TCC
Nokia

T117 (EN ISO/IEC 17025)

GSM 1900 Test Report for RH-67

Test Report no.:	DTX11990-EN	**Date of Report:**	September 10, 2004
Number of pages:	24	**Customer's Contact person:**	Ole Sørensen
		Responsible Test engineer:	Ruben Hansen

Testing laboratory:	TCC Copenhagen Nokia Danmark A/S Frederikskaj DK-1790 Copenhagen V Denmark Tel. +45 33 29 29 29 Fax. +45 33 29 20 01 FCC Reg. # 99059, June 2003 IC File # 4820, January 2004 IC File # 4820-1, February 2004	**Client:**	Nokia Corporation Arco Tower Shimomeguro 1-8-1 Meguro-ku TOKYO 153-0064 JAPAN Tel. +81 3 5759 7001 Fax. +81 3 5740 6858

Tested devices/ accessories: **Phone;RH-67, Battery; BL- 5C, MMC card; MU-1; Charger; ACP-12U**

Supplement reports:

Testing has been carried out in accordance with: 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.

Documentation: The documentation of the testing performed on the tested devices is archived for 15 years at TCC Copenhagen.

Test Results: The tested device complies with the requirements in respect of all parameters subject to the test.
The test results and statements relate only to the items tested.
The test report shall not be reproduced except in full, without written approval of the laboratory.

Date and signatures for the contents:

6/9/2004

Ruben Hansen
EMC Team Leader

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1. Summary of test results

Section in CFR 47	Section in RSS-133		Result
§2.1046 (a)	6.2	Conducted RF output	PASS
§24.232 (b)	6.2	Radiated RF output	PASS
§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	N.A.
§24.238 (a), §2.1053	6.3	Spurious radiated emission	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 Passed
FAIL Failed
X Measured, but there is no applicable performance criteria
N.A. Not Applicable

2. EUT Information

Product	Type	SN	HW	MV	SW	DUT
Phone	RH-67	004400/51/170257/1	2003		3.0431.0	234483
Phone	RH-67	004400/51/170341/3	2003		3.0431.0	234403
Phone	RH-67	004400/51/170155/7	2003		3.0431.0	234400
Battery	BL-5C	067040011124239111				232349
Battery	BL-5C	0670400363563 L075520101784				234485
Battery	BL-5C					232901
MMC card	MU-1					233523
MMC card	MU-1	MC12U064DACA-0QA00 SVSA240Q2412				234210
MMC card	MU-1	MC56UO32DCCA-2QA00 SUCE394X2 426				234426
AC Charger	ACP-12U	067530339971L072FA00 16736				234515

2.1. EUT description

The EUT is a triple band (900MHz/1800MHz/1900MHz) E-GPRS (EDGE) GSM mobile phone with Bluetooth, Camera and FM-radio
The EUT was not modified during the tests.

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3. EUT Test Setup

For each test the EUT was exercised to find the worst case of operation modes and device configuration.
The test setup photographs are in Appendix A

4. Applicable Standards

The tests were performed in guidance of CFR 47, part 24 and 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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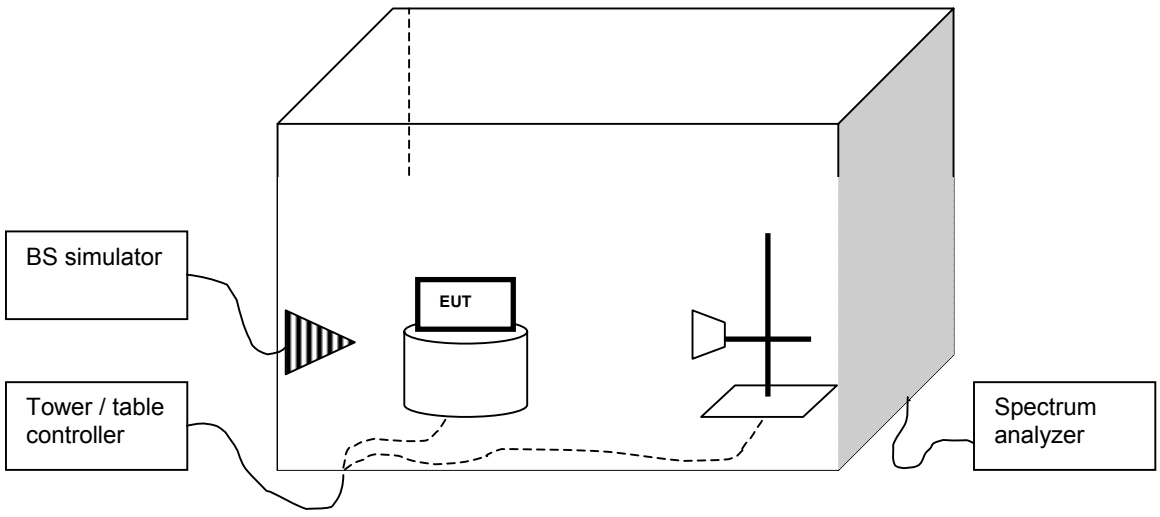
5. Radiated RF output power

