
Bluetooth test report for RM-57

CONTENTS

1	LABORATORY INFORMATION	4
2	CUSTOMER INFORMATION	4
3	SUMMARY OF TEST RESULTS	5
4	EUT INFORMATION	6
4.1	EUT description	6
5	EUT TEST SETUPS	6
5.1	Setup A (conducted measurements)	7
5.2	Setup B (radiated measurements)	7
6	STANDARDS AND MEASUREMENT METHODS	8
7	CARRIER FREQUENCY SEPARATION	9
7.1	EUT operation mode	9
7.2	Limits and results	9
7.3	Screen shot	9
8	NUMBER OF HOPPING FREQUENCIES	10
8.1	EUT operation mode	10
8.2	Limits and results	10
8.3	Screen shot	10
9	TIME OF OCCUPANCY	11
9.1	Connection mode	11
9.1.1	EUT operation mode	11
9.2	Limits and results	11
10	20dB BANDWIDTH	13
10.1	EUT operation mode	13
10.2	Limits and results	13
10.3	Screen shots	13
11	PEAK OUTPUT POWER	15
11.1	EUT operation mode	15
11.2	Limits and results	15
11.3	Screen shots	16
12	BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS	18
12.1	Hopping enabled	18
12.1.1	EUT operation mode	18
12.1.2	Limits and results	18
12.1.3	Screen shots	18
12.2	Hopping disabled	20
12.2.1	EUT operation mode	20
12.2.2	Limits and results	20
12.2.3	Screen shots	20
13	AC POWERLINE CONDUCTED EMISSIONS	22
13.1	Test setup	22
13.2	EUT operation mode	22
13.3	Limit	22
13.4	Results	22
14	SPURIOUS RF CONDUCTED EMISSIONS	24
14.1	EUT operation mode	24
14.2	Limits and results	24
14.3	Screen shots	24
15	SPURIOUS RADIATED EMISSIONS	26
15.1	Test method	26
15.2	EUT operation mode	26
15.3	Limits, 3m measuring distance	26
15.4	Results	26
16	TEST EQUIPMENT	29

16.1	Conducted measurements	29
16.2	Radiated measurements	29

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 Joensuunkatu 7 FIN-24100 SALO BOX 86 FIN-24101 SALO Salo Tel. +358-71-8008000 Fax. +358-71-8044277
Contact person:	Jorma Hanni
Receipt of EUT:	3.1.2005
Date of testing:	4-10.1.2005
Date of report:	10.1.2005

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

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	HW	SW	EUT number
EUT	RM-57	Phone	004400521611481	0701	2.10	40147
	RM-57	Phone	004400521611499	0701	2.10	40148
Accessories	BL-5C	Battery	-	6.0	-	40123
	ACP-12	Charger	-	5.0	-	40121

Notes: -

4.1 EUT description

The EUT is a triple band (GSM900/1800/1900 EGPRS) mobile phone with Bluetooth connection. 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.

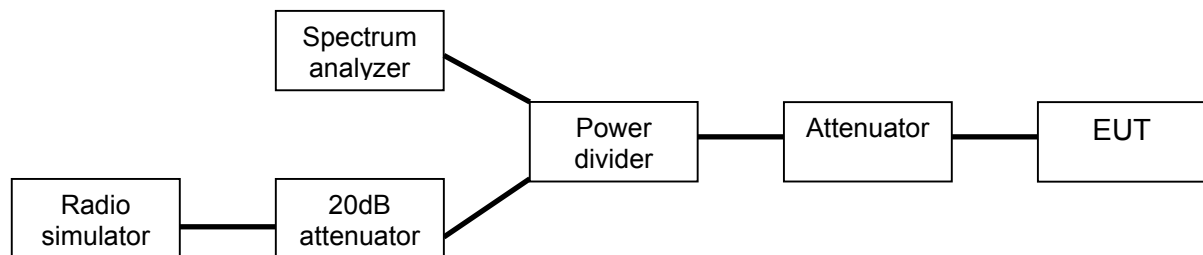
Two different test setups were used: one for conducted measurements, another for radiated measurements. One EUT was equipped with an external antenna connector for conductive measurements.

