
Bluetooth test report for RM-36

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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:	94436 (June 14, 2002)
IC file number:	IC 3608 (March 5, 2003)

2 CUSTOMER INFORMATION

Client:	Nokia Corporation P.O. Box 68 Sinitaival 5 FIN-33721 TAMPERE, FINLAND Tel. +358 (0) 7180 08000 Fax. +358 (0) 7180 46880
Contact person:	Tero Huhtala
Receipt of EUT:	20.12.2004
Date of testing:	22-28.12.2004
Date of report:	3.1.2005

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:


Jari Jantunen EMC 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

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.

	Name	Type	S/N	EUT number
EUT	Phone	RM-36	004400471619989	40141
	Phone	RM-36	004400471619757	40140
Accessories	Battery	BL-5C	-	40136
	Battery	BL-5C	-	40123
	Charger	ACP-12	-	40121

Notes: -

4.1 EUT description

The EUT is a triple band (GSM900/1800/1900 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.

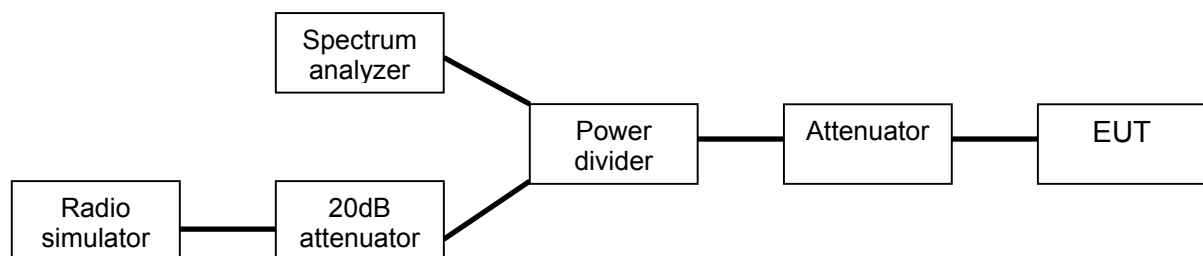
Two different test setups were used: one for conducted measurements, another for radiated measurements. One EUT was equipped with an external antenna connector for conductive measurements.

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

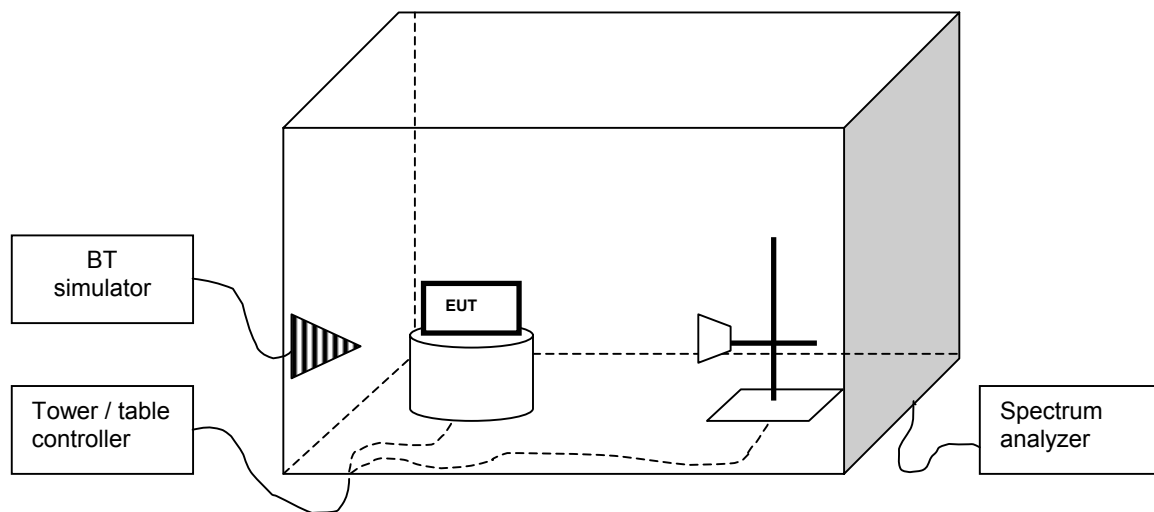
In tests, where absolute level reporting were required, the results were corrected with all applicable factors as detailed in the result section of each measurement.



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.



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".

