Bluetooth test report
for
RM-68

FCC ID:PYARM-68
IC: 661V-RM68

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CONTENTS

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1 LABORATORY INFORMATION

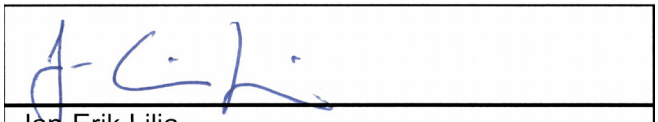
Test laboratory:	TCC Tampere Sinitaival 5 FIN-33720 TAMPERE Tel. +358 7180 46800 Fax. +358 7180 46880
FCC registration number: IC file number:	94436 (June 14, 2002) IC 3608 (March 5, 2003)

2 CUSTOMER INFORMATION

Client:	Nokia Corporation Joensuunkatu 7 FIN-24100 SALO BOX 86 FIN-24101 SALO Salo Tel. +358-71-8008000 Fax. +358-71-8044277
Contact person:	Ulla Valjakka
Receipt of EUT:	25.11.2004
Date of testing:	26.11-17.12.2004
Date of report:	21.12.2004

The tests listed in this report have been done to demonstrate compliance to the FCC rules section §15.247 and IC standard RSS-210.

Contents approved:



Jan-Erik Lilja
Senior Test Engineer

3 SUMMARY OF TEST RESULTS

Rule part in CFR 47	Section in RSS-210		Result
15.247, a1	6.2.2 (o), a1	Carrier frequency separation	PASS
15.247, a1ii	6.2.2 (o), a3	Number of hopping frequencies	PASS
15.247, a1ii, 15.247, f	6.2.2 (o), a3	Time of occupancy	PASS
15.247, a	6.2.2 (o), a1	20dB bandwidth	PASS
15.247, b1	6.2.2 (o), a3	Peak output power	PASS
15.247, c	6.2.2 (o), e1	Band-edge compliance of RF emissions	PASS
15.207	6.6	AC powerline conducted emissions	PASS
15.247, c	6.2.2 (o), e1	Spurious RF conducted emissions	PASS
15.247, c	6.2.2 (o), e1	Spurious radiated emissions	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	RM-68	Phone	004400561600766	2140	4.24	40131
	RM-68	Phone	004400561600675	2140	4.24	40133
Accessories	BL-5C	Battery	-	6.0	-	40123
	ACP-12	Charger			-	40121

Notes: -

4.1 EUT description

The EUT is a triple band (GSM850/1800/1900 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.

Two different test setups were used: one for conducted measurements, another for radiated measurements. One EUT was equipped with an external antenna connector for conductive measurements.

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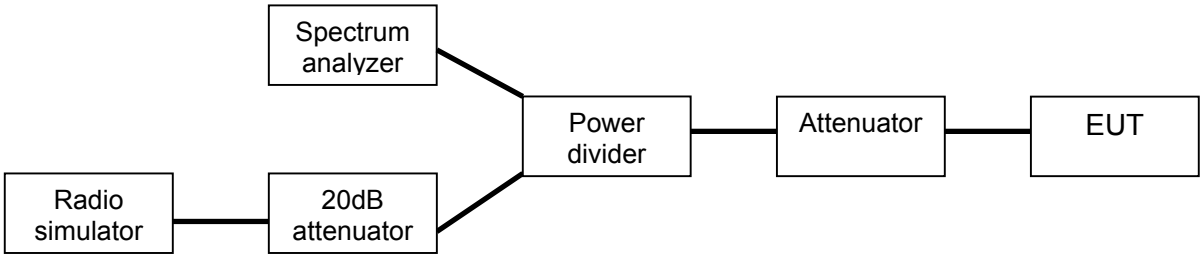
5.1 Setup A (conducted measurements)

This setup was used in conducted measurements. The Bluetooth simulator was used to control the following:

- set the EUT channel (2 – 80)
- set the number of EUT TX slots (1, 3, 5)
- set the EUT to TX, RX and TX/RX mode
- enable/disable frequency hopping
- select between several different test modulation patterns

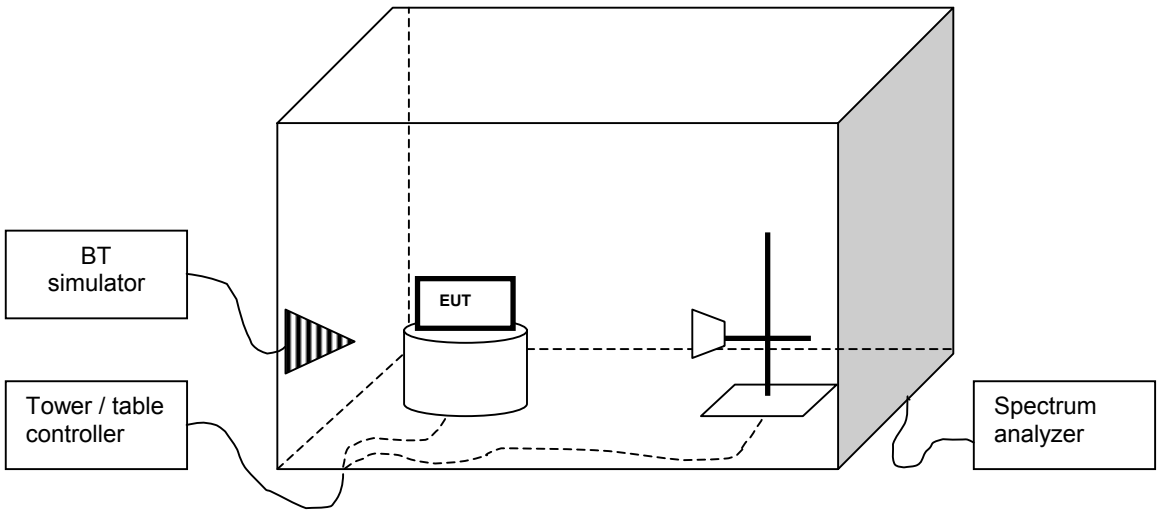
In tests, where absolute level reporting were required, the results were corrected with all applicable factors as detailed in the result section of each measurement.