EUT(s)	RH-67 Dut # 234403		
Accessories	BL-5C Dut # 232349		
Temp, Humidity, Air Pressure	15 ºC	87 RH%	1011 mbar
Date of measurement	01/09/2004		
FCC rule part	§24.232 (b)		
RSS-133 section	6.2		
Measured by	Ruben Hansen		
Result	**Passed**		

5.1. Test setup

The EUT was set on a non-conductive turn table in a semi anechoic chamber. In the corner of the chamber there was a communication antenna, which was connected to the BS simulator located outside the chamber. The radiated power from the EUT was measured with an antenna fixed to a antenna tower. The tower and turn table were remotely controlled to turn the EUT and change the antenna polarization. The measured signal was routed from the measuring antenna to 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.



5.2. Test method

a) The maximum power level was searched by moving the turn table and measuring antenna and manipulating the EUT. This level (P_{EUT}) was recorded.

b) The EUT was replaced with a substituting antenna.

c) The substituting antenna was fed with the power (P_{Subst_TX}) giving a convenient reading on the spectrum analyzer. That reading (P_{Subst_RX}) on spectrum analyzer was recorded.

5.3. EUT operation mode

	GSM	EGPRS
EUT operation mode	TX on, 1 time slot transmission, GMSK modulation	TX on, 2 time slot transmission, 8PSK modulation
EUT channel	512, 661, 810	512, 661, 810
EUT TX power level	0 (+30dBm)	0 (+30dBm)

5.4. Limit

EIRP [W]
≤ 2

5.5. Results

The formula below was used to calculate the EIRP of the EUT.

$$P_{EIRP[W]} = \frac{10^{(P_{Subst\_TX[dBm]}+(P_{EUT[dBm]}-P_{Subst\_RX[dBm]})+G_{Substitute\_antenna[dBi]}-L_{Cable[dB]})/10}}{1000}$$

where the variables are as follows:

$P_{EUT\ [dBm]}$	Measured power level (from step a in 7.2) from the EUT
$P_{Subst\_TX\ [dBm]}$	Power (from step c in 7.2) fed to the substituting antenna
$P_{Subst\_RX\ [dBm]}$	Power (from step c in 7.2) received with the spectrum analyzer
$G_{Substitute\_antenna\ [dBi]}$	Gain of the substitutive antenna over isotropic radiator
$L_{Cable\ [dB]}$	Loss of the cable between signal generator and the substituting antenna

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EUT: 234403 Mode: EGPRS

EUT Channel	P eut [dBm]	P subst TX [dBm]	P subst RX [dBm]	Cable Loss [dB]	Ant. Gain [dBi]	EIRP [dBm]	EIRP [W]
512	-13.97	0	-48.04	5.2	2.15	31.02	1.265
661	-13.15	0	-48.08	5.63	2.15	31.45	1.396
810	-13.59	0	-48.12	5.95	2.15	30.73	1.183