7 CARRIER FREQUENCY SEPARATION

EUT	40141
Accessories	40136
Test setup	A
Temp, Humidity, Air Pressure	22 °C 44 %RH 998 mbar
Date of measurement	22.12.2004
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, DM5, PRBS
EUT channel	Hopping
EUT TX power level	Nominal

7.2 Limits and results

Limit (MHz)	Result (MHz)
≥ 0.025 or 20dB BW	1.0016

7.3 Screen shot



Date: 22.DEC.2004 13:36:00

Picture 1 Carrier frequency separation of channels 38 and 39

8 NUMBER OF HOPPING FREQUENCIES

EUT	40141		
Accessories	40136		
Test setup	A		
Temp, Humidity, Air Pressure	22 °C	44 %RH	998 mbar
Date of measurement	22.12.2004		
FCC rule part	§15.247(a) (2)		
RSS-210 section	6.2.2 (o), a3		
Measured by	Jan-Erik Lilja		
Result	PASS		

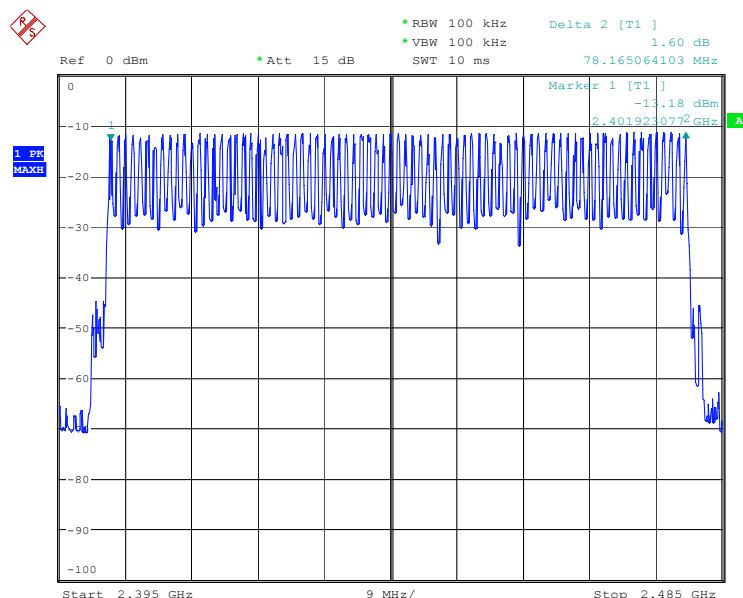
8.1 EUT operation mode

EUT operation mode	Connection, DM5, PRBS
EUT channel	Hopping
EUT TX power level	Nominal

8.2 Limits and results

Number	Measured value
≥ 75	79

8.3 Screen shot



Date: 22.DEC.2004 14:34:26

Picture 2. Number of hopping frequencies

9 TIME OF OCCUPANCY

EUT	40141
Accessories	40136
Test setup	A
Temp, Humidity, Air Pressure	24°C 36 %RH 1008 mbar
Date of measurement	28.12.2004
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, DM5, PRBS
EUT channel	Hopping
EUT TX power level	Nominal

9.2 Limits and results

Limit (s)	Measured value (s)
≤ 0.4	0.006

In measurement time of 31.6 s, total of 24 transmissions occurred. The duration of one transmission was 0.25 ms. $24 \times 0.25 = 6$ ms.

10 20dB BANDWIDTH

EUT	40141		
Accessories	40136		
Test setup	A		
Temp, Humidity, Air Pressure	24°C	36 %RH	1008 mbar
Date of measurement	28.12.2004		
FCC rule part	§15.247 (a) (1)		
RSS-210 section	6.2.2 (o), a1		
Measured by	Jan-Erik Lilja		
Result	PASS		