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 (0 –78)
- set the EUT to TX, RX and TX/RX mode
- enable/disable frequency hopping

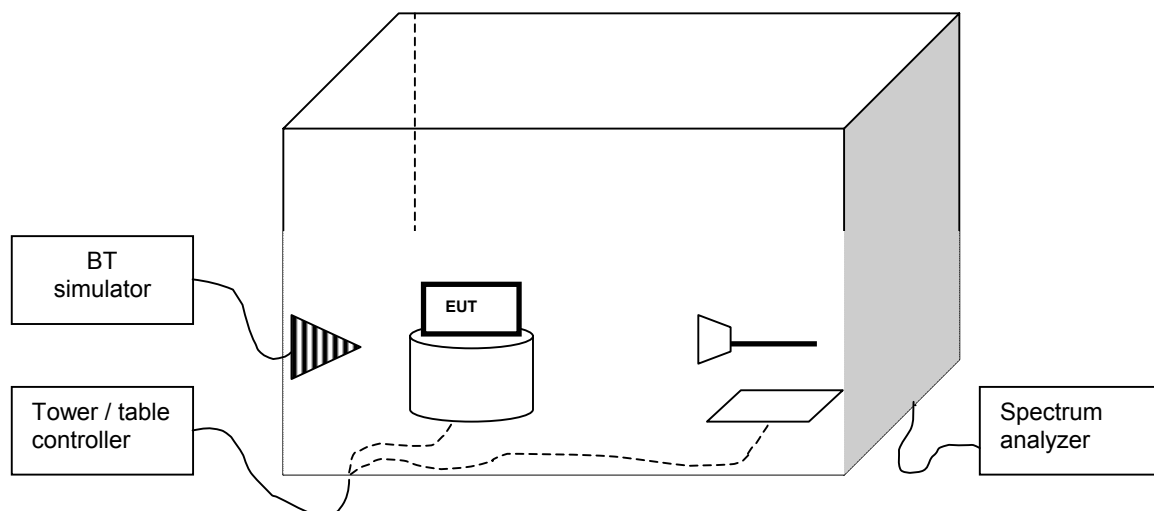
In tests, where absolute level reporting were required, the results were corrected with all applicable factors as detailed in the result section of each measurement.



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	40147		
Accessories	40123		
Test setup	A		
Temp, Humidity, Air Pressure	24 °C	38 %RH	994 mbar
Date of measurement	4.1.2005		
FCC rule part	§15.247 (a) (1)		
RSS-210 section	6.2.2 (o), a1		
Measured by	Jan-Erik Lilja		
Result	PASS		

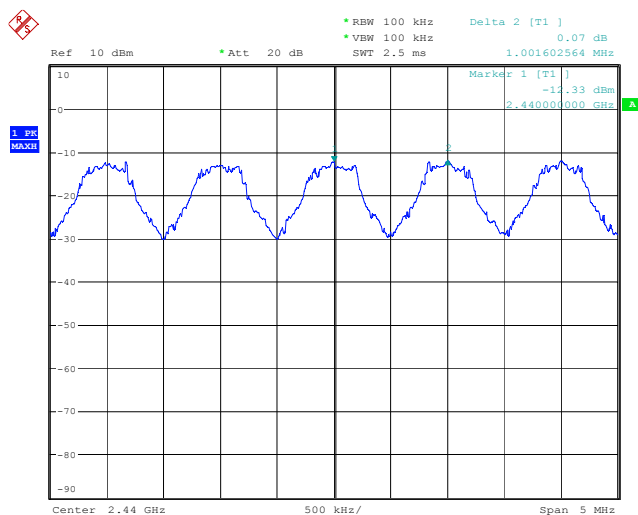
7.1 EUT operation mode

EUT operation mode	Connection, DH5 packet type
EUT channel	Hopping
EUT TX power level	Nominal

7.2 Limits and results

Limit (MHz)	Result (MHz)
≥ 0.025 or 20dB BW	1.002

7.3 Screen shot



Date: 4.JAN.2005 10:34:21

Picture 1 Carrier frequency separation of channels 38 and 39

8 NUMBER OF HOPPING FREQUENCIES

EUT	40147		
Accessories	40123		
Test setup	A		
Temp, Humidity, Air Pressure	24 °C	38 %RH	994 mbar
Date of measurement	4.1.2005		
FCC rule part	§15.247(a) (2)		
RSS-210 section	6.2.2 (o), a3		
Measured by	Jan-Erik Lilja		
Result	PASS		