EUT: 234403 Mode: GSM 1900

EUT Channel	P eut [dBm]	P subst TX [dBm]	P subst RX [dBm]	Cable Loss [dB]	Ant. Gain [dBi]	EIRP [dBm]	EIRP [W]
512	-14,92	0	-48,04	5,2	2,15	30,07	1,016
661	-13,84	0	-48,08	5,63	2,15	30,76	1,191
810	-13,99	0	-48,12	5,95	2,15	30,33	1,079

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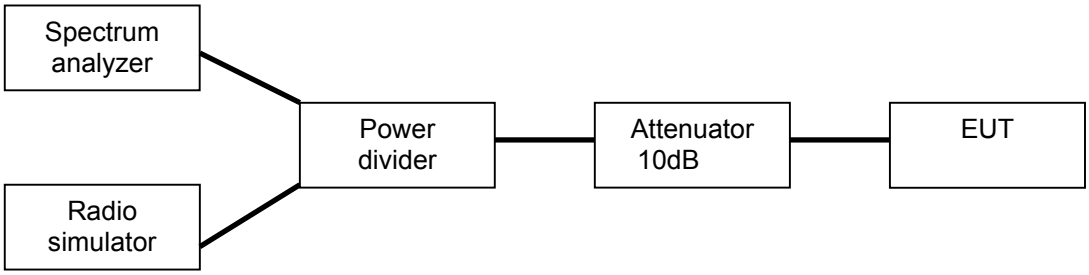
6. 99% occupied bandwidth

EUT	RH-67 dut 234483		
Accessories	BL-5C dut 234485		
Temp, Humidity, Air Pressure	21.4 ºC	48.0 RH%	1016.2 mbar
	08/24/2004		
	§2.1049 (h)		
	5.6		
	Jan Engelbrechtsen		

6.1. Test setup

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



6.2. 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)

6.3. Results

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

EUT Channel	99% occupied bandwidth [kHz]
661	241,5

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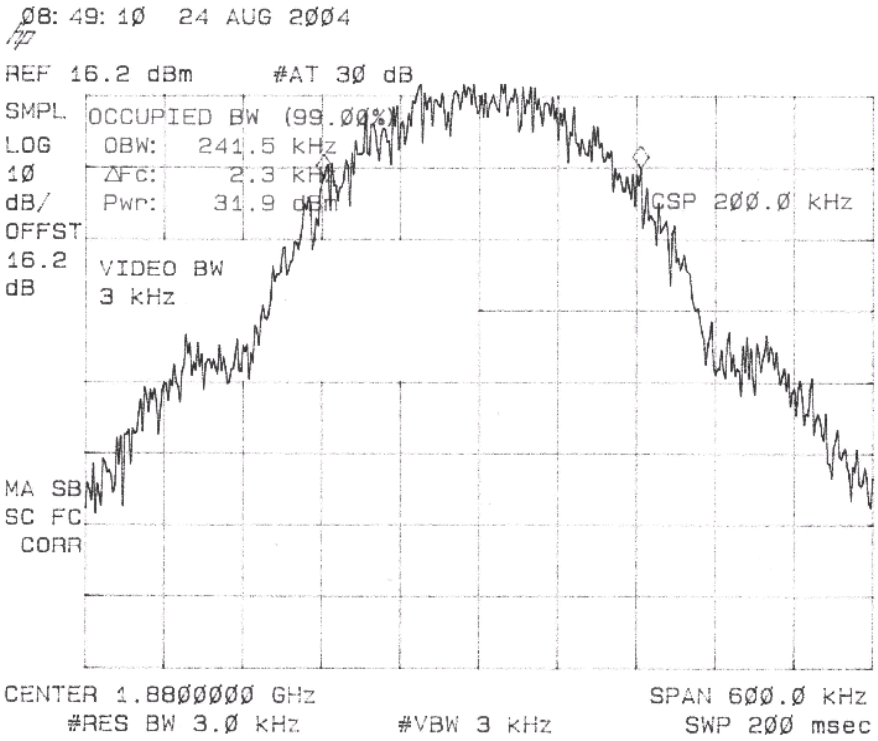
6.4. Screen shot