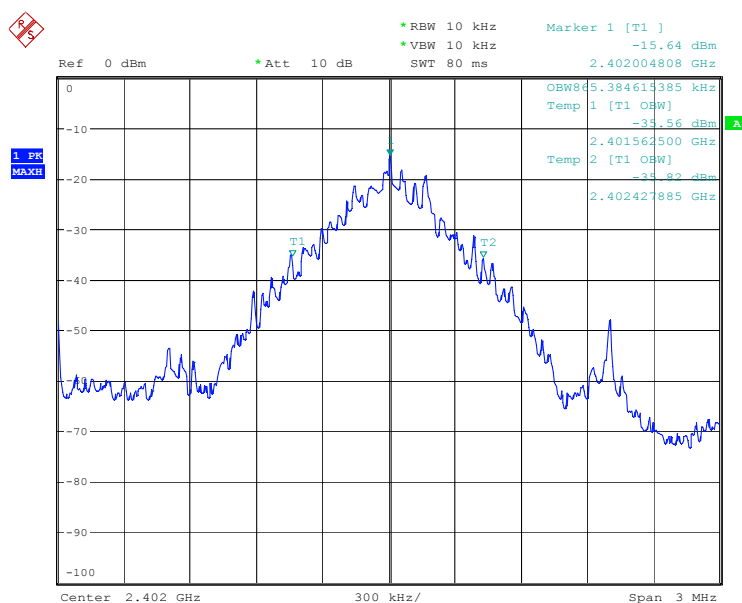
10.1 EUT operation mode

EUT operation mode	Connetction, DM5, PRBS
EUT channel	0, 38 and 87
EUT TX power level	Nominal

10.2 Limits and results

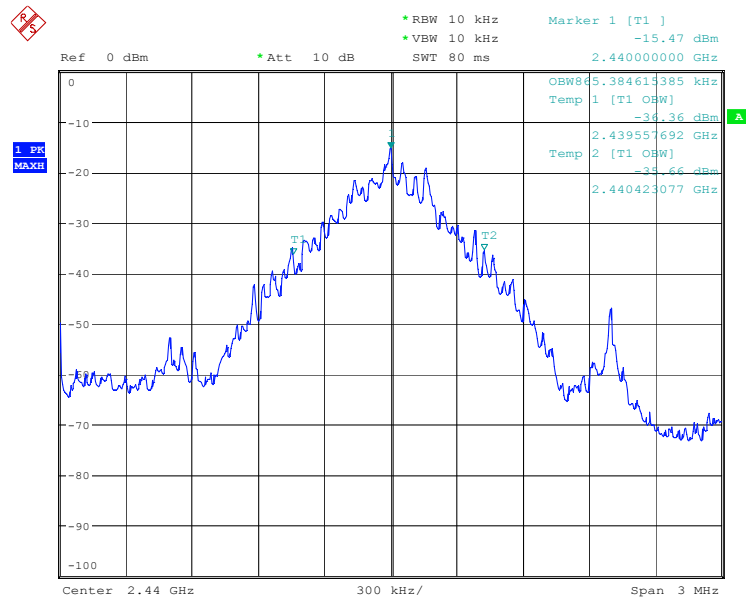
EUT Channel	Limit (MHz)	Measured value (MHz)
0	≤1.0	0.8654
38		0.8654
78		0.8654

10.3 Screen shots



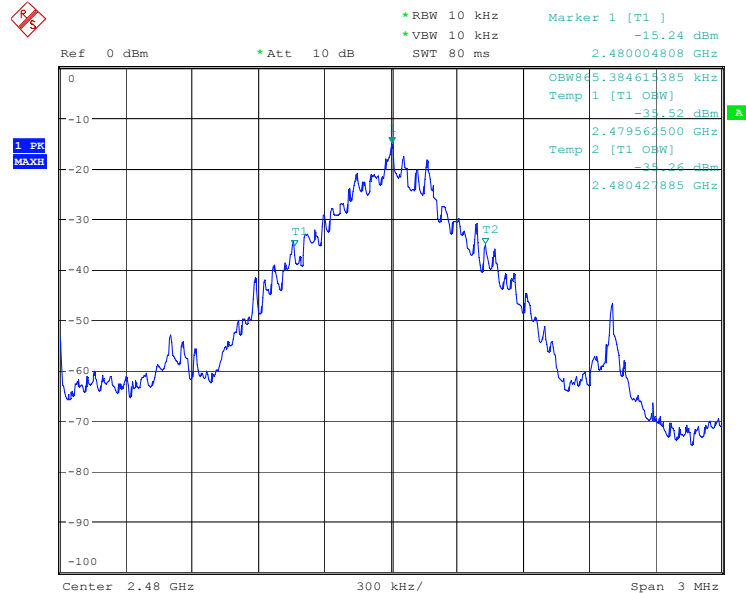
Date: 28.DEC.2004 12:01:03

Picture 5. 20dB bandwidth, channel 0



Date: 28.DEC.2004 12:03:11

Picture 6. 20dB bandwidth, channel 38



Date: 28.DEC.2004 12:05:02

Picture 7. 20dB bandwidth, channel 78

11 PEAK OUTPUT POWER

EUT	40141
Accessories	40136
Test setup	A
Temp, Humidity, Air Pressure	24°C 36 %RH 1008 mbar
Date of measurement	28.12.2004
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, DM5, PRBS
EUT channel	0, 38 and 78
EUT TX power level	Nominal