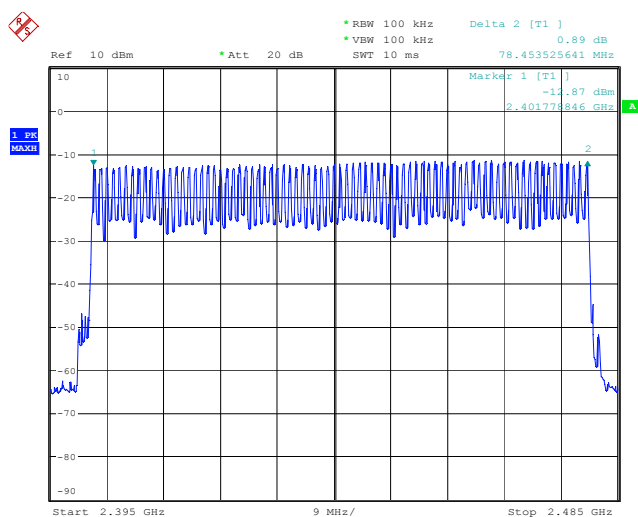
8.1 EUT operation mode

EUT operation mode	Connection, DH5 packet type
EUT channel	Hopping
EUT TX power level	Nominal

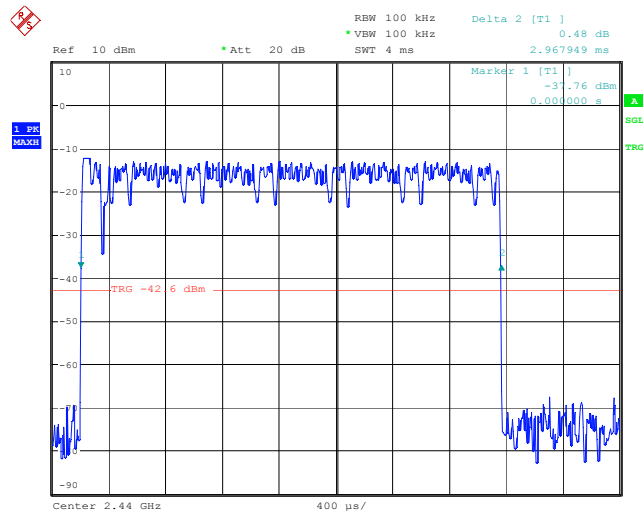
8.2 Limits and results

Number	Measured value
≥ 75	79

8.3 Screen shot



Picture 2 Number of hopping frequencies



Date: 4.JAN.2005 10:55:15

Picture 4. Duration of one transmission, channel 38

10 20dB BANDWIDTH

EUT	40147
Accessories	40123
Test setup	A
Temp, Humidity, Air Pressure	24 °C 38 %RH 994 mbar
Date of measurement	4.1.2005
FCC rule part	§15.247 (a) (1)
RSS-210 section	6.2.2 (o), a1
Measured by	Jan-Erik Lilja
Result	PASS

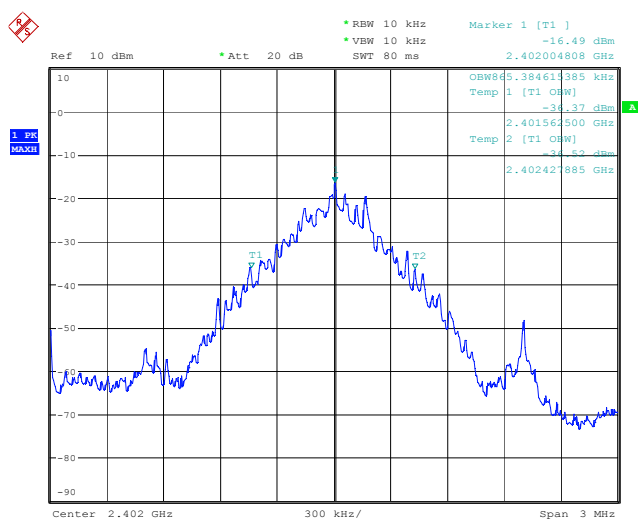
10.1 EUT operation mode

EUT operation mode	Connection, DH5 packet type
EUT channel	0, 38 and 78
EUT TX power level	Nominal