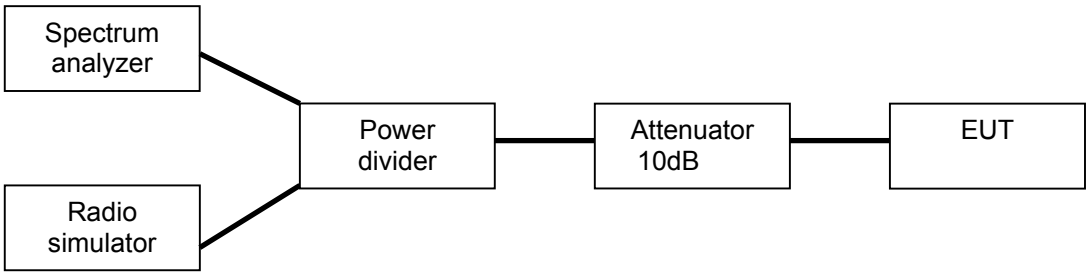
Picture 4. 99% occupied bandwidth, channel 661

7. Bandedge compliance

EUT	RH-67 dut 234483		
Accessories	BL-5C dut 234485		
Temp, Humidity, Air Pressure	21.4 ºC	48.0 RH%	1016.2 mbar
Date of measurement	08/24/2004		
	§24.238 (a)		
	6.3		
	Jan Engelbrechtsen		
	Passed		

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	See section 7.4
EUT TX power level	0 (+30dBm)

7.3. Limit

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

7.4. 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.

EUT Channel	Level [dBm]
512	-14.60
810	-15.30

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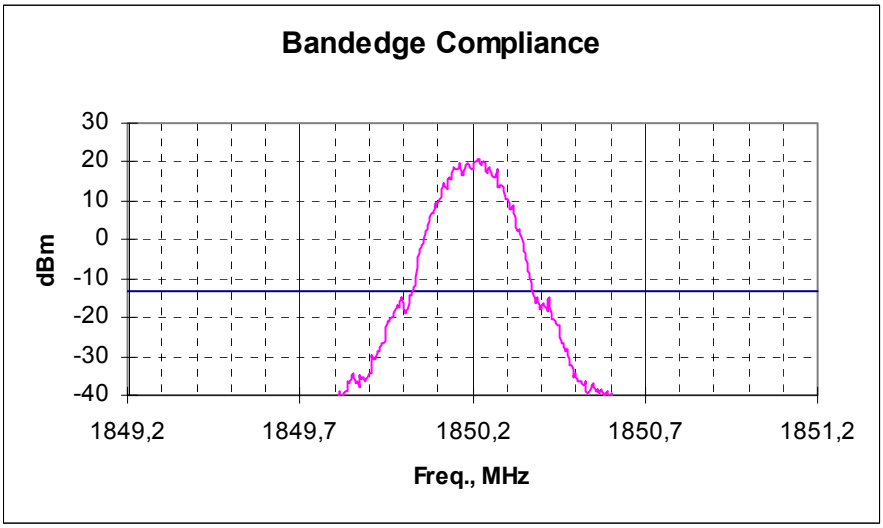
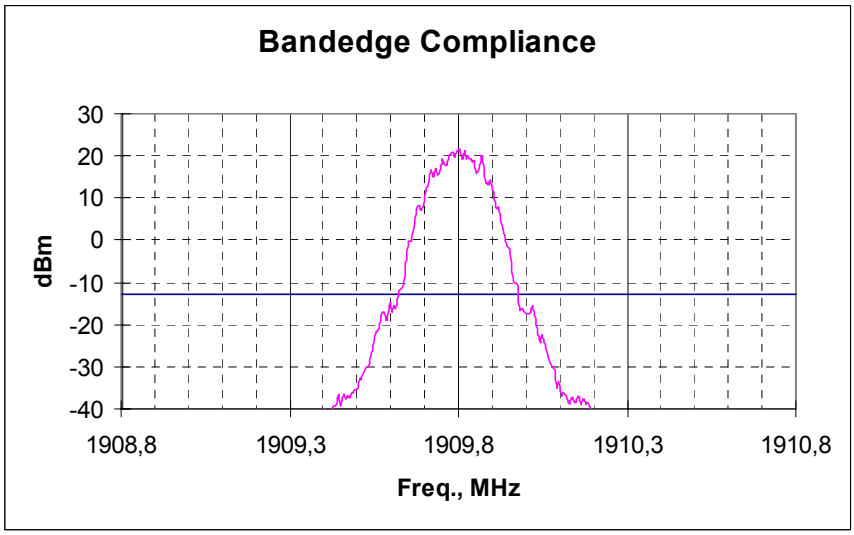
7.5. Screen shots