11.2 Limits and results

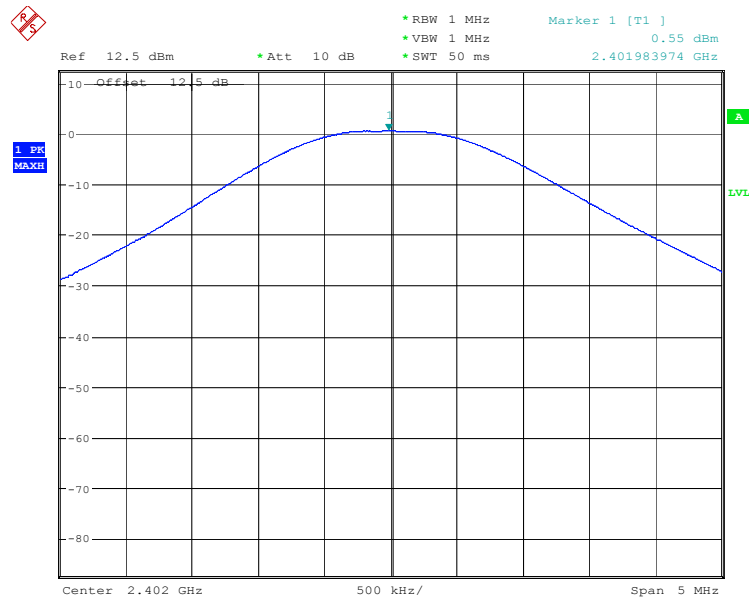
EUT Channel	Limit (W)	Test result (W)
0	≤ 1	0.0011
38		0.0012
78		0.0012

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

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

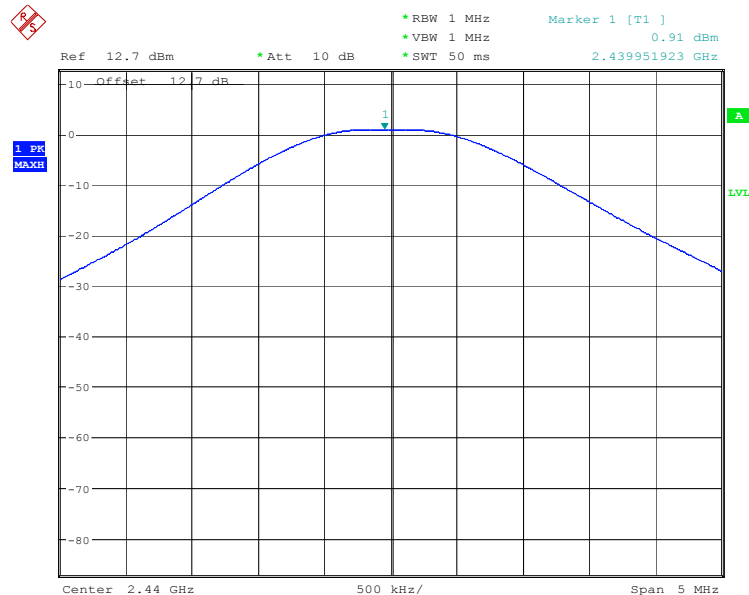
EUT Channel	Measured value [dBm]	Signal path loss [dB]	Peak output power [dBm]	Peak output power [W]
0	-11.93	-12.48	0.55	0.0011
38	-11.74	-12.65	0.91	0.0012
78	-11.31	-12.25	0.94	0.0012