10.2 Limits and results

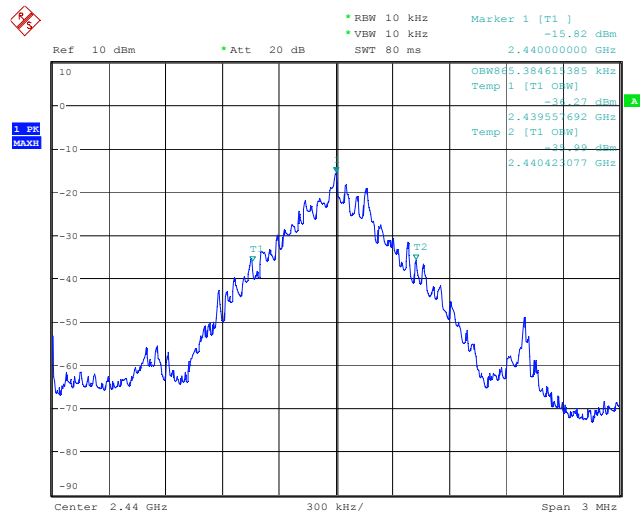
EUT Channel	Limit (MHz)	Measured value (MHz)
0	≤1.0	0.865
38		0.865
78		0.865

10.3 Screen shots

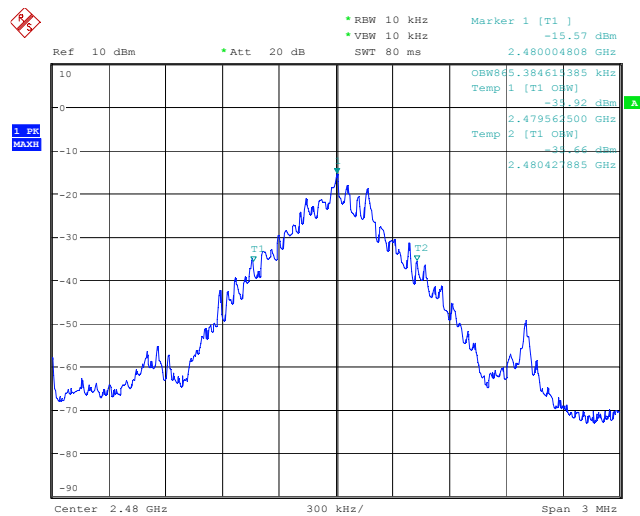


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Picture 5. 20dB bandwidth, channel 0



Picture 6. 20dB bandwidth, channel 38



Picture 7. 20dB bandwidth, channel 78

11 PEAK OUTPUT POWER

EUT	40147
Accessories	40123
Test setup	A
Temp, Humidity, Air Pressure	24 °C 38 %RH 994 mbar
Date of measurement	4.1.2005
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, DH5 packet type
EUT channel	0, 38 and 78
EUT TX power level	Nominal

11.2 Limits and results

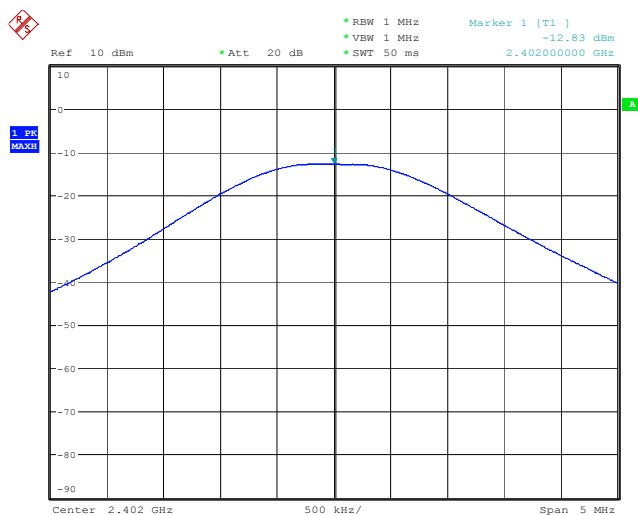
EUT Channel	Limit (W)	Test result (W)
0	≤ 1	0.00094
38		0.00113
78		0.00120

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

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

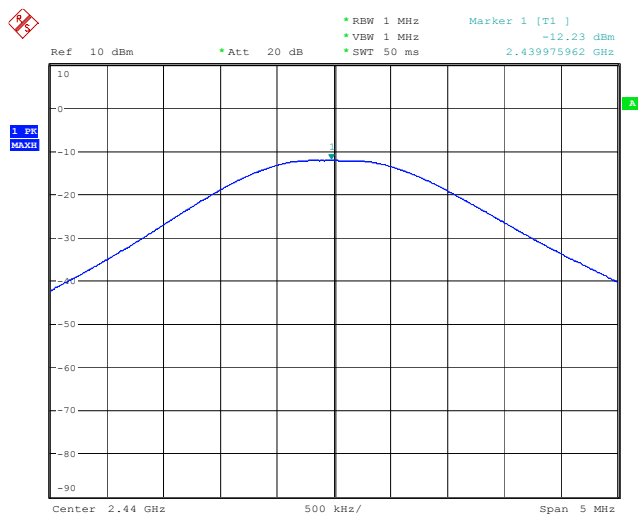
EUT Channel	Measured value [dBm]	Signal path loss [dB]	Peak output power [dBm]	Peak output power [W]
0	-12.83	12.57	-0.26	0.00094
38	-12.23	12.77	0.54	0.00113
78	-11.87	12.66	0.79	0.00120