Picture 5. Lower bandedge, channel 512 RBw 3KHz VBw 3KHz



Picture 6. Upper bandedge, channel 810 RBw 3KHz VBw 3KHz

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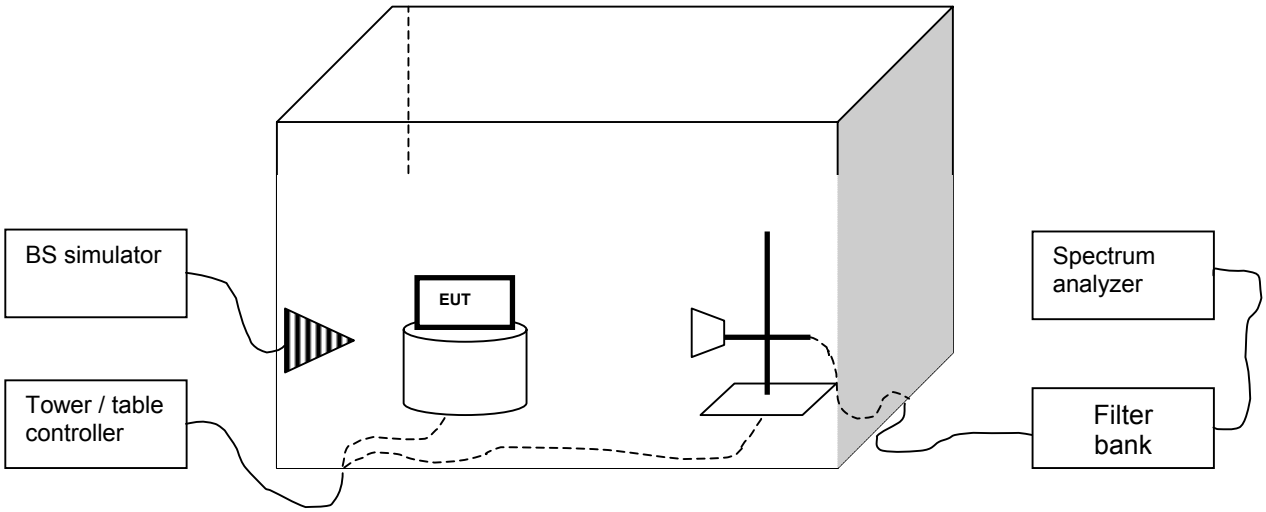
8. Spurious radiated emission

EUT	RH-67 dut#234403	
Accessories	BL-5C dut#232349, MU-1 dut#234210	
Temp, Humidity	22,5ºC	46.0RH%
Date of measurement	10-09-2004	
FCC rule part	§24.238 (a), §2.1053	
	6.3	
	Jesper Nielsen	
	PASSED	

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 manually.



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.

8.3. EUT operation mode

	GSM	EGPRS
EUT operation mode	TX on, 1 time slot transmission, GMSK modulation	TX on, 2 time slot transmission, 8PSK modulation
EUT channel	661	661
EUT TX power level	0 (+30dBm)	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 documented only at the transmitter's mid-channel 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

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Emission levels, EUT 233859, channel 661, GMSK

Frequency [MHz]	$P_{Measured}$ [dBm]	$P_{Subst\ TX}$ [dBm]	L_{Cable} [dB]	$G_{Antenna}$ [dBi]	$P_{Emission}$ [dBm]
3760,00	-56.77	-47.3	8.73	15.80	-40.23
5640,00	-64.47	-52.5	11.53	18.03	-46.00