5.2 Setup B (radiated measurements)

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 BT 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 Bluetooth simulator was used to the same as in conducted measurements.

In tests, where absolute level reporting were required, the results were corrected with all applicable factors as detailed in the result section of each measurement.



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6 STANDARDS AND MEASUREMENT METHODS

The tests were performed in guidance of CFR 47 Part 15.247, Part 2, FCC public notice DA 00-705 (March 30, 2000), ANSI C63.4 (1992), RSS-210 (Issue 5, November 2001) and CISPR-22. Deviations, modifications or clarifications (if any) to above mentioned documents are written in each section under "Test method".

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7 CARRIER FREQUENCY SEPARATION

EUT	40131		
Accessories	40123		
Test setup	A		
Temp, Humidity, Air Pressure	22 ºC	43 %RH	1012mbar
Date of measurement	26.11.2004		
FCC rule part	§15.247 (a) (1)		
RSS-210 section	6.2.2 (o), a1		
Measured by	Jan-Erik Lilja		
Result	**Pass**		

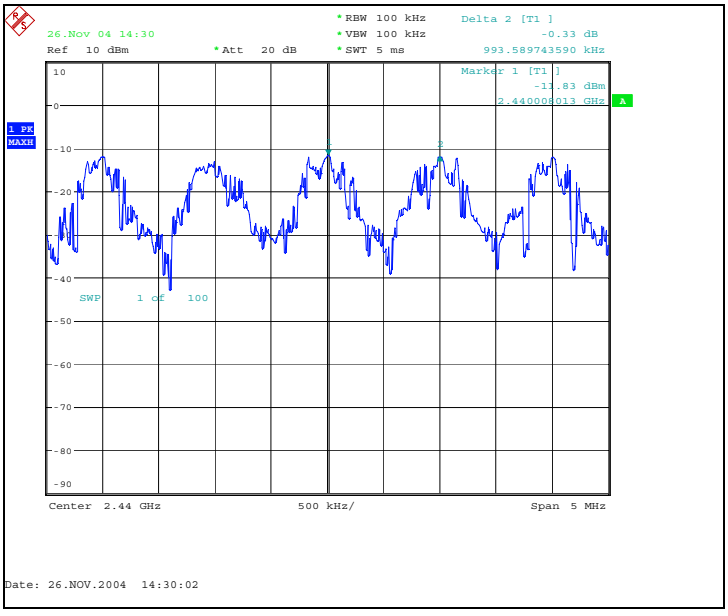
7.1 EUT operation mode

EUT operation mode	Connection, 1 time slot
EUT channel	Hopping
EUT TX power level	Nominal

7.2 Limits and results

Limit (MHz)	Result (MHz)
≥ 0.025 or 20dB BW	0.994

7.3 Screen shot



Picture 1 Carrier frequency separation of channels 38 and 39

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8 NUMBER OF HOPPING FREQUENCIES

EUT	40131		
Accessories	40123		
Test setup	A		
Temp, Humidity, Air Pressure	22 ºC	43 %RH	1012mbar
Date of measurement	26.11.2004		
FCC rule part	§15.247(a) (2)		
RSS-210 section	6.2.2 (o), a3		
Measured by	Jan-Erik Lilja		
Result	**PASS**		

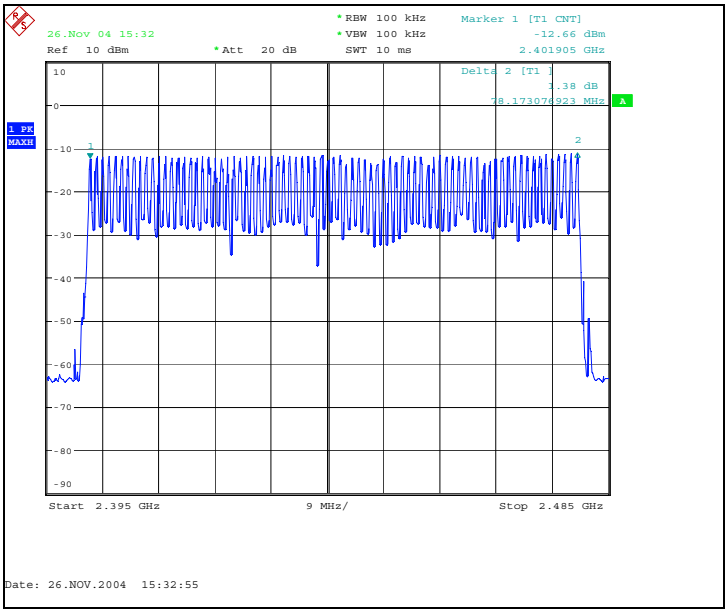
8.1 EUT operation mode

EUT operation mode	Connection, 1 time slot
EUT channel	Hopping
EUT TX power level	Nominal