11.3 Screen shots



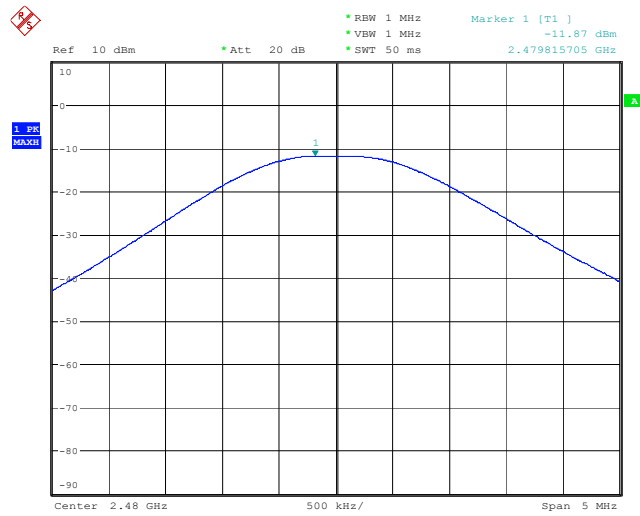
Date: 4.JAN.2005 11:15:19

Picture 8. Peak output power on channel 0



Date: 4.JAN.2005 11:13:10

Picture 9. Peak output power on channel 38



Date: 4.JAN.2005 11:11:43

Picture 10. Peak output power on channel 78

12 BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

12.1 Hopping enabled

EUT	40147
Accessories	40123
Test setup	A
Temp, Humidity, Air Pressure	24 °C 38 %RH 999 mbar
Date of measurement	4.1.2005
FCC rule part	§15.247 (c) (1)
RSS-210 section	6.2.2 (o), e1
Measured by	Jan-Erik Lilja
Result	PASS

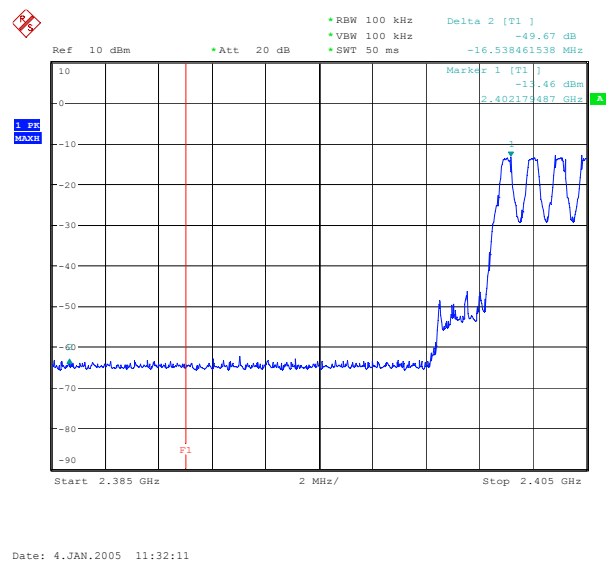
12.1.1 EUT operation mode

EUT operation mode	Connection, DH5 packet type
EUT channel	Hopping
EUT TX power level	Nominal