Emission levels, EUT 233859, channel 661, 8PSK

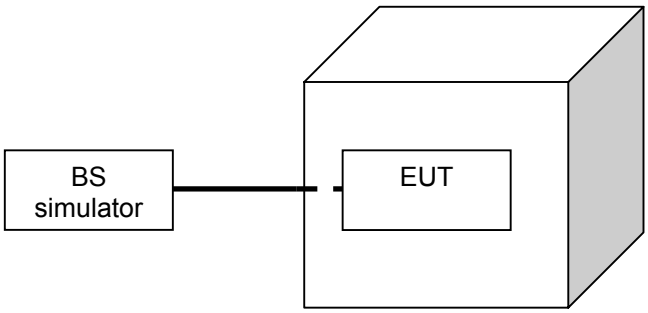
Frequency [MHz]	$P_{Measured}$ [dBm]	$P_{Subst\ TX}$ [dBm]	L_{Cable} [dB]	$G_{Antenna}$ [dBi]	$P_{Emission}$ [dBm]
3760,00	-58.58	-49.1	8.73	15.80	-42.03
5640,00	-63.20	-51.2	11.53	18.03	-44.70

9. Frequency stability, temperature variation

EUT	RH-67 dut# 234483		
Accessories	BL-5C dut# 234485, MU-1 dut#233523		
Temp, Humidity, Air Pressure	21.6 ºC	42.5 RH%	1024.2 mbar
	25-08-2004		
	§24.235, §2.1055 (a)(1)(b)		
	7		
	Jan Engelbrechtsen		
	Passed		

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 (slot 2), 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 EUT was placed in the chamber

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b) The climate chamber temperature was set to the maximum value (50ºC) and the temperature was allowed to stabilize.for 45 minutes

c) .The EUT was set to transmit.

d) The transmit frequency error was measured after 1 minute

e) The call was released

f) Temperature decreased 10 ºC and allowed to stabilize for 45 minutes after set temperature was reached

g) The steps c – f were repeated

9.5. Results

Temperature [ºC]	Deviation [Hz]	Deviation [ppm]
50	-5.23	0.0028
40	5.42	0.0029
30	-6.2	0.003
20	Reference value	0
10	3.92	0.002
0	-11,13	0.006
-10	-7.51	0.004
-20	-36.12	0.02
-30	-3.85	0.002

Table 15. Frequency deviation, temperature variation

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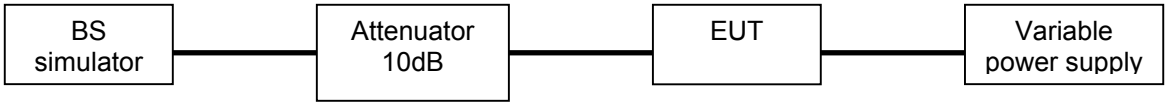
10. Frequency stability, voltage variation

EUT	RH-67 dut 234483		
Accessories	Battery eliminator xxxx		
Temp, Humidity, Air Pressure	21.0 ºC	59.5 RH%	1007.8 mbar
Date of measurement	30-08-2004		
FCC rule part	§24.235, §2.1055 (d)(1)(2)		
	7		
	Jan Engelbrechtsen		
	Passed		

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.

10.5. Results

Level	Voltage [V]	Deviation [Hz]	Deviation [ppm]
Nominal	3.7	-26	0.014
Battery cut-off point	3.38	-28	0.015

Table 16. Frequency deviation, voltage variation

11. AC powerline conducted emissions

EUT	RH-67 Dut # 234400	
Accessories	BL-5C Dut # 232901, ACP-12U Dut # 234515, MMC Dut # 234426	
Temp, Humidity, Air Pressure	23ºC	44% RH
Date of measurement	10-09-2004	
FCC rule part	§15.107	
ICES-003 section	5.3	
Measured by	Allan F. Henriksen	
Result	**PASS**	

11.1. Limit

CISPR 22 Class B limit

Frequency band (MHz)	Quasi-peak limit (dBµV)	Average limit (dBµV)
0.15 – 0.5	66 – 56	56 – 46
0.5 – 5	56	46
5 – 30	60	50