8.2 Limits and results

Number	Measured value
≥ 75	79

8.3 Screen shot



Picture 2 Number of hopping frequencies

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IC: 661V-RM68

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9 TIME OF OCCUPANCY

EUT	40131		
Accessories	40123		
Test setup	A		
Temp, Humidity, Air Pressure	23 ºC	44 %RH	1008 mbar
Date of measurement	15.12.2004		
FCC rule part	§15.247 (a) (3)		
RSS-210 section	6.2.2 (o), a3		
Measured by	Jan-Erik Lilja		
Result	PASS		

9.1 Connection mode

9.1.1 EUT operation mode

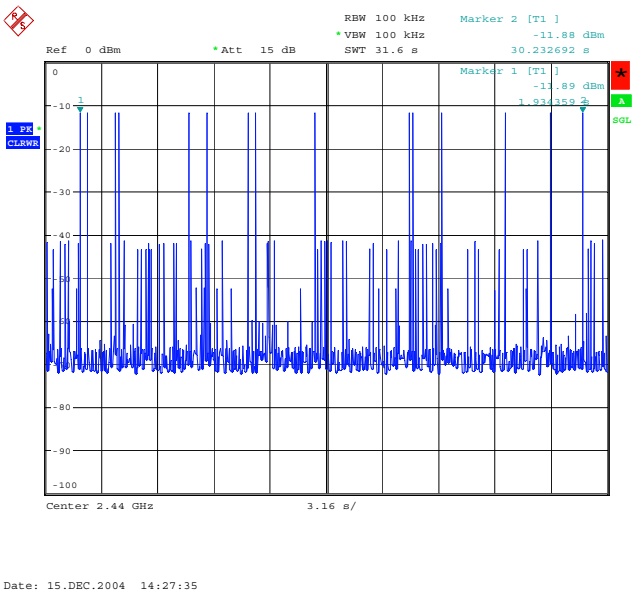
EUT operation mode	Connection, 1 time slot
EUT channel	Hopping
EUT TX power level	Nominal

9.2 Limits and results

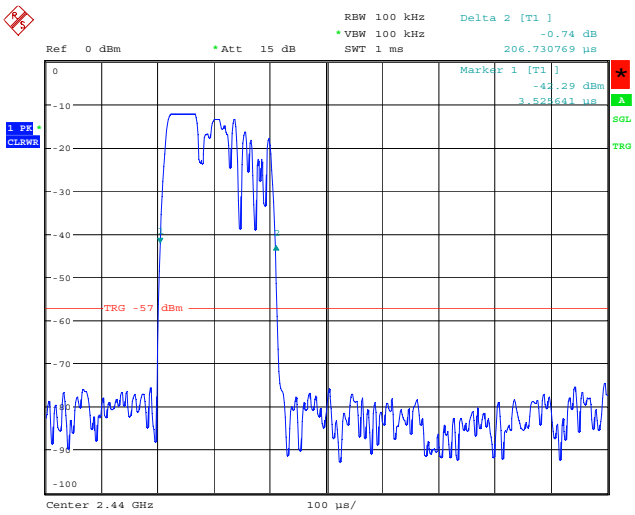
Limit (s)	Measured value (s)
≤ 0.4	0.0029

In measurement time of **31.6 s**, total of **14** transmissions occurred. The duration of one transmission was **207 µs**. **YY** * **ZZ** = 2.898 ms **result**.

Screen shots



Picture 3. Number of transmissions, channel 38



Picture 4. Duration of one transmission, channel 38

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IC: 661V-RM68

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10 20dB BANDWIDTH

EUT	40131		
Accessories	40123		
Test setup	A		
Temp, Humidity, Air Pressure	23 ºC	44 %RH	1008 mbar
Date of measurement	15.12.2004		
FCC rule part	§15.247 (a) (1)		
RSS-210 section	6.2.2 (o), a1		
Measured by	Jan-Erik Lilja		
Result	**PASS**		

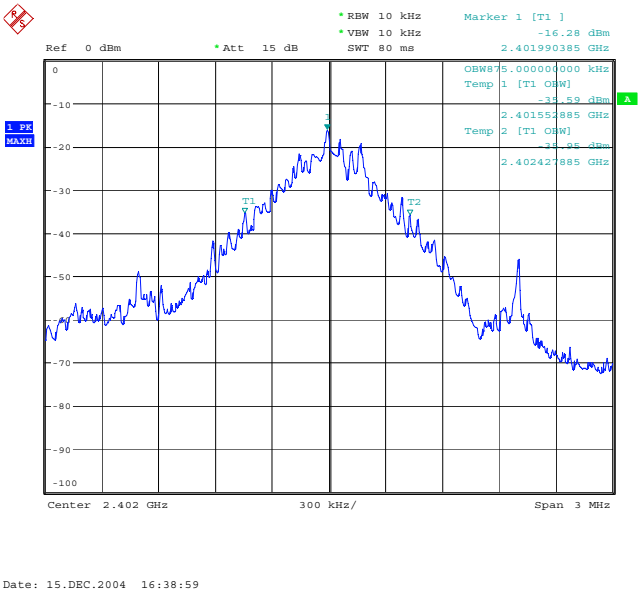
10.1 EUT operation mode

EUT operation mode	Connetction, 1 time slot
EUT channel	0, 38 and 78
EUT TX power level	Nominal