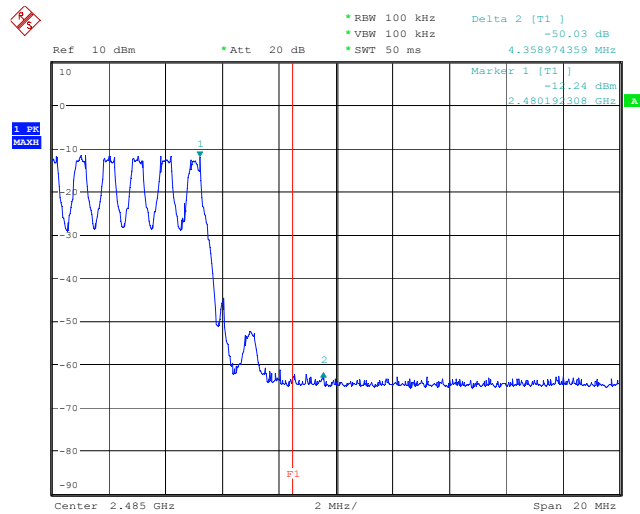
12.1.2 Limits and results

Channel	Limit (dBc)	Result (dBc)
0	≤ -20	-49.7
78		-50.0

12.1.3 Screen shots



Picture 11. Bandedge compliance, low end



Date: 4.JAN.2005 11:40:48

Picture 12. Bandedge compliance, high end

12.2 Hopping disapled

EUT	40149		
Accessories	40123		
Test setup	A		
Temp, Humidity, Air Pressure	22 °C	39 %RH	983 mbar
Date of measurement	10.2005		
FCC rule part	§15.247 (c) (1)		
RSS-210 section	6.2.2 (o), e1		
Measured by	Jan-Erik Lilja		
Result	PASS		

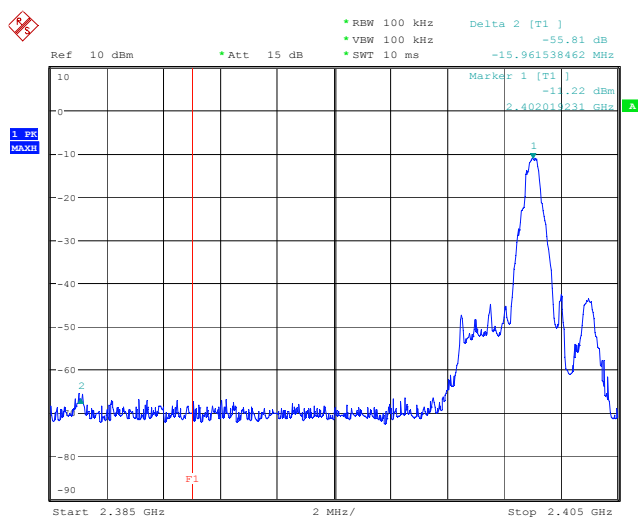
12.2.1 EUT operation mode

EUT operation mode	Connection, DH5 packet type
EUT channel	0 and 78
EUT TX power level	Nominal

12.2.2 Limits and results

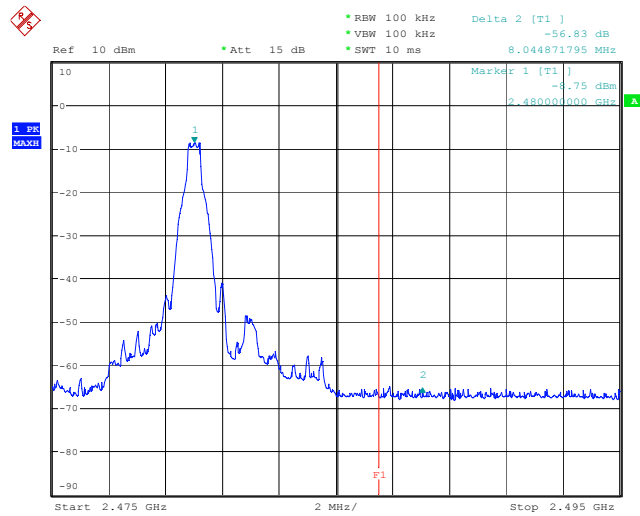
Frequency	Limit (dBc)	Result (dBc)
0	≤ -20	-55.8
78		-56.8

12.2.3 Screen shots



Date: 10.JAN.2005 13:20:11

Picture 13. Bandedge compliance, low end



Date: 10.JAN.2005 13:23:07

Picture 14. Bandedge compliance, high end

13 AC POWERLINE CONDUCTED EMISSIONS

EUT	40148
Accessories	40121, 40123
Temp, Humidity, Air Pressure	23°C 42 %RH 1002 mbar
Date of measurement	10.1.2005
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