11.3 Screen shots



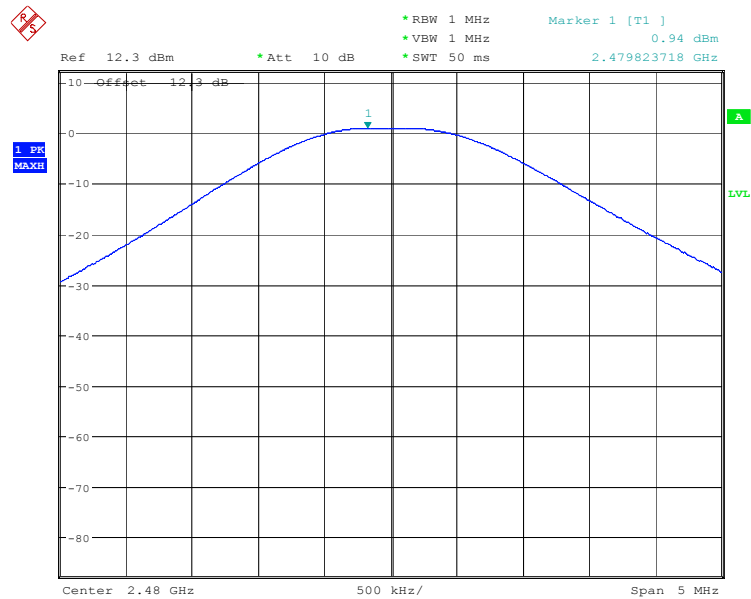
Date: 28.DEC.2004 12:16:58

Picture 8. Peak output power on channel 0



Date: 28.DEC.2004 12:19:01

Picture 9. Peak output power on channel 38



Date: 28.DEC.2004 12:21:05

Picture 10. Peak output power on channel 78

12 BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

12.1 Hopping enabled

EUT	40141		
Accessories	40136		
Test setup	A		
Temp, Humidity, Air Pressure	24°C	36 %RH	1008 mbar
Date of measurement	28.12.2004		
FCC rule part	§15.247 (c) (1)		
RSS-210 section	6.2.2 (o), e1		
Measured by	Jan-Erik Lilja		
Result	PASS		

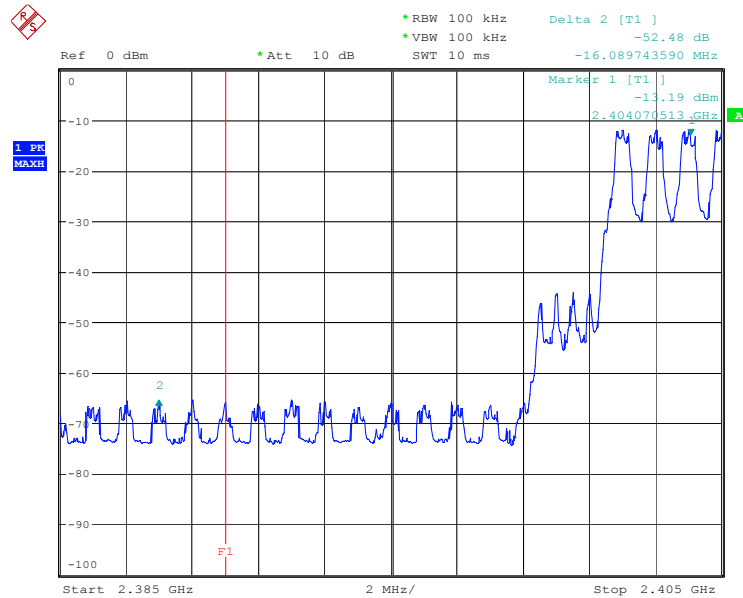
12.1.1 EUT operation mode

EUT operation mode	Connection, DM5, PRBS
EUT channel	Hopping
EUT TX power level	Nominal

12.1.2 Limits and results

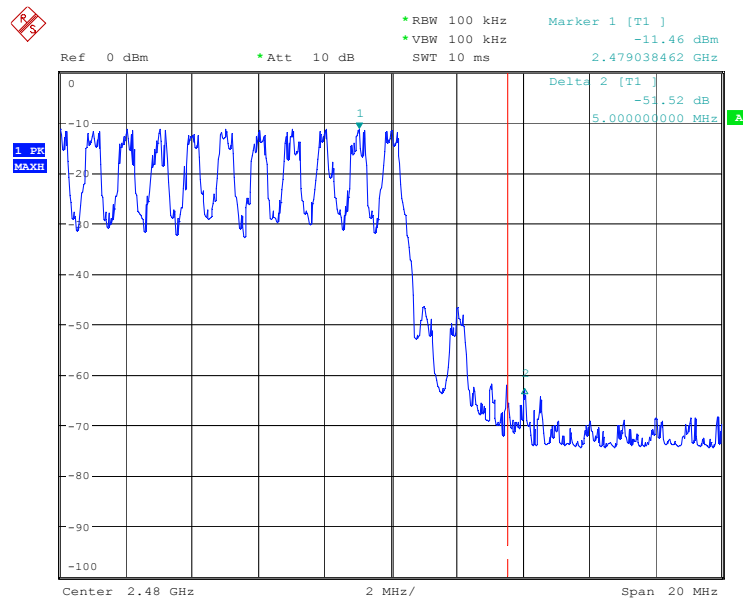
Frequency	Limit (dBc)	Result (dBc)
Lower bandedge	≤ -20	-52.5
Upper bandedge		-51.5