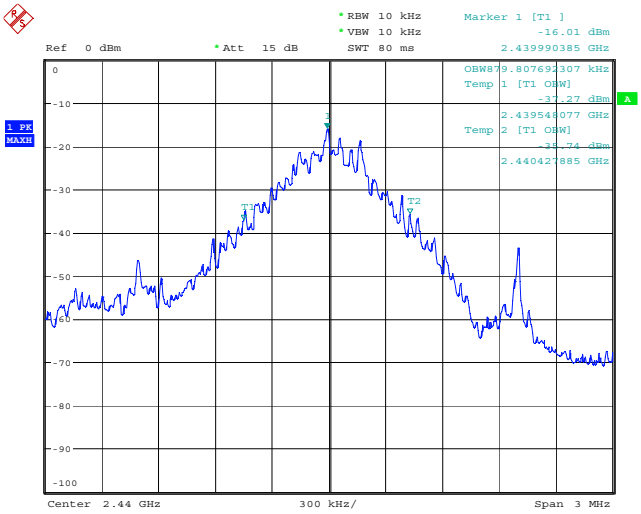
10.2 Limits and results

EUT Channel	Limit (MHz)	Measured value (MHz)
0	≤1.0	0.875
38		0.880
78		0.899

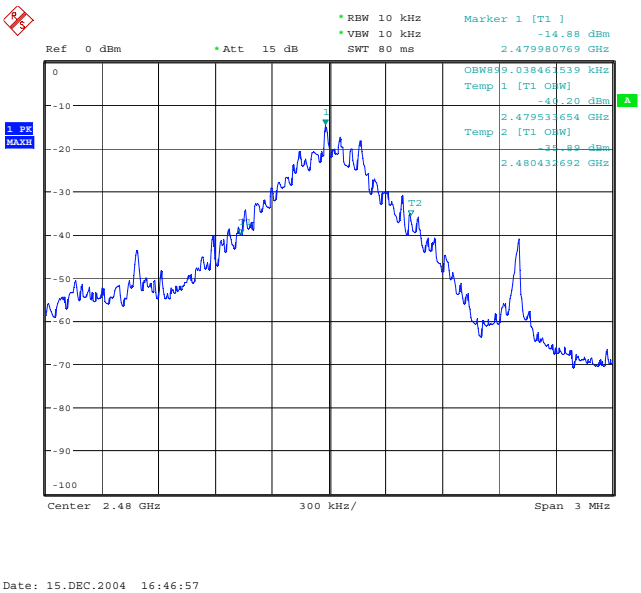
10.3 Screen shots



Picture 5. 20dB bandwidth, channel 0



Picture 6. 20dB bandwidth, channel 38



Picture 7. 20dB bandwidth, channel 78

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11 PEAK OUTPUT POWER

EUT	40131		
Accessories	40123		
Test setup	A		
Temp, Humidity, Air Pressure	23 ºC	44 %RH	1008 mbar
Date of measurement	15.12.2004		
FCC rule part	§15.247 (b) (1)		
RSS-210 section	6.2.2 (o), a3		
Measured by	Jan-Erik Lilja		
Result	**PASS**		

11.1 EUT operation mode

EUT operation mode	Connection, 1 time slot
EUT channel	0, 38 and 78
EUT TX power level	Nominal

11.2 Limits and results

EUT Channel	Limit (W)	Test result (W)
0	≤ 1	0.00116
38		0.00121
78		0.00129

The measured power values were corrected with the attenuation of the cables, attenuator and power divider using the formula:

$$P[W] = \frac{10^{(P_{Meas[dBm]} + L_{Cables[dB]} + L_{Attenuator[dB]} + L_{Divider[dB]})/10}}{1000}$$

EUT Channel	Measured value [dBm]	Signal path loss [dB]	Peak output power [dBm]	Peak output power [W]
0	-11.73	12.36	0.63	0.00116
38	-11.73	12.55	0.82	0.00121
78	-11.18	12.28	1.1	0.00129