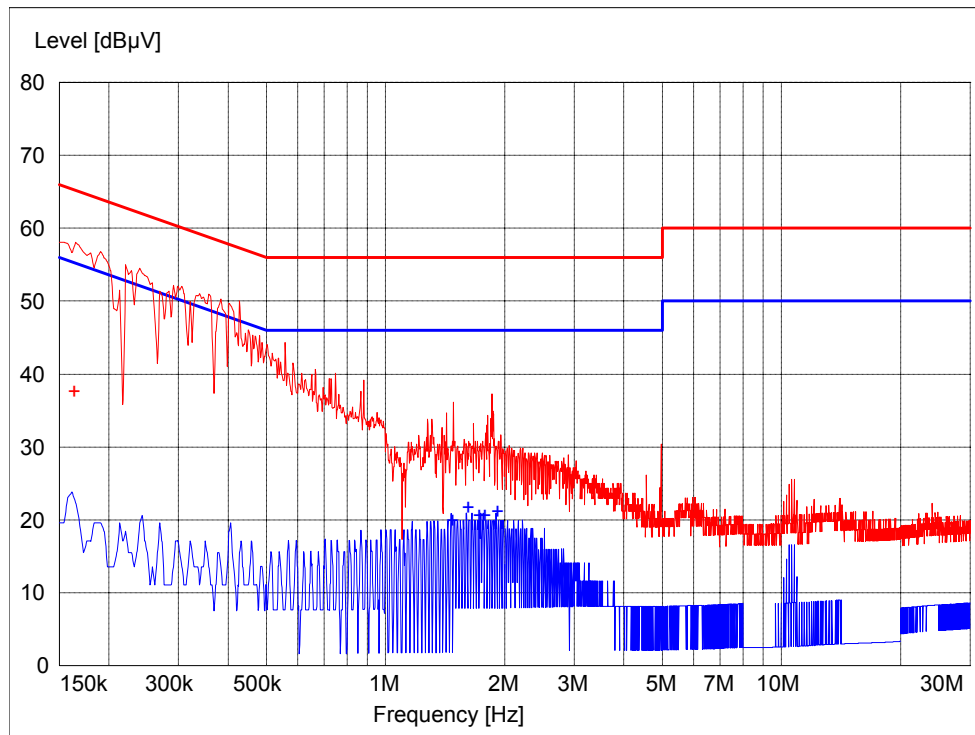
EUT operation mode	Connection, DH5 packet type
EUT channel	38
EUT TX power level	Nominal
EUT operation voltage	115VAC/60Hz

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 Emission measurement data, average detector

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin	Detector dB	Line	PE
1.477500	20.00	10.40	46.00	26.00	AV	N	GND
1.617000	21.70	10.40	46.00	24.30	AV	N	GND
1.725000	20.60	10.40	46.00	25.40	AV	L1	GND
1.779000	20.60	10.40	46.00	25.40	AV	L1	GND
1.918500	21.10	10.40	46.00	24.90	AV	N	GND

Table 2 Emission measurement data, quasi-peak detector

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin	Detector dB	Line	PE
0.163500	37.60	10.10	65.30	27.70	QP	N	GND

14 SPURIOUS RF CONDUCTED EMISSIONS

EUT	40147
Accessories	40123
Test setup	A
Temp, Humidity, Air Pressure	24 °C 38 %RH 994 mbar
Date of measurement	14.1.2004
FCC rule part	§15.247 (c) (2)
RSS-210 section	6.2.2 (o), e1
Measured by	Jan-Erik Lilja
Result	PASS

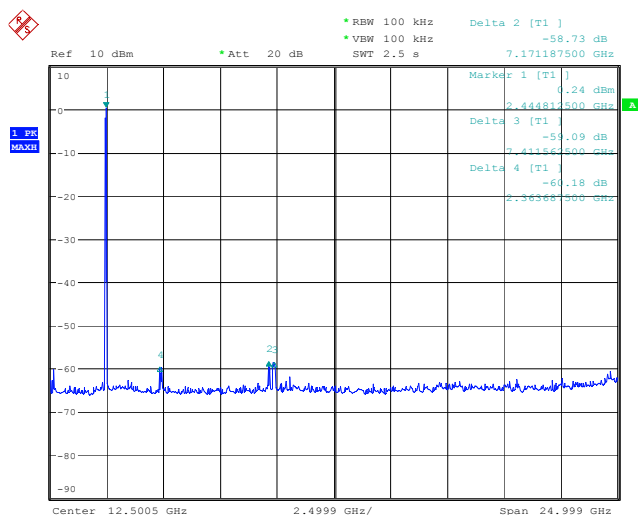
14.1 EUT operation mode

EUT operation mode	Connection, DH5 packet type
EUT channel	0, 38 and 78
EUT TX power level	Nominal