12.1.3 Screen shots



Date: 28.DEC.2004 13:53:19

Picture 11. Bandedge compliance, low end



Date: 28.DEC.2004 14:25:57

Picture 12. Bandedge compliance, high end

12.2 Hopping disabled

EUT	40141
Accessories	40136
Test setup	A
Temp, Humidity, Air Pressure	24°C 36 %RH 1008 mbar
Date of measurement	28.12.2004
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).

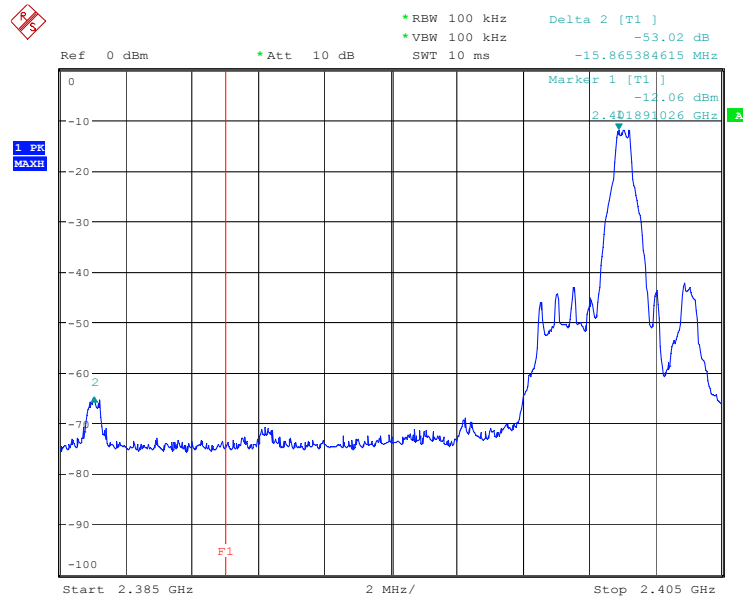
12.2.2 EUT operation mode

EUT operation mode	Connection, DM5, PRBS
EUT channel	0 and 78
EUT TX power level	Nominal

12.2.3 Limits and results

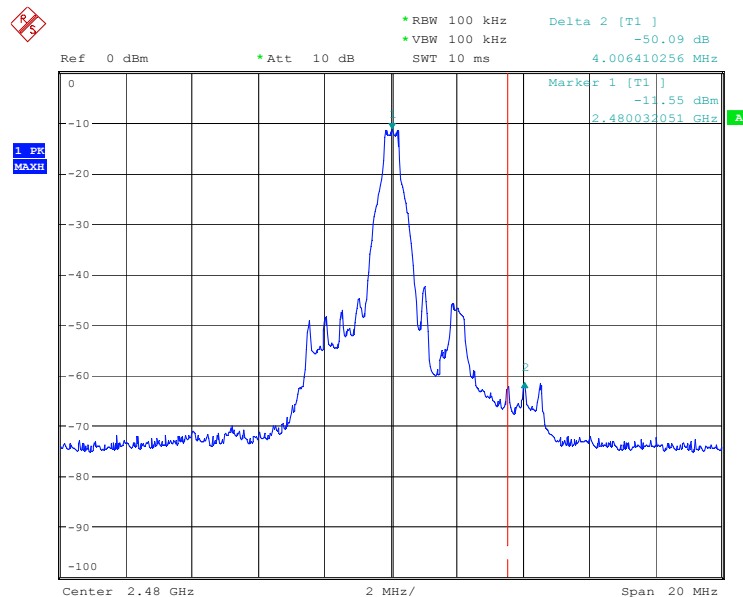
Channel	Limit (dBc)	Result (dBc)
0	≤ -20	-53.0
78		-50.1

12.2.4 Screen shots



Date: 28.DEC.2004 14:32:21

Picture 13. Bandedge compliance, low end



Date: 28.DEC.2004 14:29:18

Picture 14. Bandedge compliance, high end

13 AC POWERLINE CONDUCTED EMISSIONS

EUT	40140		
Accessories	40121, 40136		
Temp, Humidity, Air Pressure	19°C	50 %RH	1008 mbar
Date of measurement	28.12.2004		
FCC rule part	§15.207		
RSS-210 section	6.6		
Measured by	Jari Jantunen		
Result	PASS		