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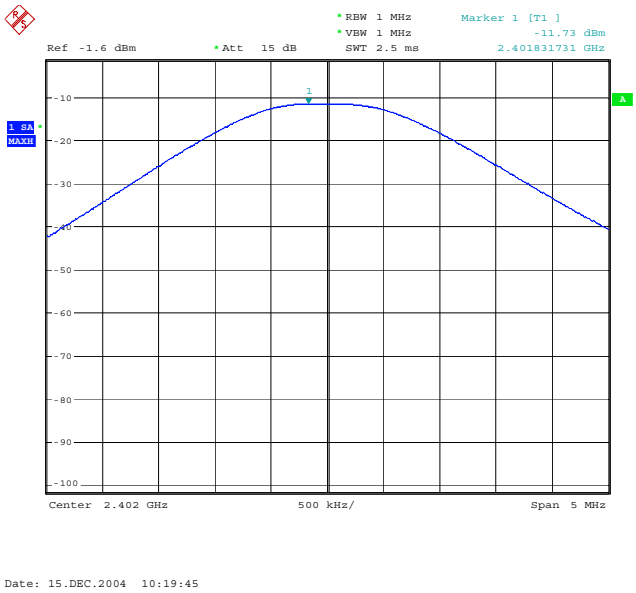
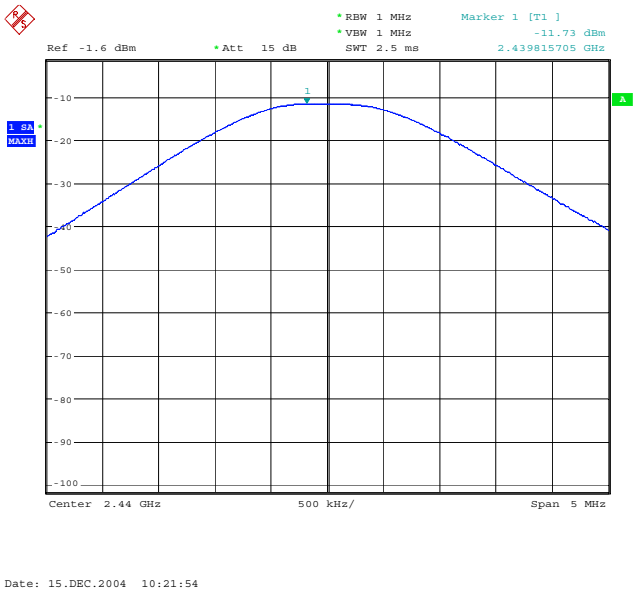
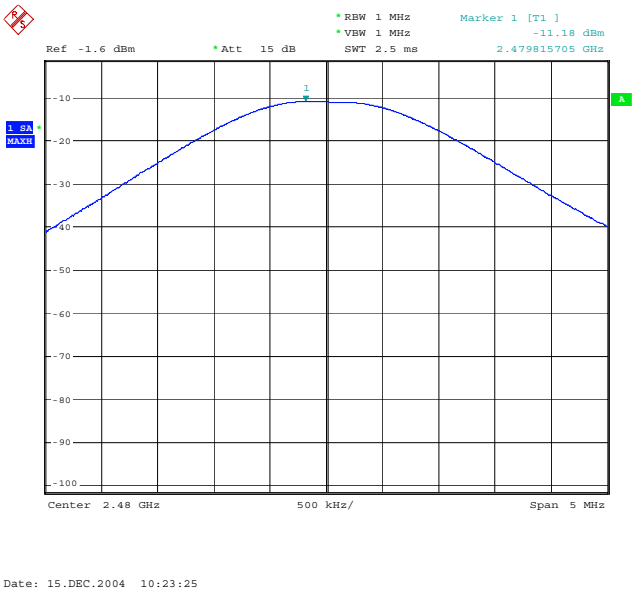
11.3 Screen shots



Picture 8. Peak output power on channel 0



Picture 9. Peak output power on channel 38



Picture 10. Peak output power on channel 78

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IC: 661V-RM68

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12 BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

12.1 Hopping enabled

EUT	40131		
Accessories	40123		
Test setup	A		
Temp, Humidity, Air Pressure	23ºC	44%RH	1025 mbar
Date of measurement	14.12.2004		
FCC rule part	§15.247 (c) (1)		
RSS-210 section	6.2.2 (o), e1		
Measured by	Jan-Erik Lilja		
Result	**PASS**		

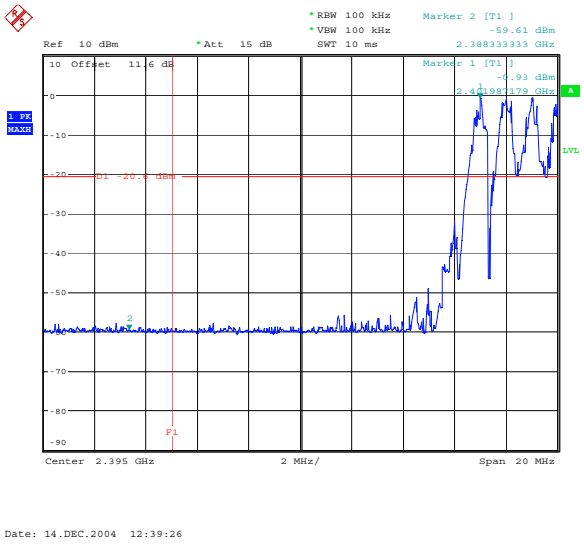
12.1.1 EUT operation mode

EUT operation mode	Connection, 1 time slot
EUT channel	Hopping
EUT TX power level	Nominal