11.2. EUT operation mode

EUT operation mode	TX on, 1 time slot transmission, PRBS 2E9-1 modulation
EUT operation voltage	115V/60Hz

11.3. Test method

The EUT and charger was placed on a non-conductive surface raised 80 centimeters above a conductive horizontal ground plane and placed at a distance of 40 centimeters from the wall,- the latter acting as a conductive vertical ground plane. The distance between the phone and the charger was 10 cm. The excess length of the DC cable between the charger and the phone was hanging down from the testing surface in such a way that it never got closer than 40 centimeters to the floor. The charger was supplied supplied with AC power through a 80 centimeter cable leading down to a 50Ω 2-wire LISN placed on the floor. The measurement receiver was connected to the LISN. The phone was charging during the measurement.

Prior to the test a call was established to the phone through a small rod antenna and a base station simulator.

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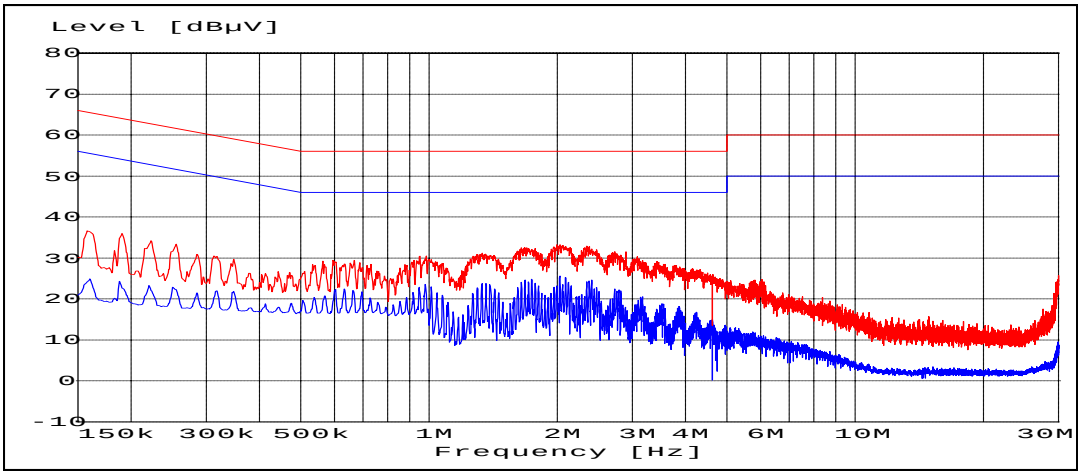
11.4. Results



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12. Test equipment

Each test equipment is calibrated once a year, except antennas which are calibrated every second year.

12.1. Conducted measurements

Equipment #	Equipment	Type	Serial #	Manufacturer
13357	Signal Generator	SMP 02		Rohde & Schwarz
13302	Spectrum Analyzer	8596E		Hewlet Packard
13524	BS Simulator	CMD-55		Rohde & Schwartz
17277	Multimeter	34401A		Agilent
15761	DC Power Supply	E3632A		Hewlet Packard
13371	Temperature chamber	2800		Thermotron
-	RF Attenuator	23-10-34		Weinchel
-	Power Divider	-		Suhner
17796	BS Simulator	4400M		Wavetek
-	Antenna Mast	-		Deisel
14900	Antenna Mast Controller	HD-100		Deisel
15191	Turn Table	G-800SDX		Yaesu
13668	Antenna	CBL6112A		Chase
13935	Two Line Artificial Mains Network	ESH-3-Z5		Rohde & Schwarz
13666	EMI Test Receiver	ESPC		Rohde & Schwarz

12.2. Radiated measurements

Equipment #	Equipment	Type	Serial #	Manufacturer
14993	EMI Test Receiver 9KHz-2750MHz	ESCS30	847124/001	Rohde&Schwarz
15191	Turntable Contoller Unit	G-800SDX	ONO10000	YAESU
14900	Antenna Controller	HD100	100\552	HD GmbH
18792	Multi Device Controller	2090	1606	ETS-EMCO
13829	Turntable Controller	4630-100	100/510	Comtest
14963	RF Preamplifier 100MHz-4GHz (Metal Chassis)	AFS3-00100400	571131	Miteq/NMP Cph
13668	BiLog Antenna 30-	BiLog-CBL6112A	2259	Chase