13.1 Test setup

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

13.2 EUT operation mode

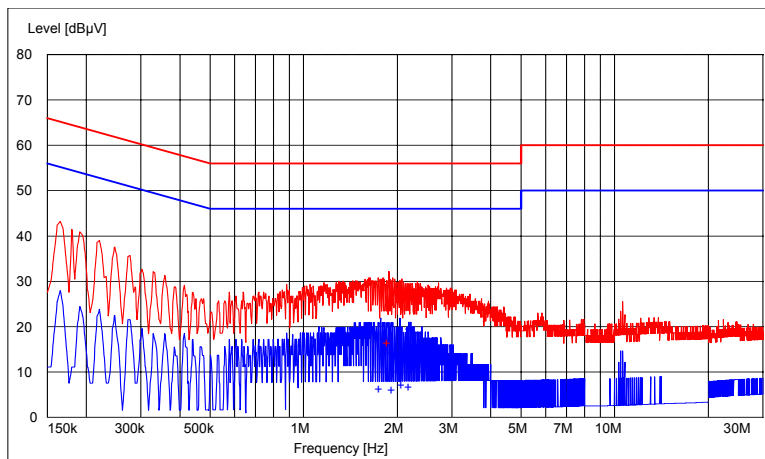
EUT operation mode	Connection, DM5, PRBS
EUT channel	38
EUT TX power level	Nominal
EUT operation voltage	115VAC/60Hz

13.3 Limit

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

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 / MHz	Level / dBμV	Margin / dB	Line	PE	Result
1.864500	16.40	39.60	N	GND	PASS

Table 2 Highest emissions, Average detector

Frequency / MHz	Level / dBμV	Margin / dB	Line	PE	Result
1.756500	6.10	39.90	N	GND	PASS
1.905000	14.20	31.80	N	GND	PASS
1.927500	6.00	40.00	N	GND	PASS
2.071500	7.20	38.80	N	GND	PASS
2.184000	6.70	39.30	N	GND	PASS
2.193000	19.50	26.50	L1	GND	PASS

14 SPURIOUS RF CONDUCTED EMISSIONS

EUT	40141		
Accessories	40136		
Test setup	A		
Temp, Humidity, Air Pressure	24°C	36 %RH	1008 mbar
Date of measurement	28.12.2004		
FCC rule part	§15.247 (c) (2)		
RSS-210 section	6.2.2 (o), e1		
Measured by	Jan-Erik Lilja		
Result	PASS		