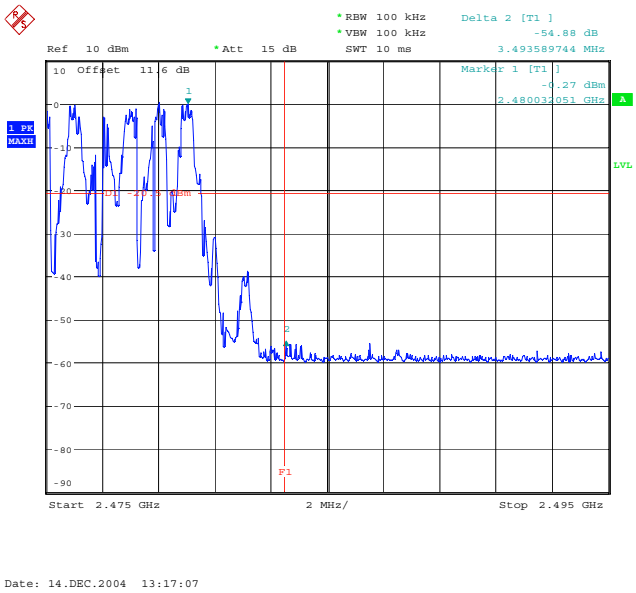
12.1.2 Limits and results

Channel	Limit (dBc)	Result (dBc)
0	≤ -20	-59.6
78		-54.9

12.1.3 Screen shots



Picture 11. Bandedge compliance, low end



Picture 12. Bandedge compliance, high end

12.2 Hopping disabled

EUT	40131		
Accessories	40123		
Test setup	A		
Temp, Humidity, Air Pressure	23ºC	44%RH	1025 mbar
Date of measurement	14.12.2004		
FCC rule part	§15.247 (c) (1)		
RSS-210 section	6.2.2 (o), e1		
Measured by	Jan-Erik Lilja		
Result	**PASS**		

12.2.1 Test method

The test is made according to ANSI C63.4 (1992).

12.2.2 EUT operation mode

EUT operation mode	Connection, 1 time slot
EUT channel	0 and 78
EUT TX power level	Nominal

12.2.3 Limits and results

Channel	Limit (dBc)	Result (dBc)
0	≤ -20	-56.8
78		-51.3

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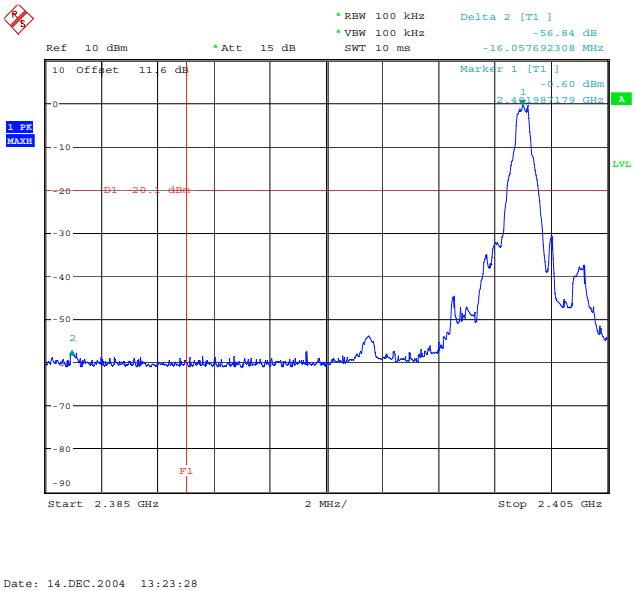
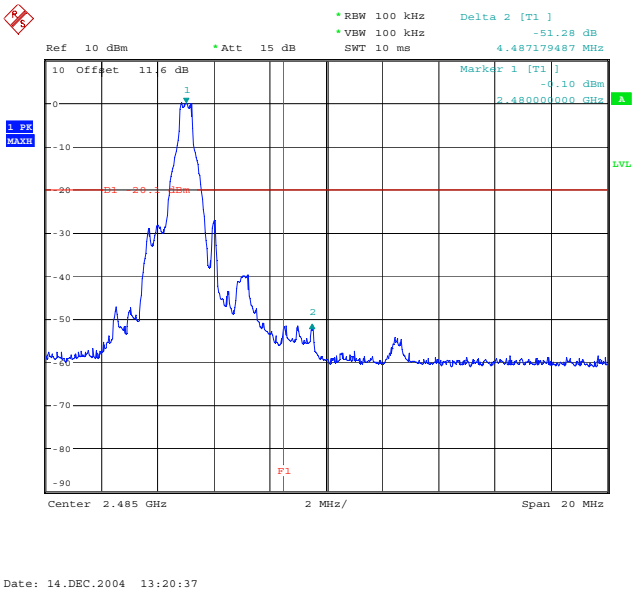
12.2.4 Screen shots



Picture 13. Bandedge compliance, low end



Picture 14. Bandedge compliance, high end

13 AC POWERLINE CONDUCTED EMISSIONS

EUT	40133		
Accessories	40123, 40121		
Temp, Humidity, Air Pressure	21ºC	49% RH	983 mbar
Date of measurement	17.12.2004		
FCC rule part	§15.207		
RSS-210 section	6.6		
Measured by	Jan-Erik Lilja		
Result	**PASS**		

13.1 Test setup

The EUT was set according to ANSI C63.4-1992, figure 9a.