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	2000MHz			
18861	EMI Test Receiver 20Hz-26,5GHz	ESI	833362/004	Rohde&Schwarz
12679	Dual Log Periodic Antenna 1-26.5 GHz	HL025	----------	Rohde&Schwarz
18860	Ultra Broadband Antenna Ultralog 30-3000MHz	HL562	100154	Rohde&Schwarz
18773	Shielded Chamber	RFD-100	2420	ETS-Lindgren
18774	Shielded Chamber	RFSD-F/A-100	2425	ETS-Lindgren
18324	High Pass Filter 3GHz SMA f Conn	WHJS3000-10SS	1	Wainwright
14114	Highpass Filter 1000MHz-4500MHz	WHK1000-12SS	1	Wainwright
13918	Highpass Filter 2000-4000MHz 50OHM SMA Conn	WHKS2000-10SS		Wainwright Instruments
13937	Ultra Stable Notch Filter 902,4MHz	WRCA902.4-0.2/40-6SS		Wainwright Instruments
13936	Ultra Stable Notch Filter 1747,5MHz	WRCD1747.5-0.2/40-10SS		Wainwright Instruments
16633	Ultra Stable Notch Filter 1880,0MHz	WRCD1880.0-0.2/40-10SS		Wainwright Instruments

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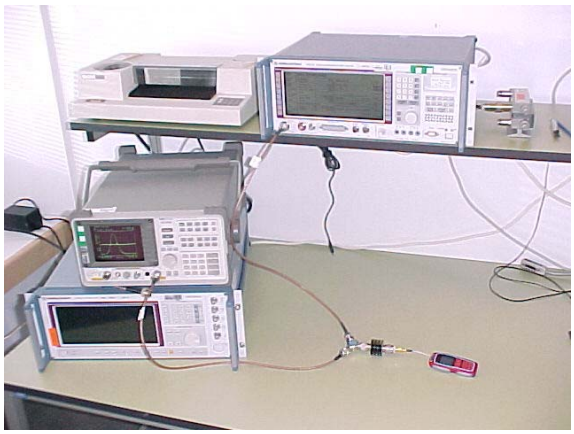
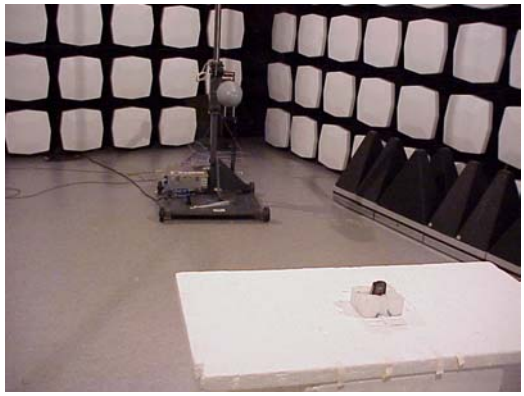
13. Test setup photographs

13.1. 99% occupied bandwidth/ Bandedge compliance



The setup

13.2. Radiated emission, Spurious and Output Power



The Anechoic Chamber

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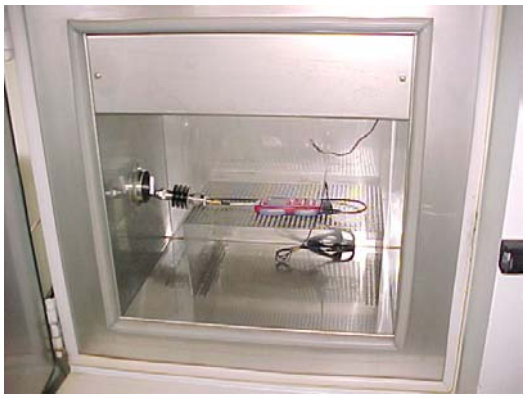
13.3. Frequency Stability, Temperature Variation



The Temperature Chamber

13.4. AC Powerlines Conducted Emission

The setup

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