14.2 Limits and results

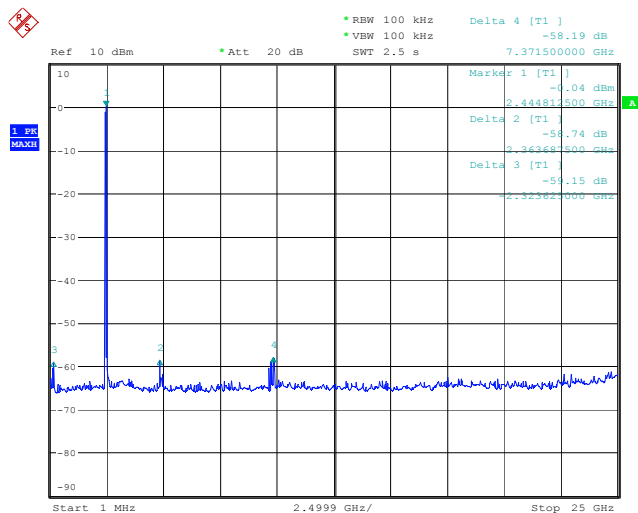
EUT Channel	Limit (dBc)	Result (dBc)
0	≤ -20	-58.7
38		-58.2
78		-55.6

14.3 Screen shots



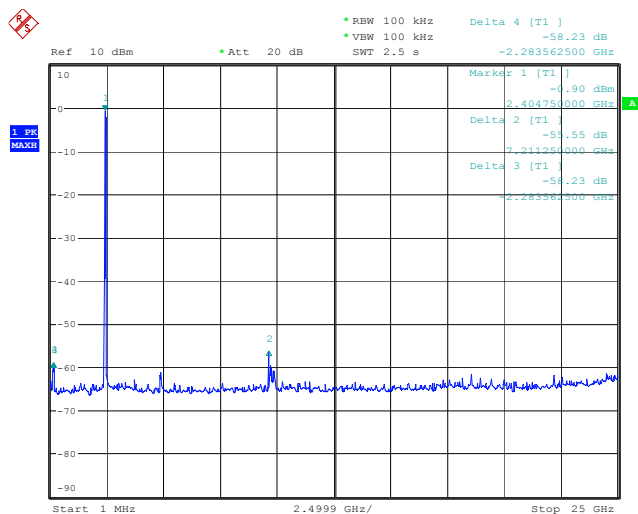
Date: 4.JAN.2005 13:40:55

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



Date: 4.JAN.2005 13:43:42

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



Date: 4.JAN.2005 13:45:59

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

15 SPURIOUS RADIATED EMISSIONS

EUT	40148
Accessories	40121, 40123
Test setup	B
Temp, Humidity, Air Pressure	19 °C 49 %RH 994 mbar
Date of measurement	4.1.2005
FCC rule part	§15.247 (c) (1)
RSS-210 section	6.2.2 (o), e1
Measured by	Jari Jantunen
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, DH5 packet type
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, Average detector

Frequency MHz	Level dB μ V/m
4804.00	26.70
7206.00	29.30
9608.00	32.60
12010.00	34.10
14412.00	36.70
16814.00	34.90

Table 4 Emission levels, channel 0, Peak detector

Frequency MHz	Level dB μ V/m
4804.00	39.50
7206.00	41.70
9608.00	45.80
12010.00	47.40
14412.00	49.30
16814.00	47.60

Table 5 Emission levels, channel 38, Quasi-peak detector

Frequency MHz	Level dB μ V/m
52.705210	15.90
119.158918	18.20

Table 6 Emission levels, channel 38, Average detector

Frequency MHz	Level dB μ V/m
4880.00	27.00
7320.00	30.30
9760.00	32.00
12200.00	33.70
14640.00	35.90
17080.00	35.90

Table 7 Emission levels, channel 38, Peak detector

Frequency MHz	Level dB μ V/m
4880.00	40.00
7320.00	43.00
9760.00	44.70
12200.00	46.90
14640.00	48.90
17080.00	49.30

Table 8 Emission levels, channel 78, Average detector

Frequency MHz	Level dB μ V/m
4960.00	27.80
7440.00	30.20
9920.00	32.80
12400.00	34.30
14880.00	35.30
17360.00	37.40

Table 9 Emission levels, channel 78, Peak detector

Frequency MHz	Level dB μ V/m
4960.00	41.30
7440.00	43.10
9920.00	45.70
12400.00	48.20
14880.00	48.50
17360.00	50.40

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