13.2 EUT operation mode

EUT operation mode	Connection, 1 time slot
EUT channel	38
EUT TX power level	Nominal
EUT operation voltage	115VAC/60Hz

13.3 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

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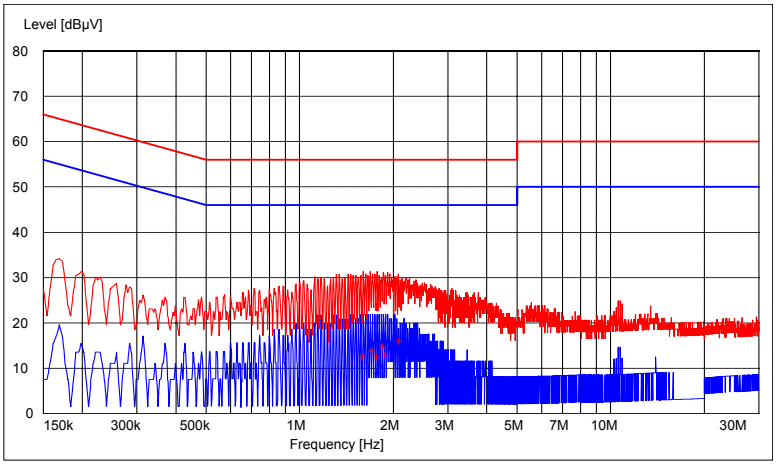
13.4 Results

The measurement results were adjusted with the attenuation of the cable between the LISN and receiver by the computer controlling the test system.



Picture 15. AC powerline emissions

Table 1 Highest emissions, Quasipeak detector

Frequency	Level	Transd	Limit	Margin	Detector	Line
MHz	dBµV	dB	dBµV	dB		
1.603500	12.40	10.40	56.00	43.60	QP	L1
1.720500	13.80	10.40	56.00	42.20	QP	L1
1.779000	12.40	10.40	56.00	43.60	QP	L1
1.864500	14.70	10.40	56.00	41.30	QP	L1
1.896000	12.80	10.40	56.00	43.20	QP	N
2.098500	16.00	10.40	56.00	40.00	QP	N

Table 2 Highest emissions, Average detector

Frequency	Level	Transd	Limit	Margin	Detector	Line
MHz	dBµV	dB	dBµV	dB		
1.783500	9.00	10.40	46.00	37.00	AV	L1
1.842000	10.40	10.40	46.00	35.60	AV	L1
1.873500	15.50	10.40	46.00	30.50	AV	L1
1.932000	16.00	10.40	46.00	30.00	AV	L1
2.017500	14.00	10.40	46.00	32.00	AV	L1

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14 SPURIOUS RF CONDUCTED EMISSIONS

EUT	40131		
Accessories	40123		
Test setup	A		
Temp, Humidity, Air Pressure	23 ºC	44 %RH	1008 mbar
Date of measurement	15.12.2004		
FCC rule part	§15.247 (c) (2)		
RSS-210 section	6.2.2 (o), e1		
Measured by	Jan-Erik Lilja		
Result	**PASS**		

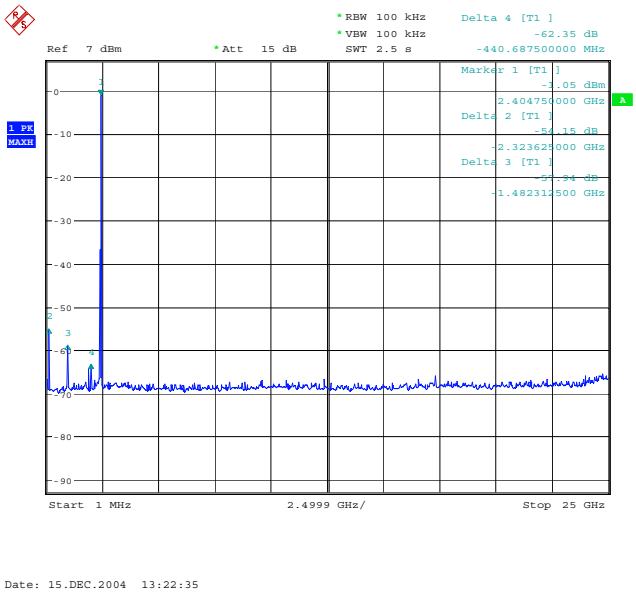
14.1 EUT operation mode

EUT operation mode	Connection, 1 time slot
EUT channel	0, 38 and 78
EUT TX power level	Nominal

