10	-22.80	-42.30
16920,00	-66.00	-25.90	-40.10

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Table 5 Emission levels, EGPRS1900, channel 661, flip closed

Frequency [MHz]	$P_{Measured}$ [dBm]	Correction Factor [dB]	$P_{Emission}$ [dBm]
3760,00	-63.10	-9.30	-53.80
5640,00	-62.20	-11.80	-50.40
7520,00	-64.00	-14.90	-49.10
9400,00	-66.50	-18.60	-47.90
11280,00	-65.70	-19.60	-46.10
13160,00	-64.50	-21.50	-43.00
15040,00	-64.80	-22.80	-42.00
16920,00	-66.80	-25.90	-40.90

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Table 6 Emission levels, GSM1900,channel 661, flip open

Frequency [MHz]	$P_{Measured}$ [dBm]	Correction Factor [dB]	$P_{Emission}$ [dBm]
3760,00	-63.00	-9.30	-53.70
5640,00	-62.00	-11.80	-50.20
7520,00	-64.00	-14.90	-49.10
9400,00	-63.30	-18.60	-44.70
11280,00	-65.80	-19.60	-46.20
13160,00	-63.50	-21.50	-42.00
15040,00	-65.30	-22.80	-42.50
16920,00	-66.80	-25.90	-40.90

Table 7 Emission levels, EGPRS1900, channel 661, flip open

Frequency [MHz]	$P_{Measured}$ [dBm]	Correction Factor [dB]	$P_{Emission}$ [dBm]
3760,00	-63.10	-9.30	-53.80
5640,00	-62.50	-11.80	-50.70
7520,00	-64.00	-14.90	-49.10
9400,00	-65.60	-18.60	-47.00
11280,00	-65.60	-19.60	-46.00
13160,00	-65.60	-21.50	-44.10
15040,00	-65.00	-22.80	-42.20
16920,00	-67.50	-25.90	-41.60

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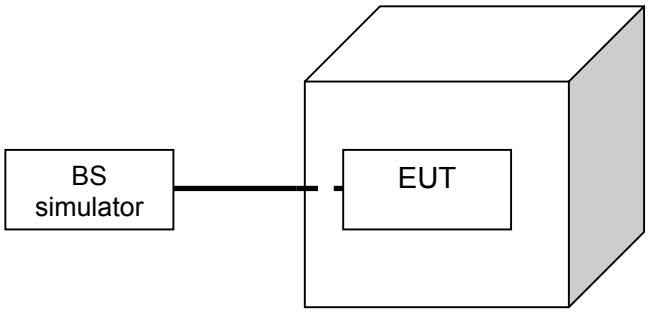
10 FREQUENCY STABILITY, TEMPERATURE VARIATION

EUT	40166		
Accessories			
Temp, Humidity, Air Pressure	23ºC	41RH%	992-1002 mbar
Date of measurement	31.1-1.2.2005		
FCC rule part	§24.235, §2.1055 (a)(1)(b)		
RSS-133 section	7		
Measured by	Jan-Erik Lilja		
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	GSM, TX on, 1 time slot, PRBS 2E9-1 modulation data
EUT channel	661
EUT TX power level	Maximum

10.3 Limit

Frequency deviation [ppm]
± 2.5

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10.4 Test method

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

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

10.5 Results

Table 8 Frequency deviation, temperature variation

Temperature [ºC]	Deviation [Hz]	Deviation [ppm]
-30	-39	-0.02074
-20	-52	-0.02766
-10	-61	-0.03245
0	-48	-0.02553
10	-41	-0.02181
20	-50	-0.02660
30	-50	-0.02660
40	-52	-0.02766
50	-28	-0.01489

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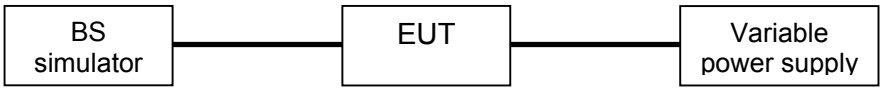
11 FREQUENCY STABILITY, VOLTAGE VARIATION

EUT	40167		
Accessories	40175		
Temp, Humidity, Air Pressure	19ºC	52 RH%	1019 mbar
Date of measurement	28.1.2005		
FCC rule part	§24.235, §2.1055 (d)(1)(2)		
RSS-133 section	7		
Measured by	Jari Jantunen		
Result	PASS		

11.1 Test setup

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



11.2 EUT operation mode

EUT operation mode	GSM, TX on, 1 time slot, PRBS 2E9-1 modulation data
EUT channel	661
EUT TX power level	Maximum

11.3 Limit

Frequency deviation [ppm]
± 2.5

11.4 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.

11.5 Results

Table 9 Frequency deviation, voltage variation

Level	Voltage [V]	Deviation [Hz]	Deviation [ppm]
Nominal	3.70	-51	0.0271
Battery cut-off point	3.45	-33	0.0176

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12 TEST EQUIPMENT

Each test equipment is calibrated once a year.

12.1 Conducted measurements

Equipment	Manufacturer	Model
Spectrum analyzer	Rohde & Schwarz	FSU
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

12.2 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
Horn antenna	EMCO	3116
Reference dipole set	Schwarzbeck	UHAP/VHAP
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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