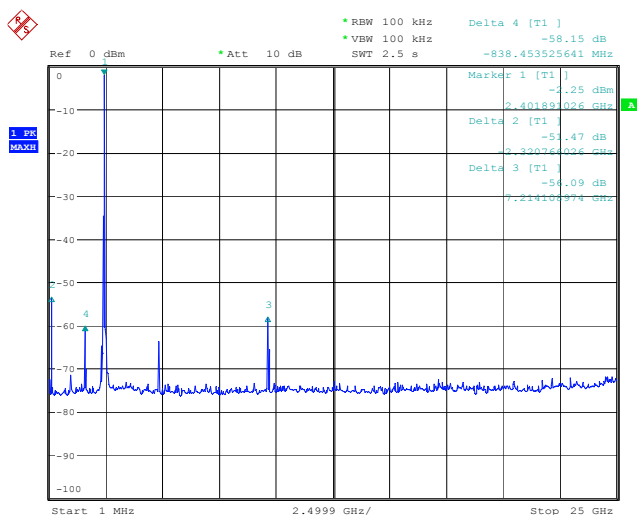
14.1 EUT operation mode

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

14.2 Limits and results

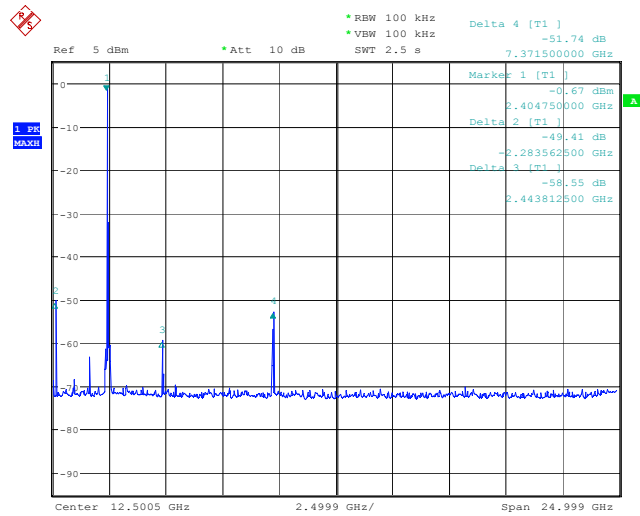
EUT Channel	Limit (dBc)	Result (dBc)
0	≤ -20	-51.47
38		-49.41
78		-50.48

14.3 Screen shots



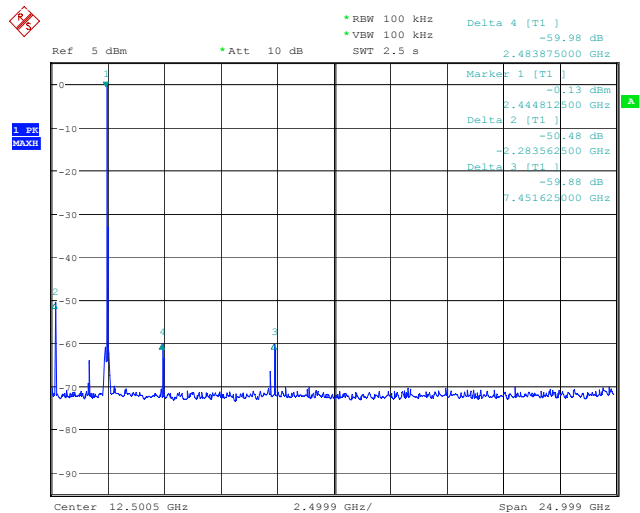
Date: 28.DEC.2004 14:49:39

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



Date: 28.DEC.2004 14:54:23

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



Date: 28.DEC.2004 14:56:13

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

15 SPURIOUS RADIATED EMISSIONS

EUT	40140
Accessories	40121, 40123
Test setup	
Temp, Humidity, Air Pressure	22°C 47 %RH 998 mbar
Date of measurement	22-23.12.2004
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

- The spectrum analyzer with peak detector was used to find all the emissions generated by the EUT.
- All suspicious frequencies with emission levels were recorded.
- The test was repeated with the EUT in three orthogonal orientations.
- For each frequency detected in (b), the emissions were maximized by moving the turn table and measuring antenna and manipulating the EUT.
- 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

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.

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 / dB μ V/m	Result
4804.00	39.40	PASS
7206.00	42.20	PASS
9608.00	45.80	PASS
12010.00	46.80	PASS
14412.00	49.20	PASS
16814.00	48.00	PASS

Table 4 Emission levels, channel 0, Average detector

Frequency / MHz	Level / dB μ V/m	Result
4804.00	26.60	PASS
7206.00	29.30	PASS
9608.00	32.60	PASS
12010.00	34.20	PASS
14412.00	36.80	PASS
16814.00	35.00	PASS

Table 5 Emission levels, channel 38, Peak detector

Frequency / MHz	Level / dB μ V/m	Result
119.44	15.70	PASS
4880.00	40.50	PASS
7320.00	44.20	PASS
7330.67	43.50	PASS
9760.00	45.40	PASS
12200.00	46.50	PASS
14640.00	49.10	PASS
17080.00	49.20	PASS

Table 6 Emission levels, channel 38, Average detector

Frequency / MHz	Level / dB μ V/m	Result
4880.00	27.30	PASS
7320.00	30.20	PASS
7333.17	30.20	PASS
9760.00	31.90	PASS
12200.00	33.80	PASS
14640.00	35.90	PASS
17080.00	35.90	PASS

Table 7 Emission levels, channel 78, Peak detector

Frequency / MHz	Level / dB μ V/m	Result
4960. 00	40.80	PASS
7440. 00	44.00	PASS
9920. 00	46.50	PASS
12400. 00	47.10	PASS
14880. 00	48.20	PASS
17360. 00	50.50	PASS

Table 8 Emission levels, channel 78, Average detector

Frequency / MHz	Level / dB μ V/m	Result
4960. 00	28.00	PASS
7440. 00	30.20	PASS
9920. 00	33.10	PASS
12400. 00	34.40	PASS
14880. 00	35.40	PASS
17360.00	37.50	PASS

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