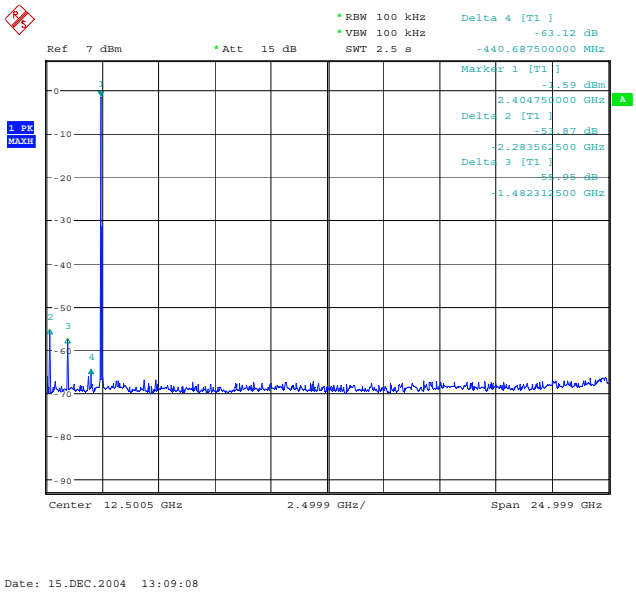
14.2 Limits and results

EUT Channel	Limit (dBc)	Result (dBc)
0	≤ -20	-54.15
38		-53.87
78		-55.12

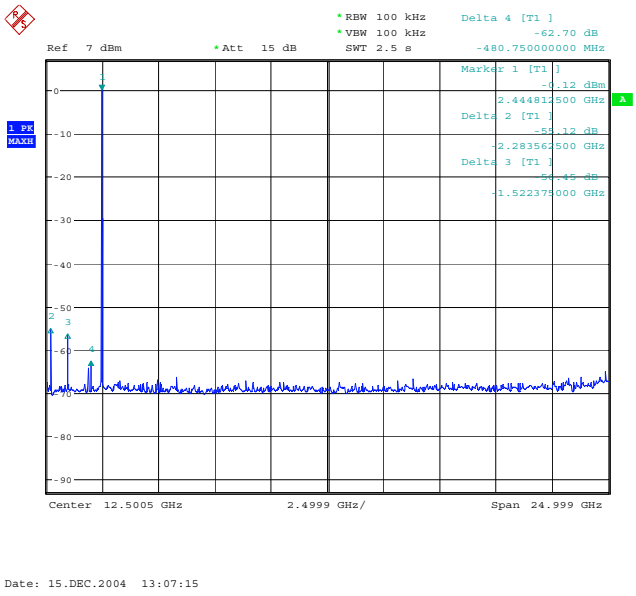
14.3 Screen shots



Picture 16. Spurious RF conducted emissions, TX on channel 0



Picture 17. Spurious RF conducted emissions, TX on channel 38



Picture 18. Spurious RF conducted emissions, TX on channel 78

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15 SPURIOUS RADIATED EMISSIONS

EUT	40133		
Accessories	40121, 40123		
Test setup	B		
Temp, Humidity, Air Pressure	22 ºC	47 %RH	1026 mbar
Date of measurement	13.12.2004		
FCC rule part	§15.247 (c) (1)		
RSS-210 section	6.2.2 (o), e1		
Measured by	Jan-Erik Lilja		
Result	**PASS**		

15.1 Test method

a) The spectrum analyzer with peak detector was used to find all the emissions generated by the EUT.

b) All suspicious frequencies with emission levels were recorded.

c) The test was repeated with the EUT in three orthogonal orientations.

d) For each frequency detected in (b), the emissions were maximized by moving the turntable and measuring antenna and manipulating the EUT.

e) The maximized emissions were measured and reported.

15.2 EUT operation mode

EUT operation mode	Connection mode, 1 time slot
EUT channel	0, 38 and 78
EUT TX power level	Nominal
EUT operation voltage	Nominal

15.3 Limits, 3m measuring distance

Frequency band (MHz)	Limit (µV/m)	Limit (dBµV/m)	Detector
30 – 88	100	40	QP
88 -216	150	43.5	QP
216 - 960	200	46	QP
960 - 1000	500	54.0	QP
1000 - 25000	500	54.0	Av
1000 - 25000	5000	74.0	Pk

As default, all emissions were compared against the general limits. If any emission exceeded that limit, it was further checked, if it was outside the restricted band thus complying with the -20dBc requirement.

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15.4 Results

The results were corrected with the cable and filter losses, preamplifier gain, antenna factor and measurement distance.

Table 3 Emission levels, channel 0, Peak detector

Frequency / MHz	Level / dBµV/m	Result
4804.00	40.00	Pass
4960.00	40.50	Pass
7206.00	42.30	Pass
7323.00	42.90	Pass
7440.00	43.60	Pass

Table 4 Emission levels, channel 0, Average detector

Frequency / MHz	Level / dBµV/m	Result
4804.00	26.60	Pass
4960.00	27.70	Pass
7206.00	29.30	Pass
7323.00	30.20	Pass
7440.00	30.10	Pass

Table 5 Emission levels, channel 38, Peak detector

Frequency / MHz	Level / dBµV/m	Result
4955.92	40.40	Pass
7277.56	42.80	Pass
7320.14	43.10	Pass
7443.39	43.00	Pass
11774.05	47.70	Pass
17948.4	55.00	Pass

Table 6 Emission levels, channel 38, Average detector

Frequency / MHz	Level / dBµV/m	Result
4959.42	27.60	Pass
7278.56	30.30	Pass
7317.14	30.10	Pass
7443.89	29.90	Pass
11778.56	34.40	Pass
17950.90	42.30	Pass

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Table 7 Emission levels, channel 78, Peak detector

Frequency / MHz	Level / dBµV/m	Result
4804.00	39.70	Pass
4882.00	39.70	Pass
4960.00	40.20	Pass
7206.00	42.10	Pass
7323.00	42.90	Pass
7440.00	42.80	Pass

Table 8 Emission levels, channel 78, Average detector

Frequency / MHz	Level / dBµV/m	Result
4804.00	26.50	Pass
4882.00	26.80	Pass
4960.00	27.80	Pass
7206.00	29.30	Pass
7323.00	30.20	Pass
7440.00	30.20	Pass

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16 TEST EQUIPMENT

Each test equipment is calibrated once a year.

16.1 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

16.2 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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